THE RELATIONSHIP BETWEEN GAMING ADDICTIVE BEHAVIOR, SATISFACTION, AND SUCCESS IN COMPUTER-BASED LEARNING

by

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Liberty University

A Dissertation Presented in Partial Fulfillment
Of the Requirement for the Degree
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ABSTRACT

The purpose of this quantitative, correlational study was to examine the association between college students’ levels of gaming addictive behavior and their levels of student satisfaction and student success in a computer-based learning environment. Additionally, gender was investigated as a moderator of the association between gaming addictive behavior and student success and between gaming addictive behavior and student satisfaction. Data was collected through online surveys from a convenience sample of undergraduate students enrolled at a large, Southern Association of Colleges and Schools (SACS)-accredited, evangelical Christian university located in Virginia. The statistical program SPSS 22.0 was used for the analyses. Hierarchical multiple regression was used to statistically analyze the association between: (a) gaming addictive behavior and student success, (b) the interaction between gaming addictive behavior and gender and student success, (c) gaming addictive behavior and student satisfaction, and (d) the interaction between gaming addictive behavior and gender and student satisfaction. Results indicated that gaming addictive behavior was not associated with student success, nor was the interaction between gaming addictive behavior and gender a significant predictor of student success. Likewise, gaming addictive behavior and student satisfaction were not significantly associated, and the interaction between gender and gaming addictive behavior was not a significant predictor of student satisfaction. The findings may be informative as researchers continue to investigate online gaming addictive behavior as a potential predictor of academic success and students’ satisfaction with computer-based learning.

Keywords: online gaming, technology in teaching, addiction, content delivery, computer-based learning
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“I am still confident of this: I will see the goodness of the Lord in the land of the living. Wait for the Lord; be strong and take heart and wait for the Lord” (Psalm 27:13-14, NIV).

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“Now to him who is able to do immeasurably more than all we ask or imagine, according to his power that is at work within us, to him be glory in the church and in Christ Jesus throughout all generations, forever and ever! Amen” (Ephesians 3:20-21, NIV).
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List of Abbreviations

Adequate yearly progress (AYP)

Assessment of Learner Satisfaction with Asynchronous Electronic Learning Systems (ALSAELS)

Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5)

Grade Point Average (GPA)

Internet Gaming Addiction (IGA)

Internet Gaming Disorder (IGD)

Massively Multiplayer Online Role-Playing Games (MMORPG)

National Association for the Education of Young Children (NAEYC)

National Council of Teachers of Mathematics (NCTM)

New Media Consortium (NMC)

No Child Left Behind Act (NCLB)

Social networking sites (SNSs)

The National Association for the Education of Young Children (NAEYC)

The National Center for Educational Statistics (NCES)

Variance inflation factor (VIF)

Virginia Polytechnic Institute and State University (Virginia Tech)
CHAPTER ONE: INTRODUCTION

Overview

The use of technological devices in education has become a prevalent phenomenon, and the use of innovative teaching tools will likely become increasingly popular in this generation of technological advancement (Ortagus & Stedrak, 2013; Zucker & Hug, 2008). In the midst of the many types of digital tools that are introduced into the education system, some are more effective than others (Christensen, 2011). While many teachers quickly gravitate towards new and innovative approaches to teaching their curriculum with technology, Christensen (2011) asserted that the quantity of technology employed in schools is not necessarily pertinent to students’ learning achievement. Instead, the quality of the technology and the specific approach that instructors utilize with technological devices in their classrooms will determine students’ academic success (Christensen, 2011). Lei (2010) also emphasized the need to carefully choose superior tools instead of simply incorporating a high number of technological tools in education. Many teachers have a tendency to try all available digital devices and to incorporate as much technology into their teaching as possible in an attempt to engage their students (Lei, 2010). However, Lei insisted that there is a wide scale of educational technology available, and teachers should be cautious in choosing what technology they will incorporate, choosing quality over quantity in their classrooms.

Innovative technology is now available that can relieve instructors’ responsibility to teach all of the content (Christensen, 2011). While many instructors adamantly perfect their lectures, assuring all content is presented, Christensen (2011) stated that technology can help relieve this time-consuming responsibility of delivering the content, allowing them the time to focus more on providing individual assistance to students. When teaching lectures is the primary source of
content delivery, instructors have little, if any, time to work individually with students (Christensen, 2011). Thus, Christensen recommended the use of computer-based content delivery systems, in which computer software or the Internet provides the majority of material to the students. This approach allows instructors to have the ability to facilitate learning in more meaningful and customizable approaches for each student. According to Sun, Lin, and Yu (2007), computer labs have provided beneficial results. The computer lab approach to content delivery not only enables instructors the time to work more effectively with students, but the approach also allows for self-assessments and immediate feedback for students (Sun et al., 2007).

**Technology and Gaming**

With the advancement of technology offered via computers and the Internet, online gaming has become a widely experienced sensation among the millennial generation, as well (Young, 2009). Although many researchers have been hesitant to categorize some types of game engagement as an actual addiction (Charlton & Danforth, 2007; Griffiths, 2010b), research continues to demonstrate the similarities between the symptoms of addictive gaming behavior and substance-related (chemical) addictions (Ding et al., 2013). It appears that a particular type of game is most addictive to players. Massively Multiplayer Online Role-Playing Games (MMORPGs) are considered the most addictive online game, resulting in the highest number of addicted players with negative outcomes such as physical, psychological, and emotional problems (Chappell, Eatough, Davies, & Griffiths, 2006; Hussain & Griffiths, 2009; Kim, Kim, Shim, Im, & Shon, 2013). MMORPGs are games that involve collaboration, alliances, and competitiveness with other MMORPG players, who are often located in different geographical regions and who maintain relationships with each other through gaming (Chappell et al., 2006).
Thus, these games, highly communal and technologically advanced in their graphics, rewards, and motivational factors, lead to the most addictive state for players, resembling that of substance addictions (Ding et al., 2013; Griffiths, 2010a).

Specific symptoms such as salience, tolerance, mood modification, conflict, relapse, and withdrawal, as seen in substance abuse addictions, are also seen in gaming addictions (Griffiths, 2010a). Impaired visual and auditory functions have been positively correlated with video game addiction (Dong, Huang, & Du, 2012). With the continually growing consensus that excessive gaming can become an addiction, the number of research studies to understand this addiction continues to grow. Previous research has identified excessive gaming behavior and gaming addiction to be related to interpersonal problems such as aggression, lack of self-control, social inhibition (Mehroof & Griffiths, 2010), intellectual deficits in executive functioning (Zhou, Yuan, & Yao, 2012), and lower academic achievement (Skoric, Teo, & Neo, 2009). The majority of the studies on gaming addiction have not been longitudinal; consequently, it is difficult to evaluate whether there is a causal relationship between gaming and these negative characteristic traits, and if so, which variable causes the other variable. It is possible that individuals who already possessed these traits are more prone to higher usage of games and gaming addiction, rather than the gaming addiction causing these traits. This study endeavors to examine the association between the level of gaming addictive behaviors and level of student success and student satisfaction, while controlling for grade point average (GPA), type of housing, and gender. This study also endeavors to examine whether gender is a moderating variable between gaming addictive behaviors and student success and between gaming addictive behaviors and student satisfaction among Christian university students.
Background

Throughout the years, technology in the classroom has taken many different forms. From PowerPoint® presentations to gamification curriculum, technology has quickly expanded from simple slide shows to complex, intuitive educational games (Erenli, 2013). Technology, highly utilized in entertainment, has quickly engulfed the teaching and learning process. Teachers and professors began incorporating more technology through the use of advanced PowerPoint® presentations. Additionally, online texting programs and clicker devices have allowed students to ask questions and submit answers instantaneously, while the results are immediately viewed on the screen or recorded. Today online learning (Ortagus & Stedrak, 2013), flipped classrooms (Davies, Dean, & Ball, 2013), and computer-based delivery systems (Sun et al., 2007) are becoming popular, and often, successful avenues to student learning (Chen, 2009; Christensen, 2011; Lee, 2014).

The technological teaching tools in use in the classroom are often reflective of the approaches and types of technology in the entertainment industry (Dunleavy & Heinecke, 2007; Lee, 2014; Lei, 2010; Sun et al., 2007). Online gaming is a form of entertainment that has quickly grown into a far-reaching phenomenon in the millennial generation. Initially, children and young adults in several Asian countries delved into this pastime at an alarming rate, to be followed at an equally alarming rate a few years later by children and young people in the United States (Jeong & Kim, 2011). This intense use of technology has led to concerns of excessive gaming and the possibility of the development of a behavioral addiction, much like a gambling addiction (Charlton, 2002; Griffiths, 2010b). However, many parents and health care providers have been hesitant to label excessive gaming as an addiction (Charlton & Danforth, 2007).
Spekman, Konijn, Roelofsm, and Griffiths (2013) specifically studied the differences between excessive gaming and what appears to be addicted gaming with corresponding symptoms. Spekman et al. concluded that there appears to be a difference between excessive play and addicted play, and that individuals can play excessively without becoming addicted to the games. Ding et al (2013) confirmed the potential for gaming to become addictive through their study of the brain’s resting state patterns that differ in individuals with addictions from individuals that do not have addictions. Yuan et al. (2013) furthered this notion of the differences in brain functioning and composition as they studied the brain’s cortical thickness of addicted gamers. After screening 165 freshman and sophomore students, 18 students identified as possessing Internet gaming disorder and were included in the study. While Yuan et al. conducted a cross-sectional study and a longitudinal design may have provided stronger substantiation for the observed brain abnormalities, the results indicated that gaming addiction likely shares similar neurobiological pathways with those of substance addictions.

Categorizing the pathological behaviors of gaming as an addiction is also supported by the synonymous symptoms that are seen in some individuals who game unremittingly and in individuals who have a substance addiction. As Griffiths (2010b) noted, such indicators as salience, tolerance, mood modification, conflict, relapse, and withdrawal symptoms are apparent in both gaming-addicted individuals and substance-addicted individuals. Thus, symptoms of behavioral and substance addictions appear to be similar, reinforcing the concept that gaming can become an unhealthy pastime with the potential to lead to full addiction. Addictions of any type inhibit one’s functioning. Wei, Chen, Huang, and Bai (2012) concluded that gamers of popular online gaming websites in Taiwan had a tendency to experience greater levels of psychological deficits such as social phobia, somatic pain, and depression. High levels of anxiety, neuroticism,
low self-control, and aggression have also been apparent in many gaming-addicted young people (Mehroof & Griffiths, 2010). These psychological correlations with gaming have led to additional studies, specifically examining young addicted gamers’ emotional and social well-being. There appears to be a difference in the prevalence of gaming addiction between genders, as males are more frequently addicted (Rehbein, Psych, Kleimann, Mediasci, & Moble, 2010). However, females who are addicted have presented more severe psychological problems than their male counterparts (Wei et al., 2012). Regardless of gender, gaming addiction appears to lead to lower scholastic outcomes (Skoric et al., 2009). Nevertheless, the methodological designs of these gaming addiction-related studies are limited, making it difficult to determine whether these findings are correlational or causational.

While Skoric et al. (2009) studied gaming addiction and academic outcomes for K-12 students, other research has provided only limited insight on college students and young adults. There is little research regarding levels of gaming addicted behaviors and levels of academic success. Further, there is no known research regarding gaming addictive behaviors or addiction and college students who attend a Christian university (Petry, 2011).

**Problem Statement**

Technology in the classroom is becoming increasingly prevalent, and many technological devices are aiding teachers and students in the process of learning (Lei, 2010). Advancements in technology have demonstrated promising results, as studies indicate increased learning (Dunleavy & Heinecke, 2007; Lee, 2014). Content delivery via the Internet or computer software systems is becoming more common and has led to differing conclusions in research (Ortagus & Stedrak, 2013; Sun et al., 2007).
Additionally, the increase of the use of gaming devices among children, adolescents, and young adults has led to a prevailing phenomenon that has affected many areas of life including gamers’ educational achievement (Haghbin, Shaderian, Hosseinzadeh, & Griffiths, 2013; Skoric et al., 2009). According to Kuss and Griffiths (2012), excessive online gaming can lead to addiction, impacting young people’s social, emotional, and mental capacities. On the school campus, students’ abilities to learn and grow developmentally are impacted. Negative consequences of gaming (e.g. low self-esteem, social inhibition, anxiety) are becoming apparent, particularly among children, adolescents, and young adults (Griffiths, 2010b; Kuss & Griffiths, 2012). Further study of how gaming influences college students and their academic achievement can provide information that will help enable educators to counteract negative consequences. Moreover, some research has suggested possible gender differences in gaming behaviors, motivations and outcomes (Hetzel-Riggin & Pritchard, 2011; Ko, Yen, Chen, & Yen, 2005). Presently, there is limited research regarding college students’ gaming activities and the impact on educational outcomes. This study endeavors to provide further understanding of how excessive and addicted online gaming affects students’ learning. Specifically, this study will examine the association between the level of gaming addictive behavior and levels of course satisfaction and success, while controlling for gender, housing, and GPA among college students enrolled in a computer-based, content delivery math course. Secondly, this study will examine whether gender moderates the association between gaming addictive behaviors and student success and between gaming addictive behaviors and student satisfaction levels.

**Purpose Statement**

The purpose of this multivariate correlational study is to evaluate the association between college students’ levels of gaming addictive behavior and their levels of course satisfaction and
success, while controlling for gender, housing and GPA in computer-based content delivery math courses at an Evangelical Christian university. In addition, moderation analyses will explore whether the association between gaming addictive behavior and student outcomes (i.e., satisfaction and success) differs based on the gender of the student.

**Significance of the Study**

There have been a number of studies conducted on gaming usage (Baer, Bogusz, & Green, 2011; Charlton & Danforth, 2007; Skoric et al., 2009). With the rise of online gaming and other forms of technology utilized for entertainment purposes, technology in education has become a rising trend in the school system (Giannetto, Chao, & Fontana, 2013). As technology invades the classroom, computer-based delivery of content is becoming ubiquitous on college campuses (Davies et al., 2013). Along with this digital revolution, students are becoming immersed in a digital world of social interaction and entertainment, some to the point of addiction (Young, 2009). Excessive gaming has become a significant and prevalent problem (Grusser, Thalemann, & Griffiths, 2007; Kim et al., 2013). Moreover, while research suggests a difference between gaming usage and gaming addiction (Charlton & Danforth, 2007; Griffiths, 2010b; Sublette & Mullan, 2012), it appears that gaming affects academic achievement (Haghbin et al., 2013; Skoric et al., 2009). Thus far, the majority of studies have been conducted on younger students (Burgess, Stermer, & Burgess, 2012; Haghbin, et al., 2013). In the midst of the rise of technological teaching tools, the current research to determine the efficacy of these tools on addicted students is limited (Kim et al., 2013).

Additional research is needed to help determine how technology affects gaming addicted students. Further awareness of the association between gaming addiction and academic achievement will add to the existing body of knowledge and can aid in the development of
improved pedagogy, specifically for students in higher education who suffer from gaming addiction. This study continues the investigation of gaming addiction and its influence on student learning. Specifically, this study examines whether the level of gaming addictive behaviors predicts success and satisfaction of university students in computer-based classrooms. This study is significant in advancing our understanding of associations between gaming addiction and the efficacy of computer-based education. Specifically, this study is significant for those developmental math students who have higher levels of gaming addictive behaviors. By studying developmental students enrolled in the Math Emporium, a math laboratory at the university equipped with individual computers, better approaches to teaching and learning in the Math Emporium could be identified and implemented for this population at the university. Beyond this university, this study could impact developmental math courses in other higher education institutions. A computer-based approach or some form of blended learning is often utilized for developmental math courses (Havill, Hashim, & Alalawi 2004). The knowledge gained from this study could inform the developmental math discipline by identifying the positive and negative aspects of gaming usage, and the variables that influence student academic success and satisfaction.

The overuse of gaming has become a problematic activity, often leading to addiction (Baer, Saran, & Green, 2012; Charlton & Danforth, 2007). Individuals are experiencing negative psychological, physical, and academic consequences (Rehbein et al., 2010; Skoric et al., 2009). This study is significant for its practical implications for pedagogy and its applications for the classroom. The desired outcome of this study is to further the knowledge of gaming addiction and potentially identify learning approaches, aids, and services that can help gaming addicts succeed in education.
Research Questions and Hypotheses

**Research Question 1:** Does gaming addictive behavior predict the level of student success rates in a computer-based content delivery classroom, controlling for gender, GPA, and student housing?

**Null Hypothesis 1:** There will be no statistically significant association between the level of gaming addictive behavior among college students in a computer-based content delivery math course and their levels of success in the course, while controlling for gender, GPA, and student housing, as measured by the Internet Gaming Disorder Scale and the students’ total scores for the course.

**Research Question 2:** Does gender moderate the association between gaming addictive behavior and success, while controlling for GPA and student housing, in a computer-based content delivery math course?

**Null Hypothesis 2:** Gender will not significantly moderate the association between gaming addictive behavior and success, while controlling for GPA and student housing, as tested using the Baron and Kenny (1986) steps.

**Research Question 3:** Does gaming addictive behavior predict the level of student satisfaction rates in a computer-based content delivery classroom, controlling for gender, GPA, and student housing?

**Null Hypothesis 3:** There will be no statistically significant association between the level of gaming addictive behavior among college students in a computer-based content delivery math course and their levels of satisfaction of the course, while controlling for gender, GPA, and student housing, as measured by the Internet Gaming Disorder Scale.

**Research Question 4:** Does gender moderate the association between gaming addictive behavior and satisfaction, while controlling for GPA and student housing, in a computer-based content delivery math course?

**Null Hypothesis 4:** Gender will not significantly moderate the association between gaming addictive behavior and satisfaction, while controlling for GPA and student housing, as tested using the Baron and Kenny (1986) steps.

**Identification of Variables**

The independent variable, or predictor, in this study is level of gaming addictive behavior. Level of gaming addictive behavior was measured by the Internet Gaming Disorder (IGD) scale, a self-report, continuous scale, using raw numbers (Lemmens, Valkenberg, & Gentile, 2013). The dependent variables are level of student satisfaction, which was measured by the Assessment of Learner Satisfaction with Asynchronous Electronic Learning Systems (ALSAELS), a self-report, continuous scale, using raw numbers (Wang, 2003), and level of success, measured by the students’ total scores for the course. Data resulting from these variables are quantifiable, as required for correlational research (Gall, Gall, & Borg, 2007). In addition, gender will be analyzed as a moderator variable.

**Definitions**

1. *Gaming Usage* and *Gaming Addiction* - Gaming usage refers to the practice of playing online games. While excessive gaming may at times lead to gaming addiction, the current literature largely agrees that there still exists a difference between excessive gaming and addicted gaming (Baer et al., 2012; Charlton & Danforth, 2007). Studies
have concluded that addiction is more common among online gamers than offline gamers who do not use the interactive capacity of the Internet (Ko et al., 2009; Ng & Wiemer-Hastings, 2005; Seo, Kang & Yom, 2009; Smyth, 2007; Tsitsika et al., 2009). While some gamers may become addicted, presenting many of the American Psychiatric Association’s *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (DSM-5) criteria for pathological gaming, many gamers remain highly engaged in their games without becoming addicted. However, there is a positive correlation between the number of hours that are spent gaming and the development of addiction (Wei et al., 2012).

2. *Student Satisfaction* - Student satisfaction involves the level of gratification and approval that the students experience in their courses. This study will use the Assessment of Learner Satisfaction with Asynchronous Electronic Learning Systems (Wang, 2003) to measure levels of student satisfaction in a computer-based content delivery classroom.

3. *Student Success* - Student success is defined as students’ performance in the course, as demonstrated by the total number of points that a student has earned in the semester. The point system ranges from 0 to 1000, and scores from all assignments are summed, resulting in students’ final scores for the class.

4. *Computer-Based Learning* - Computer-based learning is a content delivery format in which computer software or the Internet provides course content to students (Christensen, 2011). This type of learning can take place in computer labs (Sun et al., 2007), distance learning (Ortagus & Stedrak, 2013), and flipped classrooms (Davies et al., 2013).

5. *Math Emporium* - The Math Emporium is a math laboratory at this university where the two introductory math courses are located. The Math Emporium is arranged with
individual computers aligned in rows throughout the classroom. The Math Emporium is a computer-based content delivery system that utilizes math software to provide course material and assessments, while customized tutoring and assistance is provided by instructors and student assistants in order to help facilitate the learning process (Twigg, 2011).
CHAPTER TWO: LITERATURE REVIEW

Introduction

The following review of the literature demonstrates the increased use of digital devices, the positive and negative effects of this advanced technology, and how these effects influence the learning process in those classrooms utilizing technology as teaching tools. Innovative technological devices are entering every facet of living. Specifically, young people are employing technology in a variety of forms for entertainment. Children and adolescents are becoming increasingly engrossed in social media outlets, smart phones, online video games, and various other technological devices (Blomfield-Neira & Barber, 2014; Charlton, 2002; Spies-Shapiro & Margolin, 2014).

In the midst of the increase in technological innovations, the education system has begun to incorporate teaching and learning tools which utilize a high degree of technology and media outlets. As the upcoming generation of students becomes increasingly comfortable with technology, there is a concern that they will become less engaged in school unless the education system also becomes well-versed in technology (Christensen, 2011). Some research has resulted in findings of positive effects, specifically on students’ development of language expression and self-esteem, due to online gaming (Griffiths, 2010; Kim et al., 2013). Unfortunately, for some individuals, this increased use of technology in various arenas of daily life may be related to negative outcomes in learning and psychological well-being (Blomfield-Neira & Barber, 2014; Ding et al., 2013; Spies-Shapiro & Margolin, 2014). Specifically, it is becoming evident that some individuals who play online video games are developing addictions to the games (Ding et al., 2013; Griffiths, 2010b). This review summarizes the current literature involving increased use of technology and media, and the advancement of digital learning within the school system, including the quality, age-appropriateness, approaches, efficacy, and perceptions of online
learning technology. Further, the review focuses on the propensity for technology addictions, symptoms of gaming addiction, motivations for gaming addiction, and differences between genders among gamers in technological learning environments.

**Theoretical Framework**

There are numerous perspectives on the problematic use of substances, and there are multiple addiction theories with various models and treatment plans for recovery (Oksanen, 2013). The neurological theory of addiction emphasizes a causal relationship between physiology and addiction (Hyman, 2007). Specifically, Hyman (2007) described the release of the neurotransmitter dopamine in addicted individuals. Dopamine that is released in addiction is greater than that which is released in a natural setting; therefore, the experience of the individual is unexpected and highly pleasurable, while the neurotransmitter is operating excessively. Hyman affirmed that this physiological alteration might influence the likelihood of addiction; yet Hyman also asserted that the neurological theory fails to incorporate all of the components of human behavior, such as cognitive reasoning and voluntary control. Similar to the neurological theory, the psychiatric theory of addiction, which focuses on a psychiatric disease leading to compulsive action, appears to also be lacking, as addictions do not lead to a complete absence of autonomy (Foddy, 2011). Orford (2001) concluded that psychological theories of addiction usually highlight extremely excessive appetites and a lack of self-control. While there are numerous and sometimes ambiguous theories to explain the pathways to addiction, the criteria necessary to identify an addiction are fewer and more clearly defined.

**Substance Addictions and Behavioral Addictions**

Brown (1991) asserted that salience, tolerance, withdrawal symptoms, conflict, euphoria, and relapse are six items that distinguish an addiction. Addictions can be classified into two
categories: (a) substance addictions and (b) behavioral addictions. Individuals who are addicted to a substance are bound by a specific chemical and usually present physical signs of their addiction (Alavi et al., 2012). Individuals addicted to a behavior are bound by an activity or the emotions that the activity rouses within the individual (Alavi et al., 2012). Griffiths (2010) stated that non-chemically related addictions should be measured against the same criteria necessary for a substance addiction diagnosis. In comparing the symptomology, both substance addictions and behavioral addictions display Brown’s (1991) criteria necessary for diagnosis of an addiction (Griffiths, 2005).

Moreover, while the criteria necessary to diagnose behavioral and substance addictions are synonymous, the brain activities of substance abusers and behavioral addicts exhibit nearly identical states (Ding et al., 2013). Behavioral addicts, such as those who are addicted to gambling or Internet gaming, also appear to have similar neurobiological abnormalities as those individuals who are addicted to substances, such as alcohol or drugs (Ko et al., 2009). According to Griffiths (2005), rewards and reinforcements are the basis for all addictions, both behavioral and chemical. Ko et al. (2009) described gaming addiction as a behavioral addiction, similar to gambling addiction. In gaming addiction, Griffiths’ (2005) foundational aspects of rewards and reinforcements are clearly evident (Wan & Chiou, 2007).

**Gaming as a Behavioral Addiction Affecting Learning**

According to Griffiths (2010b), while online gaming is a common hobby, not all gamers are addicted nor will they all become addicted if they continue to game excessively. Many individuals are extensively involved in this activity, yet they show no signs of addiction. Griffiths stated that enthusiasm and high involvement in gaming only becomes problematic if it
takes value away from the individual’s life. Therefore, Griffiths maintained that excessive gaming differs from addictive gaming.

While many individuals still refuse to accept an engrossment of online games as a potential addiction, there is strong evidence to suggest that prominent similarities exist between substance addictions and behavioral addictions, and that excessive gaming can present the necessary criteria of a behavioral addiction (Ding et al., 2013; Griffiths, 2005). The DSM-5 (APA, 2013) included Internet Gaming Disorder in the appendix section as a tentative disorder in need of further research. The DSM-5 has made alterations to the criteria necessary for classifying pathological behaviors. The criteria currently required for the diagnosis of Internet Gaming Addiction include the following symptoms: (a) preoccupation, (b) tolerance, (c) withdrawal, (d) relapse, (e) escape, (f) problems, (g) deceit, (h) displacement, and (i) severe consequences (APA, 2013).

In the midst of the perception that gaming has positive effects, there is evidence that some individuals, specifically adolescents, can become so engrossed in gaming that the technology becomes a behavioral addiction (Ko et al., 2009). Therefore, as many adolescents become progressively addicted to technology such as online gaming, these adolescents also sit in the 21st century classroom where technological innovation is becoming more pervasive. Digital teaching and learning tools have become the innovative approach to gaining student engagement, motivation, and higher learning outcomes (Christensen, 2011). In the 21st century, a time when technology is entering nearly every facet of life, the education system has begun to incorporate a number of technological devices into their teaching approaches. The technology becoming prevalent in schools include individual student computers (Zucker & Hug, 2008), online learning formats (Enfield, 2013; Jaster, 2013), and other special computer software programs (Kebritchi,
Hirumi, & Bai, 2010). As time has progressed, specific approaches to technology in the classroom have demonstrated success in meeting learning outcomes. Specifically, approaches that incorporate online delivery of learning content have experienced both popularity and academic success (Ortagus & Stedrak, 2013). Primary technological approaches in teaching involve computer-based and online systems of content delivery. However, the learning technology may be less advantageous for gaming-addicted students than for those who are not addicted to Internet games. By studying the association between gaming addictive behaviors and academic achievement in a technologically-based learning environment, the theory of behavioral addictions may be extended. This study can also provide further understanding and acceptance of gaming addiction as a relevant behavioral addiction. With further knowledge of gaming addiction and its effect on learning, strategies can be implemented to help students achieve success in their education.

Advancement of Digital Learning Tools

In this century’s invasion of technology, digital teaching and learning tools are becoming increasingly popular in the educational system. Despite the research demonstrating the lower learning outcomes of students who are addicted to online gaming (Skoric et al., 2009), educators are including more virtual technology in elementary schools, middle and high schools, and schools of higher education (Christensen, 2011; Ortagus & Stedrak, 2013). As children and adolescents become progressively more involved with technology in the form of entertainment, many educators believe that the education system in America must mirror this fast-paced development of entertainment technology by implementing more technology in the classroom (Christensen, 2011).
The integration of technology in education over the last decade may be largely related to federal mandates such as the No Child Left Behind Act (NCLB, 2002) and the Common Core Standards (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010) for kindergarten through twelfth grade. The achievement gap in K-12 education led to President George W. Bush’s NCLB Act (2002), with the intention of improving education, specifically for low-achieving students. Standardized testing of students and adequate yearly progress (AYP) of schools became required. The implementation of math and reading assessments were specifically emphasized in order to demonstrate proficiency in these subjects. Students’ learning achievement is now measured through test scores, and continued federal funding for schools is determined by students’ performance on these standardized tests. Thus, instead of teaching approaches which emphasize students’ learning outcomes, the most common pedagogy currently in use revolves around teaching students how to achieve high scores on the standardized tests (Groen, 2012). Interestingly, in spite of the Common Core Standards and NCLB’s (2002) strong emphasis on closing the educational gap, there has been no significant rise in test scores (Lee, 2010). However, educators are still held accountable for reaching student learning standards (i.e. raising test scores). In light of the lack of improvement under these federal mandates, concerns regarding students’ learning and ability to master content have elevated (Donlevy, 2007). According to Trolian and Fouts (2011), teaching for testing, a performance-oriented teaching approach, has implications for higher education. In performance-oriented environments, intrinsic motivation and resiliency in the midst of failure are not naturally cultivated. Trolian and Fouts asserted that the characteristics of resiliency and intrinsic motivation are often necessary for the successful completion of college learning, which involves
abstract information and more difficult challenges and failures than what is experienced in K-12 education.

While math and writing are primary areas of focus, an aspect of NCLB (2002) is the required computer literacy by eighth grade (Padron, Waxman, Lee, Lin, & Michko, 2012). Thus, technological competence is highly valued by federal standards. In a third-year review of NCLB, the goals set for technology proficiency were analyzed (Lemke, Wainer, & Haning, 2006). The report highlights the NCLB Act’s emphasis on utilizing technology for learning, and identified how states are emphasizing technology in the school districts, specifically through improving students’ academic achievement and enhancing professional development for educators (Lemke et al., 2006). Additionally, the third-year report stated that general technology literacy is of continued importance, in addition to utilizing technology to learn other subjects. In addition to the technology emphasis of the NCLB Act (2002), the National Council of Teachers of Mathematics (NCTM, 2003) described the use of technology as an essential component to the effective learning of mathematics. Computers, calculators, and software programs are regularly incorporated in teaching math in K-12 education. Furthermore, the US Department of Education (2007) underscored the importance of technology in higher education through online learning to provide supplemental resources for students in rural areas, as well as to offer teaching aids for residential students in the classroom. The Department of Education also highlighted online learning for K-12 and consistent internet access for utilizing online learning resources.

Thus, multiple teaching and learning tools have been developed for a wide age range of students. The New Media Consortium (NMC) Horizon Report: 2014 K-12 Edition (Johnson, Adams Becker, Estrada & Freeman, 2014a) and the NMC Horizon Report: 2014 Higher Education Edition (Johnson, Adams Becker, Estrada & Freeman, 2014b) provide the newest
developments in education. The 2014 Horizon Reports offer information on the upcoming
educational technology and predictions for the future. The Horizon Reports confirm the
increased use of media and technology in teaching and learning, including the use of social
media, analytics, and hybrid, computer-based learning formats for all educational levels. The
Horizon Report: 2014 Higher Education Edition (Johnson et al., 2014b) highlighted the
importance of the field of education remaining relevant in this generation of mass media and
technology. If educators fail to adapt to the quickly changing trends, then the education model
may fail and education that has been valued and proven throughout past generations will fade
(Johnson et al., 2014b). Overall, the perceptions and attitudes of technological tools appear to be
positive, and the efficacy of the tools appears to support promising approaches to learning for the
majority of students (Lee, 2014; Lei, 2010).

Quality over Quantity

In an examination of the technological tools that are being utilized in the classroom, it
appears that the quality of the technology is of much greater importance than the quantity of
technology. Christensen (2011) asserted that the education system of the last decade has
attempted to incorporate more technology in their teaching approaches. Specifically, teachers
have been incorporating within their lectures more enhanced PowerPoint® presentations and
such tools as online texting programs, which allow students to text messages that are
instantaneously shown on the screen for in-class discussion. These texting programs have
creatively enabled students to ask questions of their instructor and provide informal answers in
class discussions, largely taking the place of the old-fashioned approach of raising one’s hand.
Christensen suggests that while these attempts to incorporate technology in the classroom are
noteworthy, he questions whether these approaches are increasing students’ learning. Due to the
fact that these approaches are simply enhancing the instructor’s lecture, Christensen suggested that adding more technology to teaching does not necessarily lead to greater learning outcomes. Instead, Christensen implied that the quality of the technological devices is of most importance and believed that fully utilizing technology in a vastly different and innovative way will overturn the current teacher-centric classroom format and will lead to the highest learning standards.

Lei (2010) likewise concluded that quality prevails over the quantity of technology in the classroom. In his study analyzing how student learning outcomes are affected by technology, Lei surveyed 133 seventh and eighth grade students, and interviewed nine teachers and nine students. The results of his study indicated that the teacher’s quantity of technology used in the classroom did not influence learning outcomes. However, as Lei assessed the various levels of quality of the digital devices in use in the classrooms and their influence on learning, he discovered significant positive and negative effects. Specifically, the digital devices that were utilized for particular subject content were negatively related to student learning outcomes; however, the more general use of digital devices led to positive relationships to student learning outcomes, specifically technology aptitude (Lei, 2010).

**Age Appropriateness**

Questions have been raised regarding the age that children should begin utilizing technology. The National Association for the Education of Young Children (NAEYC, 2012) provided guidance to educators concerning the level and types of technology that should be used for children, from birth through eight years of age. NAEYC stated that technology can be an effective tool but must be managed carefully by the teachers, be age appropriate for the children, and ensure that it promotes further interaction, instead of isolation, with classmates and teachers. NAEYC specifically noted that technology which allows young students to achieve results
through hands-on interaction is especially beneficial. NAEYC also contended that the proper types of technology should be used with careful monitoring by adults, in an attempt to avoid non-participatory types of technology such as watching television.

To help ensure age appropriateness for technology use, Hillman and Marshall (2009) designed a system to examine the types of technology used in classrooms. In evaluating content for children ages three through five years, Hillman and Marshall identified six components that lead to beneficial technology for students of this young age. These components include: (a) interactivity and participation, (b) digital literacy, (c) global citizenry, (d) plausible and consistent feedback, (e) participation with adults, and (f) developmental appropriateness. It is hoped that this criteria will help guide educators to choose the most beneficial literacy technology for pre-school and kindergarten students.

Lee (2014) analyzed the use of iPads among preschool children from low income homes. Young children have become adept at playing technologically innovative toys as much, if not more, than traditional toys, and many are comfortable with such devices as iPads and laptops. Therefore, it was theorized that utilizing iPads in the preschool classrooms would increase learning. In this study by Lee, a case study approach was utilized in which a number of preschool classrooms were selected. Specific applications were downloaded on the iPads to increase learning in math and science which necessitated a high level of student interaction. Lee’s results demonstrated a high level of interaction among students and their teachers. Problem-solving was encouraged as a collaborative effort and took place regularly in small groups. Results also demonstrated development in the students’ communication. Students were better able to articulate to their teachers and classmates their learning comprehension by providing examples with pictures and drawings (Lee, 2014). Overall, Lee’s study suggests that
iPad use in preschool classrooms in low income areas can be a beneficial learning tool in which students gain a greater capacity to interact and communicate with others. These studies take into account the appropriate age and type of technology that appear to be beneficial for students’ learning (Hillman & Marshall, 2009; Lee, 2014).

**Approaches and Efficacy**

While it appears that children and adolescents should be carefully monitored on the amount of time and type of technology used, benefits are also noted, such as the use of technology to increase learning (American Academy of Pediatrics, 2013). Thus, incorporating technology into the educational system has taken a variety of approaches. Due to the technology phenomenon of the 21st century, many students own a variety of personal devices such as smartphones, tablets, and laptops. Teachers have sought creative ways to incorporate what students regularly use into their teaching approaches. Additionally, learning through websites and e-books is growing in popularity. However, as Christensen (2011) asserted, simply enhancing traditional classroom lessons with technological devices is not an adequate improvement to education and will not have significant increases in learning outcomes.

**Computers in the Classroom**

Zucker and Hug (2008) studied the impact of the one-to-one ratio of student-to-laptop model within the classroom. In this model of learning, laptop computers are provided to each student for the duration of the school year, creating a one-to-one approach of student-to-laptop ratio. In addition, Internet access is also provided to enhance learning. Of particular interest to Zucker and Hug was the influence that daily laptop use had in physics courses. A laptop, which included special software, was given to both students and teachers. For example, one program provided testing for students in which immediate results were sent to the teachers to help identify
areas of weaknesses. When reviewing the results across subjects, teachers reported that they often utilized the one-to-one ratio of student-to-laptop model by incorporating daily practice drills and Internet research of the subjects being studied in the classroom. Specifically, the students in the physics courses engaged in a high level of usage of the laptops. Students daily utilized the laptops to aid in learning through probes and simulations. This extensive use of the laptops provided the students with more time to learn the concepts instead of time spent recording notes from lectures. While Zucker and Hug’s study did not specifically analyze learning outcomes, it did provide data indicating students’ and teachers’ use of the laptops. Specifically, it confirmed teachers’ extensive use of the technology that is available to them through the one-to-one ratio of laptops, and indicated a high level of student interaction with the technology.

Dunleavy and Heinecke (2007) also studied the effects of one-to-one laptop use, specifically in math and science courses for at-risk middle school students. Dunleavy and Heinecke used a pretest-posttest control-group method, over a two year span, to examine students’ academic achievement. The randomized sample of 167 students were divided into one-to-one laptop classrooms and non-laptop classrooms. Standardized achievement tests were compared with results that indicated significant differences on science achievement, with the one-to-one laptop classrooms exceeding the achievement levels in non-laptop classrooms. Further, a difference between genders in the science classrooms was also noted, as boys outpaced the girls. No significant differences were found between the one-to-one laptop math classrooms and the non-laptop math classrooms, leading Dunleavy and Heinecke to conclude that this model of technology in teaching may only be beneficial in some contexts and subjects.
Online Learning Formats

With students’ increased use of individual computers, online learning formats have become popular over the last decade (Ortagus & Stedrak, 2013). This educational innovation has opened the door to a variety of educational approaches to employing technology (Christensen, 2011). Some formats involve all content delivery through an online platform, while other formats involve partial content delivery via the Internet. A blended model of online learning integrates both autonomous, computer-based learning as well as learning in a more traditional classroom setting (Enfield, 2013; Jaster, 2013; Lo, Johnson, & Tenorio, 2011; Talley & Scherer, 2013).

One type of approach to blended learning is the inverted, or flipped, classroom. Inverted courses utilize computer-based content delivery outside of the classroom followed by classroom periods that incorporate practice time, exercises, and teacher-facilitated activities for the students. In a study by Braun, Ritter, and Vasko (2014), undergraduate engineering students were enrolled in inverted math classrooms. Twenty percent of the math topics were taught through the inverted approach, resulting in higher satisfaction among students. The study extended through three academic semesters. While no significant difference in learning outcomes was found between the topics delivered in an inverted format and topics delivered in a traditional classroom, students indicated their desire for autonomous learning time, while still maintaining the availability of instructors when needed. Thus, the blended approach appears to offer a student-centric model to learning (Braun, 2014; Elliot, Choi, & Friedline, 2013; Enfield, 2013; Jaster, 2013).

Elliot et al. (2013) studied the implementation of a blended statistics course for graduate students in a social work program. Social work students tend to display a high level of research
and statistics anxiety, possibly due to faculty’s lack of emphasis and incorporation of the material throughout the degree programs (Elliot et al., 2013). Furthermore, social work education often lacks an adequate foundation of statistics and research course work. To counteract the statistics and research deficit, Elliot et al. developed a course that utilized traditional classroom time, supplemented by independent learning in an online statistics lab. After conducting their study utilizing a post-test design on a class of 25 students enrolled in the blended statistics course, Elliot et al. found that students demonstrated higher levels of confidence in their statistical abilities and competence in interpreting research findings.

**Computer Labs**

In light of the fast-paced development of online systems and blended models of learning, campus computer labs incorporating online content delivery are becoming increasingly popular, as well. Sun et al. (2007) studied the impact of a web-based content delivery system on learning outcomes in relation to differing learning preferences of students. This study incorporated elementary school science classes. The experimental group of students engaged in customized online learning, while the control group continued with the traditional classroom presentation of content. In the experimental group, the online program could adapt to each student’s unique learning preference. The results of this study indicated significantly higher achievement levels for students in the experimental group. These online computer labs deliver the content to the student in adaptable formats, allowing the student to progress at his or her own pace. Well-designed computer labs that utilize software and online delivery of content provide assessments both for the students and for their teachers, who act more as facilitators than as lecturers (Sun et al., 2007). This approach enables teachers to focus on individual students’ learning preferences and to help facilitate the learning process instead of having to focus on perfecting their content.
delivery (Christensen, 2011). Further, Sun et al. (2007) noted that online programs delivered important information of areas in which teachers may be inadequate.

The online lab is a student-centric approach to learning. It is an approach that utilizes technology extensively, and allows students the most control over their learning. Control over the learning process, immediate results of assessments, and teachers serving as coaches appear to be strong motivators for student engagement (Christensen, 2011). Additionally, online programs may at times be better equipped to convey concepts than the teachers are able to communicate the concepts (Chen, 2009; Christensen, 2011). Chen (2009) reiterated these benefits, as he extolled online learning formats for their capability to customize learning for each student, leading to greater student comprehension of the material. Further, he emphasized self-regulation as a primary component to successful online learning. Chen’s study examined online programs that incorporated self-regulated learning motivations. His study incorporated a quasi-experimental design and a random sample of 135 fourth grade students. The results of his study identified four groups of students with various levels of self-regulated learning ability and self-regulated learning performance. The online, self-regulated technology utilized in the study successfully promoted learning performance. Therefore, further examination of these online programs could lead to continued personalization of online teaching tools and computer-based content delivery approaches (Chen, 2009).

According to Sun et al. (2007), the benefits of self-assessment and teacher facilitation in computer labs with software or Internet content delivery are manifold. Additional studies have been conducted on computer-based content delivery classrooms. As Christensen (2011) asserted, the efficacy of this approach may revolve around teachers’ ability to adequately facilitate individual learning in the classrooms.
Math classrooms, in particular, appear to be experimenting and benefiting from the computer-based content delivery approach. Jackson, Brummel, Pollet, and Greer (2013) studied elementary students’ success and satisfaction rates in computer-based math classrooms. While their study incorporated interactive, synchronous computers referred to as tabletops, in which multiple students could work together, the teachers provided the majority of content delivery and the computers supplemented the teachers’ instruction with additional content and learning exercises. With only two hours a week of computer time, results still indicated higher achievement in math for the experimental group using the tabletop interactive system. Jackson et al. concluded that interactive computer technology has the potential to be a promising teaching tool.

**Math Emporiums**

According to Afzal and Gondal (2010), online computer-assisted instruction, a specific approach in which computers hold the entire responsibility of delivering the material, although resulting in high student satisfaction rates, did not result in the strongest academic achievement when compared to teacher facilitated mathematics instruction. Afzal and Gondal concluded that schools should be well-equipped with math labs comprising individual computers, special programs for teaching mathematics, and instructors that are trained to facilitate the learning of math.

The teaching and learning of mathematics appear to be enhanced in the blended approach of computer-based and instructor-based teaching (Afzal & Gondal, 2010; Jackson et al., 2013). Math labs, or emporiums, have been constructed to accommodate the blended approach. The math emporium at Virginia Polytechnic Institute and State University (Virginia Tech) opened in 1997, spearheading this new approach to teaching math (Kasten, 2000). The math emporium at
Virginia Tech is housed in a large facility and maintains 500 individual computers. While the math emporium initially offered only introductory math courses, it soon offered 24 different math courses, facilitated by instructors and teaching assistants who are available for individual tutoring when students request assistance (Kasten, 2000). The math emporium provides an alternative to the traditional classroom, enabling students to work at their own pace on the computer, and receive help from the instructors and teaching assistants through tutoring approaches that are most conducive to their learning preferences and current competency of the material. Since the establishment of the math emporium, Virginia Tech math courses have exhibited lower withdrawal and failure rates, and higher test scores and final grades among students. Currently, the emporium at Virginia Tech offers 20 math courses, and continues to offer personalized assistance and incorporate innovative software (Twigg, 2011).

**Developmental Math Emporiums.** The math emporium is also beneficial for developmental math students. According to Braun et al. (2014), there is often vastly differing degrees of math competency among incoming freshman. At Virginia Tech, faculty members expressed their difficulty in teaching a large number of students who had immensely different knowledge bases of mathematical concepts (Kasten, 2000). Likewise, developmental math students have a wide range of competency levels (Ashby, Sadera, & McNary, 2011). To aid in the deficiency of math competency, computer-based learning has been implemented in many colleges, and has played a noteworthy role in developmental courses (Havill et al., 2004). Community colleges, with their open-door policy, have been the forerunners of developmental courses (Ashby et al., 2011). Software that provides students with additional exercises and assessments to enhance their math abilities is now prevalent; however, Havill et al. (2004) noted that the quality of the software is a paramount factor for the computer-based learning outcomes.
Havill et al. identified the self-paced component of computer-based learning, as is provided in math labs and emporiums, to be an essential factor that leads to success for developmental math students. Thus, math emporiums offer a unique and significant opportunity for developmental students, providing additional aids through the computer-based programs.

In the midst of the apparent success of computer-based learning in various types of math courses and for various levels of math competency, the computer-based approach likely has a favorable outlook for adaptation to a fully web-based content delivery system in many subjects (Chen, 2009). In comparison to the traditional classroom, Chen (2009) asserted that computer-based content delivery has the potential to customize teaching to individual students. This approach to learning has the capacity to reach students who have various learning preferences. Chen further claimed that this individualized approach promotes self-management and goal-oriented learning. The web-based programs provide immediate feedback, promoting self-regulated learning. Chen’s study resulted in increased learning and satisfaction rates among the experimental group utilizing the web-based content delivery system, with participants agreeing that their self-regulated learning was enhanced by utilizing this system. The numerous approaches of incorporating technology in teaching appear to vary greatly, with some approaches resulting in higher learning outcomes. Christensen (2011) emphasized the need to move toward a more individualized self-regulated format in which students gain most of the course content through a computer-based approach, while instructors maintain availability to individually customize assistance according to students’ unique needs. In this format, Christensen contends, instructors can focus on application of the computer-taught concepts through student interaction, exercises, and hands-on activities that enable the development of critical thinking and a fuller
comprehension of the course concepts. The computer-based approach may prove to be the most effective innovative teaching tool of the next generation (Christensen, 2011).

**Attitudes and Perceptions**

The attitudes and perceptions of technological teaching tools are of great importance for the continued use in the education system. There appears to be positive feedback from students who were surveyed on their satisfaction of these devices. In addition to the identification of self-regulated learning types, Chen’s (2009) study also included a survey to identify students’ satisfaction rates. Over 70% of the students had positive attitudes towards the program and agreed that it aided in their learning.

Lei (2010), in his study of 133 sixth and seventh grade students, found that the quality of the technology utilized in the classroom in a general setting is correlated with high levels of students’ self-esteem. Students felt good about their learning and more confident in themselves. Further, Christensen (2011) confirmed that when students were provided with customized learning tools and with instructors who worked with them individually, they felt more confident and were more engaged in learning.

Zucker and Hug’s (2008) study of the one-to-one student-to-laptop model also led to positive attitudes about the technological use. Over 90% of students stated it was helpful. Teachers who were included in the study were also satisfied with their laptop use, indicating that the occasional Internet outages did not significantly alter teaching and learning in their classrooms.

Student satisfaction with technology was also found in Zhu, Weng, and Cheng’s (2009) study on student experiences of programmable logic devices in design classes. After observation and an extensive survey administered to the experimental group of students, the conclusions
indicated that the students not only enjoyed using the programmable logic devices but also believed that these devices aided in learning. Zhu et al. specifically noted that students who tended to experience difficulty in the class benefitted the greatest from the devices. Thus, it appears that much of the technology incorporated in the classroom has resulted in improved learning outcomes as well as student satisfaction.

**Technology and the Potential for Addiction**

This generation has seen a massive expansion in the development and use of technology (Baer et al., 2011; Spies-Shapiro & Margolin, 2014). The general population, and especially adolescents, consider technology to be an integral part of their daily lives. Adolescents of the 21st century were born into a time of great technological advancement, and thus, they are highly adapted to the persistent use of technology and quickly acquire the skills for the newest technological advancements (Christensen, 2011).

One aspect of technological innovation is the upsurge in social media outlets. Spies-Shapiro and Margolin (2014) described adolescents’ increasingly excessive use of social networking sites (SNSs), and the impact that social media has on adolescents’ psychosocial development. Spies-Shapiro and Margolin discovered that SNSs have an effect on adolescents’ identity development, as adolescents heavily rely on the input of their peers to shape personal identities. Spies-Ahapiro and Margolin’s study identified a potentially positive aspect of the use of SNSs. They asserted that SNSs provide the opportunity for adolescents to interact with other individuals whom they would otherwise have no contact in a personal context. This communication could provide an opportunity to learn about others, to gain a greater appreciation for diversity, and to develop higher levels of empathy. Conversely, Spies-Shapiro and Margolin’s investigation also found that social comparisons with other adolescents were
common, and can have a negative influence on adolescents’ self-esteem. Adolescents often fabricate their lives, presenting only the positive aspects. Therefore, adolescents engaged on SNSs often believe their peers to be happier and more attractive than they consider themselves to be. Due to the fact that social comparison is a common effect of the constant flow of images and text on SNSs, studies on SNS have resulted in both positive and negative conclusions for adolescent development (Spies-Shapiro & Margolin, 2014).

Furthermore, when considering social media outlets, Blomfield-Neira and Barber (2014) studied SNSs and the relationship to adolescents’ adjustment, specifically measured by their levels of depression, self-esteem, and self-concept. They examined students from 34 high schools by administering a questionnaire measuring these three aspects of adjustment and the students’ levels of SNS use. Blomfield-Neira and Barber concluded that students who spent more time on SNSs exhibited higher levels of depression. They also concluded that these students had lower levels of self-esteem, yet higher levels of self-concept. An additional finding was the differences between male and female participants as well as differences in frequency of use of SNSs.

The overuse of SNSs and the multifaceted effects of this use is only one aspect of the growing consumption of technology among students today. The concern of whether or not overuse of technology can become an addiction has been posed repeatedly (Ding et al., 2013; Griffiths, 2005; Griffiths, 2010a; Ko et al., 2009). In particular, the misuse of computer activities has been described as similar to pathological gambling (Charlton, 2002). However, Charlton (2002) asserted that the current categorization of the DSM criteria for gambling addiction may not effectively categorize computing behaviors. In his factor analysis, Charlton questioned Brown’s (1991) checklist for identifying addiction, and whether Brown’s items could
be applied to the overuse of computing activities. Charlton’s study sought to discover whether there existed a difference between computing addiction with pathological symptoms and high engagement of computing behaviors. Charlton’s results indicated that the difference between addicted individuals and highly engaged individuals is often unclear. Many individuals moved from a highly engaged state in which they presented only a small number of symptoms of addiction into a fully addicted state, exhibiting many symptoms of addiction. However, Charlton asserted that many individuals who may be considered addicted according to Brown’s checklist (1991) could be more accurately considered highly engaged, computing individuals.

It appears that the concept of digital addiction is somewhat unclear due to the numerous types of technology and use of terminology utilized in identifying both addiction and specific technological devices (Charlton, 2002). However, digital addiction appears to be exemplified most accurately and prevalently in online gaming (Charlton & Danforth, 2007). Online gaming, which usually involves participation with other game players in a highly stimulating virtual environment, has particularly undergone scrutiny in comparison to other types of digital activities. However, as in Charlton’s (2002) previous study on computer behavior, once again, it was discovered that there lies a difference between addiction and high engagement in regards to gaming behaviors, as well. Feng et al. (2013) found considerable variance in the reported prevalence of Internet Gaming Addiction (IGA). In a study of 644 Dutch adolescents, with a mean age of 14.8, and a subsequent study of 573 different adolescents, with a mean age of 15.2, utilizing the same survey, Lemmens, Valkenburg, and Peter (2009) found the prevalence rate to be between 2-9%. Hussain, Griffiths, and Baguley (2012) studied 1,420 gamers, with a mean age of 23, and found that 3.6% of participants were classified as addicted. In a two-year longitudinal study by Gentile et al. (2011), a 9% prevalence rate of gaming addiction among
adolescents was found. The variance found in the prevalence of gaming addition could be partially due to the vague distinction made between addictive gaming and excessive gaming. Nevertheless, there appears to be a difference between addiction and excessive engagement in gaming.

**Excessive and Addictive Gaming Behavior**

Online gaming has become a popular form of entertainment, specifically for adolescents. As Charlton and Danforth (2007) have noted, there appears to be a difference between highly engaged gaming and addictive gaming. Baer et al. (2012) concurred that large amounts of time spent gaming does not necessarily lead to addiction. In their study of 110 middle school and high school students, Baer et al. discovered that emotional problems were associated with addictive gaming behaviors. However, when addictive criteria were not present, regardless of the amount of time spent gaming, there was found to be no correlation between gaming and emotional problems among the adolescents, even in the case of excessive hours of gaming (Baer et al., 2012). Charlton and Danforth (2007) asserted that the primary difference between excessive gamers and addicted gamers is the consequences that result from the gaming. They explained that gamers who play extensively yet who do not experience negative consequences are merely highly engaged in games; whereas, gamers who do experience negative consequences are considered to be addicted.

Before one can consider this difference between high engagement and addiction, the definition of gaming addiction must be more fully established. Again, as Brown (1991) stated, salience, tolerance, withdrawal symptoms, conflict, euphoria, and relapse are six items, or consequences, that identified an addiction. Griffiths (2010a) largely concurred with Brown’s identification of the primary criteria associated with an addiction.
Gaming addiction has been categorized as a behavioral addiction, much like gambling addiction (Ko et al., 2009). According to Ding et al. (2013), individuals with behavioral addictions displayed similar brain activity with individuals that were addicted to a substance. Specifically, individuals with either type of addiction presented different resting state patterns in the brain in comparison with individuals who were not addicted to a substance or behavior. Ko et al. (2009) also concluded that individuals who were addicted to gaming appeared to have comparable neurobiological abnormalities as individuals addicted to a substance. Griffiths (2005) asserted that rewards and reinforcement are the foundation to all addictions, both behavioral and chemical. Therefore, the current literature suggests that gaming addiction is defined and identified in the same manner in which substance addictions or other behavioral addictions are defined. Thus, an individual who presents salience, tolerance, withdrawal symptoms, conflict, mood modifications (including euphoria), and relapse is considered to be in an addicted state. Individuals who may game excessively but do not present these criteria are likely not addicted (Griffiths, 2010a).

**Potential Symptomology of Gaming Addiction**

A number of characteristics appear to be related to gaming addiction. While the majority of research is correlational and therefore cannot claim a causal effect, there are numerous studies that have resulted in similar conclusions suggesting symptomology, as a number of primary characteristics common among gaming addicts are presented. While there appear to be plausible positive characteristics of gaming such as greater increased communication in gamers (Kim et al., 2013), there are numerous negative characteristics that present themselves in individuals who are addicted to gaming. These characteristics include aggression, a decline in academic performance, psychosomatic issues and sleep problems, an inability to sustain healthy
relationships, a decrease in interaction with parents and teachers, depression, and impaired emotional and behavioral functioning.

As demonstrated by a survey given to 44,610 German ninth-grade students by the Criminological Research Institute of Lower Saxony, Rehbein et al. (2010) reported higher levels of violence and aggression among adolescents addicted to gaming. Further, this study demonstrated that gaming addiction is associated with psychological and social strain, as evidenced by an increase of truancy and suicidal thoughts, and a decrease in sleep and academic achievement levels (Rehbein et al., 2010). Skoric et al. (2009) also found a decrease in academic performance in a cross-sectional study of 333 elementary school gamers. The difference between engaged gamers and addicted gamers was evident, as it led to differing results in their study. Skoric et al. found that English test scores were significantly higher for engaged gamers depending on the amount of time spent gaming on the weekdays. However, addicted gamers had significantly lower scores in English and average scores on math and science, as was hypothesized. Weis and Cerankosky (2010) likewise discovered negative outcomes in learning in a study of elementary-aged boys. Furthermore, the boys’ gaming behaviors were related to decreases in the learning outcomes of reading and writing. Weis and Cerankosky also concluded that the academic achievement of the boys was affected by their after-school gaming which took the place of other after-school scholastic activities.

The growing rise of online gaming has a negative impact on the learning of college students, as well. Burgess et al. (2012) found that college students who were addicted to gaming had lower GPAs than those who were not addicted. In the study, Burgess et al. (2012) predicted that as the time students dedicated to gaming increased, the time dedicated to homework
decreased, resulting in lower academic achievement. Burgess et al. suggested that gaming offers a more entertaining option than schoolwork because addicted gamers are enticed by their games.

In addition to emotional and academic issues, addicted gamers also experience psychosomatic symptoms and physical ailments related to their addiction. Spekman et al. (2013), in their study of 1,004 adolescent boys, asserted that boys who exhibit problematic gaming behavior can experience physical pain related to their psychological state of extensive gaming. In this study, Spekman et al. also identified personality problems related to addiction and confirmed once again the similar neurological process between substance and behavioral addictions. In concurrence with existing literature, Spekman et al. discovered a significant difference in results between adolescents with problematic, or addictive, gaming behaviors, and adolescents who exhibit high usage of gaming without addictive characteristics.

Social and relational aptitude appears to be altered in gaming addicts as well. Jeong and Kim’s (2011) study of the level of social activities with parents and the resulting self-efficacy among adolescents addicted to gaming indicated a negative correlation. Thus, it appears that the more adolescents engage in gaming, the less apt they are to engage in family activities. According to Jeong and Kim, this lack of engagement with parents and family members leads to lower self-efficacy in adolescents. Further, Young (2009) emphasized the loss of important relationships when individuals become addicted to gaming. While addicted gamers become more immersed in gaming, marriages have ended, families have been severely disrupted, and longtime friends have been discarded. Young cited the following symptoms of gaming addiction: (a) social and psychological withdrawal, (b) loss of interest in previously enjoyed hobbies, (c) defensiveness and lying, and (d) continued gaming in spite of negative consequences. In a qualitative study of addicted gamers of the MMORPG entitled *EverQuest,*
Chappell et al. (2006) cited lying to family and friends as a characteristic of addicted gamers. Chappell et al. stated that MMORPGs are highly addictive because games build pressure and demands on gamers, enticing them to return and achieve the goals. Further, Chappell et al. noted that this demanding type of game often becomes burdensome to the addicted player, as the gaming can lead to loss of jobs, spouses, and friends, as gamers become more invested in the game and isolate themselves from their real-life context. Similarly, Young (2009) added the characteristic of escapism as a symptom. This psychological symptom is a behavior in which the gamer uses the games as an escape from his or her daily life and its real-world experiences.

The reasons to escape the real world and indulge in a virtual world of gaming may be due to a variety of reasons. One reason may be social phobia, which Wei et al. (2012) stated could be a contributor to depression. In a study seeking to understand the relationship between gaming, social phobia, and depression, Wei et al. discovered that levels of depression as well as psychosomatic symptoms were higher and more prevalent in correlation with higher numbers of hours gaming. Wei et al. concluded that individuals addicted to gaming had higher levels of depression, more isolation, and lower levels of self-esteem and belongingness than those who were not addicted to gaming. They further noted that many individuals who experience psychosomatic symptoms may possibly be experiencing depression as well (Wei et al., 2012).

As previously noted, these characteristics are correlated with gaming addiction. While it may be assumed that this correlation is causal, indicating that gaming addiction causes the symptoms, this conclusion is premature. It should be considered that individuals who already have a propensity for these personality characteristics may be more likely to become addicted to gaming. Mehroof and Griffiths (2010) stated that particular personality characteristics have been identified that exist in individuals who are addicted to gaming. Mehroof and Griffiths studied
the specific personality characteristics of sensation-seeking, neuroticism, self-control, aggression, state anxiety, and trait anxiety, and these characteristics’ relationship with gaming addiction. Five of the six traits were shown to have a positive relationship with gaming addiction. Mehroof and Griffiths suggested that personality traits might initially contribute to the development of gaming addiction. Further, they believed that the traits might also enable gamers to maintain an addicted state. Therefore, it appears that such general personality characteristics as social inhibition, hostility, and self-discipline are aspects that may not only lead to addiction, but also make it difficult to break the addiction (Mehroof & Griffiths, 2010).

**Motivations for Gamers**

Whether the psychological, emotional, and physical characteristics that are related to gaming addiction are correlational or causational is debatable. However, as Mehroof and Griffiths (2010) asserted, there are foundational motivational factors that appear to contribute to the addictive draw to online games. In reviewing the literature, specific reasons to engage in gaming are identified.

In a study by Wan and Chiou (2006), a qualitative approach was taken to understand in greater depth the motivations that lie behind ten Taiwanese adolescent gaming addicts. Wan and Chiou viewed the adolescents' motivations to game through a psychodynamic lens, as they identified five needs that the addicted gamers fulfill by gaming. Entertainment, building social relationships, challenge, escapism, and emotional coping (such as releasing stress, venting, and distraction from loneliness) are the five themes that presented themselves throughout the interview process. Wan and Chiou also noted that the strong needs of power, control, and success were probably motivators that underlie the other factors, yet the motivators remain at an unconscious level in the addicted gamers. Due to the fact that this study only included
Taiwanese adolescents, Wan and Chiou cautioned generalization to other populations. The motivation of building social relationships is supported by research (Hussain & Griffiths, 2009; Wan & Chiou, 2006). According to Hussain and Griffiths (2009), the majority of addicted gamers find that building a social network of friends is more satisfying online than within in-person contexts.

Therefore, it appears that the socialization factor is a strong motivator for gaming. Ng and Wiemer-Hastings (2005) affirmed that gamers who show symptoms of dependency to gaming are influenced most heavily by the social component that their online gaming environment offers them. Ng and Wiemer-Hastings further suggested that more introverted individuals tend to gravitate towards this type of social context within a virtual world, rather than engaging in the real world.

In another study by Wan and Chiou (2007), they identified the motivations for online gaming from a cognitive theory framework. Wan and Chiou’s study sought to understand the difference between the motivations of those who are addicted to gaming and those who are not addicted to gaming. Wan and Chiou initially organized the motivations into two categories, extrinsic and intrinsic. First, they discovered that gaming addicts appear to be more intrinsically motivated rather than extrinsically motivated, whereas adolescents not addicted to gaming were significantly more motivated to participate in gaming by extrinsic motivators. Second, Wan and Chiou also found that relevance, expectancy, contingency, and tangibility were four extrinsic factors that were theorized to undermine intrinsic motivation and had a disadvantageous impact on intrinsic motivation. If the extrinsic motivators provided by the games were low in relevancy and expectancy, intangible, and contingent, then they would have a beneficial effect on the development of intrinsic motivation, which appears to lead to gaming addiction. Conversely, if
the extrinsic rewards of the game are expected, relevant, tangible, and non-contingent, gamers were less likely to be influenced towards intrinsic motivation. With these findings, Wan and Chio believed that game designers could have greater success in marketing and selling the games if they were designed in such a way as to lead to intrinsic motivation. Nevertheless, Wan and Chio believed that laws should be mandated to inform parents of the motivating factors of any game that could lead to addiction.

**Gender and Gaming Addiction**

Both gaming addiction symptomology and motivations appear to differ between genders. The difference in prevalence between males and females is noteworthy, as addicted males tend to significantly outnumber addicted female gamers (Rehbein et al., 2010; Wei et al., 2012). According to Wei et al. (2012), while females amount to a smaller percentage of the gamer population, females also appeared to spend fewer hours gaming each week and had engaged in gaming behavior for a shorter time span than the males in their study. In spite of the lower prevalence rate, Wei et al. found that females exhibited greater levels of symptoms such as social phobia, depression, and somatic pain. Further Wei et al. noted that depression also appears to be a predictor for gaming addiction among females. Hetzel-Riggin and Pritchard (2011) discovered the motivating nature of depression on female gamers; females who demonstrated depressive behaviors increased their pathological gaming. While females may present more severe symptomology, Wei et al. (2012) asserted that addictive gaming is largely a male-dominated phenomenon. Rehbein et al. (2010) also concluded that males engage in online gaming and become addicted at a rate significantly higher than females. However, Rehbein et al. noted that females appear to have a higher prevalence rate for other Internet outlets such as chat rooms and social media.
According to Ko, Yen, Chen, Chen, and Yen (2005), while females may be motivated to game to relieve depression, males appear to be motivated by the sense of achievement and social interaction that they receive while gaming. Ko et al. also concurred with the higher prevalence rate of addiction among males. The sense of achievement and social interaction that adolescent males gain through gaming can influence their perception of themselves by increasing self-esteem. However, Ko et al. also found that adolescents who had lower self-esteem and a more negative view of life were more prone to become addicted to their games.

Overall, it is evident that the prevalence of online gaming addiction among males is higher than among females (Ko et al. 2005; Rehbein et al., 2010; Wei et al. 2012). It is also apparent that symptoms are presented differently by gender (Hetzel-Riggin & Pritchard, 2011). While motivations may differ as well, it appears that there are some commonalities in regards to psychological well-being among both female and male addicted gamers (Ko et al., 2005).

**Educational Technology for Addicted Gamers**

In the midst of the technological phenomenon experienced in the 21st century and the apparent benefits to the learning process that technological devices can offer students, the question posed is whether this technology is beneficial for students who are addicted to gaming. Whether or not utilizing technological devices can engage, motivate, and raise student satisfaction rates among addicted students, is questionable. Kim et al. (2013) hypothesized that gaming teaching tools could increase addicted gamers’ academic achievement. In a culture highly infiltrated with addicted gamers, Kim et al. sought to discover the influence of a special course utilizing gaming characteristics on addicted gamers’ writing and speaking skills. In a Korean high school, the course was offered consisting of narrative type teaching tools similar to aspects that gamers would experience in the storylines of their games. The students in the
gaming-simulated writing and speaking course improved in their writing and speaking skills. Kim et al. concluded that while an overall difference between the writing and speaking of the experimental and control groups was not significant, specific variables within both the speaking and writing skills were significant. It is believed that the motivation of these students to improve in their language skills was based on the familiar content and the game-like approaches to the delivery of the content. The results of this study identify an approach that could help educate addicted gamers. By providing these students with game-like teaching tools within the classroom, students addicted to gaming were academically benefited by using their gaming skills within their courses to achieve language skills.

Additional game-like curricula, now commonly referred to as gamification (Erenli, 2013; Giannetto et al., 2013), have been developed. To enhance learning, gamification uses avatars, graphics, and scenarios that resemble current games. Gamification is defined as the application of game mechanics to concepts and projects in environments other than gaming, such as in learning environments (Goehle, 2013; Villagrasa, Fonseca, Redondo, & Duran, 2014). Gamification within learning environments is specifically characterized by a student-centered learning approach, interaction within the game context, and a storyline which utilizes advanced three-dimensional graphics (Kebritchi et al., 2010). Educational outcomes are sought within this gaming context. Students become engaged in the game as they also achieve valuable learning. Gamification has been utilized in various subjects with various age groups including K-12 and university students (Goehle, 2013; Kebritchi et al., 2010; Villagrasa et al., 2014).

Kebritchi et al. (2010) studied motivation and achievement levels of high school students playing a 3-Dimensional mathematics game. Their study of 193 high school algebra and pre-algebra students resulted in mixed findings. Kebritchi et al. incorporated qualitative and
quantitative methods of analysis, incorporating interviews with teachers and students, and pre and post achievement tests and motivation surveys for the students. The achievement tests and interviews highlighted an increase in math achievement, while the motivation surveys did not demonstrate a significant effect on motivation. However, the interviews with both teachers and students demonstrated increased motivation to learn the math content (Kebritchi et al., 2010).

Regardless of the mixed findings from Kebritchi et al. (2010) on student motivation, students are increasingly incorporating games into their daily lives. Due to the fact that the majority of students in the United States participate in some level of gaming, students are developing technological skills that are not often being utilized in the classroom (Erenli, 2013). Instead, Erenli (2013) claimed that students are required to incorporate more traditional, and less practiced, learning methods to achieve success in the classroom. The use of game-like learning has led to differing opinions among educators and researcher (Kebritchi et al., 2010). Research has provided varied results, with some findings of empirical studies indicating improvement in attaining the sought-after learning outcomes, while others have demonstrated flawed methodology leading to inconclusive results (Kebritchi, et al, 2010). Nevertheless, a growing number of teachers are incorporating gamification into their teaching approaches. However, it is presently a controversial method because some educators have adopted it without caution while others believe it will be a quickly passing fad (Erenli, 2013). In addition, the addictive nature of games may stifle the learning process for students who are already addicted to games. Erenli (2013) stated that gamification might have different outcomes for this population of students. Gaming-addicted students may focus on the addictive nature of the games instead of the learning content. Conversely, gamification could have a positive effect, as demonstrated by Kim et al. (2013), by helping students engage in the “real world” of knowledge (Erenli, 2013, p. 20).
While this game-like learning technology may have been beneficial for the Korean gaming-addicted students (Kim et al., 2013), the most imminent innovative technology that is being incorporated into the American educational system is online learning delivery systems (Christensen, 2011; Ortagus & Stedrak, 2013). Online learning systems appear to offer students many advantages over traditional classroom lectures (Chen, 2009; Sun et al., 2007). However, this approach may not be beneficial for all students. Thus far, there is no literature identifying the success and satisfaction rates of university students who have varying levels of gaming addictive behaviors in an online learning or computer-based environment.

**Summary**

The phenomenon of technology has provided a vast number of outlets for individuals, and children and adolescents will quickly adopt the newest digital innovations available (Baer et al., 2011; Spies-Shapiro & Margolin, 2014). The problem of digital addiction, and specifically gaming addiction, has become troublesome. The characteristics correlated with video game addiction are largely negative and unhealthy, resulting in many psychological, emotional, physical, and academic deficits (Baer et al., 2012; Brunborg, Mentzoni, & Froyland, 2014; Rehbein et al., 2010; Skoric et al., 2009). Further, the intrinsic motivations to game appear to be deeply impactful, continually reinforcing the growing addiction (Wan & Chiou, 2007).

In the midst of gaming addiction, technology continues to progress and the education system has begun to incorporate additional and new innovative technologies into the classroom (Erenli, 2013; Giannetto et al., 2013). There are many different approaches to utilizing technology, with some approaches appearing to be more beneficial than others. While age-appropriateness of the technology is essential (Hillman & Marshall, 2009), it appears that the quality of the technology is of greater importance than the quantity (Lei, 2010). Further, the
The benefits of incorporating innovative technological methods within education are numerous. Quality technological devices and programs allow for such motivating components as automatically scored assignments and frequent testing, enabling both students and teachers to have a better understanding of areas needing improvement (Christensen, 2011; Goehle, 2013; Sun et al., 2007). Further, technology in teaching is becoming increasingly popular, and students’ attitudes towards this technology are largely positive (Chen, 2009; Kebritchi et al., 2010; Lei, 2010; Ortagus & Stedrak, 2013; Zhu et al., 2009; Zucker & Hug, 2008). While the exhilarating innovations in teaching and learning multiply, students who are addicted to gaming may not be benefiting from some types of technological advances (Erenli, 2013). Further, addicted gamers may potentially have low satisfaction rates and perceive this technology as boring in comparison to their games. Thus, this study seeks to evaluate the levels of gaming addictive behaviors among college students and their level of satisfaction in a computer-based math learning system. Secondly, this study seeks to examine the relationship between the levels of gaming addictive behaviors among college students and their level of success in a computer-based math classroom. Finally, this study seeks to understand the moderating effects of gender on gaming addictive behavior and student satisfaction and success.
CHAPTER THREE: METHODOLOGY

Introduction

Chapter Three describes the design, participants, setting, measurements, and data analyses. This study utilized a convenience sample of university students enrolled in computer-based math courses. The study was conducted for the purpose of addressing two aims: (a) determining the association between gaming addictive behaviors and the outcomes of student satisfaction and student success, while controlling for gender, GPA, and student housing; and (b) determining whether the associations between gaming addictive behaviors and the outcomes of student satisfaction and success were moderated by gender, while controlling for GPA and student housing. All models were tested using multiple regression in SPSS 22.0.

Design

The purpose of this quantitative study was to explore the association between video game addictive behaviors and the levels of student satisfaction and student success in a computer-based learning environment for college students. A multivariate correlational design was used to determine the association between the predictor variable, level of video game addictive behaviors, and each of the criterion variables, satisfaction rates and success rates. In a multivariate correlational design, predictor variables can be examined to identify potential influence on criterion variables (Gall et al., 2007). Additionally, a multivariate correlational research design is most appropriate for this study due to the continuous nature of the predictor variable (i.e., gaming addictive behaviors) and the outcome variables (i.e., student satisfaction and success). Finally, Baron and Kenny’s (1986) steps for testing moderation using multiple regression were employed to assess whether gender moderated links between addictive behaviors and the outcome variables (satisfaction and success).
**Research Questions**

**RQ1:** Does gaming addictive behavior predict the level of student success rates in a computer-based content delivery classroom, controlling for gender, GPA, and student housing?

**RQ2:** Does gender moderate the association between gaming addictive behavior and success, while controlling for GPA and student housing? (See Figure 1.)

**RQ3:** Does gaming addictive behavior predict the level of student satisfaction rates in a computer-based content delivery classroom, controlling for gender, GPA, and student housing?

**RQ4:** Does gender moderate the association between gaming addictive behavior and satisfaction, while controlling for GPA and student housing? (See Figure 2.)

![Diagram](attachment:image.png)

*Figure 1. Diagram of the proposed conceptual moderator model for student success.*
Figure 2. Diagram of the proposed conceptual moderator model for student satisfaction.

Null Hypotheses

$H_{01}$: There will be no statistically significant correlation between the level of gaming addictive behavior among college students in a computer-based content delivery math course and their levels of success in the course, while controlling for gender, GPA, and student housing, as measured by the Internet Gaming Disorder Scale and the students’ total scores for the course.

$H_{02}$: Gender will not significantly moderate the association between gaming addictive behavior and success, while controlling for GPA and student housing, as tested using the Baron and Kenny (1986) steps.

$H_{03}$: There will be no statistically significant correlation between the level of gaming addictive behavior among college students in a computer-based content delivery math course and their levels of satisfaction of the course, while controlling for gender, GPA, and student housing, as measured by the Internet Gaming Disorder Scale and the Assessment of Learner Satisfaction with Asynchronous Electronic Learning Systems.
**H04**: Gender will not significantly moderate the association between gaming addictive behavior and satisfaction, while controlling for GPA and student housing, as tested using the Baron and Kenny (1986) steps.

**Participants and Setting**

The participants for this study were drawn from a convenience sample of students at a large evangelical Christian university located in Central Virginia during the spring semester of the 2014-2015 academic year. The university has an annual enrollment of 12,000 undergraduate students. Students in this study were residential students who are either housed on campus in dormitories or live off campus and commute to their classes. The National Center for Educational Statistics (NCES, 2013) reported the following demographics of the student body at this university: (a) 41% male and 59% female; and (b) White 48%, Unknown 28%, Black or African American 15%, Non-resident alien 3%, Hispanic 2%, two or more races 2%, Asian 1%, American Indian 0.5%. A convenience sample was utilized in this study due to the readily available and large number of participants (Gall et al., 2007).

The setting for this study was comprised of two university math courses. Participation of this study was offered to students enrolled in 56 course sections of the developmental courses Math 100: Fundamentals of Mathematics; and Math 110: Intermediate Algebra. Both courses are developmental math courses. Developmental courses are offered for students who have not exhibited college level comprehension of the subjects (Ashby et al., 2011; Havill et al., 2004). One or both of the math courses are necessary components of a degree program for developmental students, which is determined by a placement exam, high school GPA, and SAT or ACT scores of incoming college students. The total number of students enrolled in the courses in the spring semester is 1,175 students. The courses are located on the campus of the
university in the Math Emporium. In these math courses, students meet once a week for a class lecture given by an instructor who covers the new math material. Students are then tasked with watching videos that reinforce the material covered in the lecture. The courses utilize a computer-based content delivery format in which students learn in part by the computer program, while instructors, staff, and student tutors are available for facilitating additional learning and individual tutoring. The Math Emporium resembles a lab, as work spaces are aligned horizontally, with each table containing three to four computers. Students are assigned rows for their class period and can choose any computer within the specified row. Students progress at their own pace and are assessed regularly; however, they have a weekly schedule that includes one designated class period as well as specific available hours for their class cohort to have access to the emporium. The course is set as a mastery-based course. Students must master the content before moving on to the next unit. A mastery score on homework and quizzes is 80%, while a mastery score on tests is 70%. When students are unable to advance to the next lesson due to non-mastery scores on assessments, instructors, staff tutors, and student tutors are encouraged to work with them individually to help them comprehend the material through one-to-one tutoring.

**Instrumentation**

The primary measures utilized in this study comprised of two surveys and the final scores of the participants. Additionally, demographical data was collected.

**Demographics**

In order to identify important characteristics of the sample and include salient covariates in analyses, data on the following demographics were collected: (a) gender, (b) ethnicity, (c) age, (d) class, and (e) student housing.
Internet Gaming Disorder Scale

Numerous gaming addiction instruments have been created to identify addiction according to the DSM criteria. Initially, a gaming scale was created by Lemmens et al. (2009) based on the DSM-IV criteria for pathological gambling which was originally adapted by Griffiths in 2005. This instrument included seven items. Players rate all items on a five-point Likert scale. The instrument is scored on a continuous scale that does not have cut-off scores indicating addiction or non-addiction. Thus, a percentile of the mean scores is often used.

Internet Gaming Disorder was included as a tentative disorder in the appendix section of the newest edition of the DSM. Due to adjustments for the criteria of pathological behaviors, the DSM-5 specifically included Internet Gaming Disorder (APA, 2013). The criteria currently necessary for diagnosis of Internet Gaming Addiction according to the DSM-5 involve the following symptoms: Preoccupation, tolerance, withdrawal, relapse, escape, problems, deceit, displacement, and severe consequences (APA, 2013).

With the revised criteria for pathological addictions in the DSM-5, Lemmens, Valkenberg, and Gentile (2013) revised their gaming addiction instrument. According to the DSM-5 (APA, 2013), there are now nine criteria associated with Internet Gaming Disorder: (a) preoccupation, (b) tolerance, (c) withdrawal, (d) relapse, (e) escape, (f) problems, (g) deceit, (h) displacement, and (i) severe consequences. The DSM-5 requires that a majority of the criteria be present for diagnosis of Internet gaming disorder. Thus, individuals who reported five or more addiction criteria from the Internet Addiction Scale are considered to be addicted to gaming. Individuals who reported fewer than five criteria would be considered not addicted. Lemmens, et al. (2013) developed two versions of the instrument: (a) an index version, incorporating dichotomous response options, which is the format that the DSM-5 utilizes for diagnosis
purposes, and (b) a continuous answer option based on a scale. Some researchers have preferred the continuous scale to strengthen variance and predictive power (Lemmens et al., 2013).

This study utilized the 27-item Internet Gaming Addiction continuous scale. Three items are included for each of the nine criteria of pathological gaming. Participants rate each item on a 6-point quantifier scale. The answer options range from 0 to 6 and include the following descriptions: never (0), one to four times in the last year (1), five to ten times in the last year (2), about once to three times a month (3), once or more a week (4), every day or almost every day (5). The lowest possible score is 0, indicating no gaming pathology, while the highest score is 162 indicating high pathological gaming addiction. The 27-item IGD scale has a Cronbach’s alpha of .94 (Lemmens et al., 2013). The scores in the current study ranged from 0 to 81.

Cronbach’s alpha for the current study was .93. This is an appropriate instrument for this study because the various versions of this instrument have been utilized in a variety of settings and countries (Gentile, 2009; Lemmens et al., 2009; Griffiths & Hunt, 1998). Further, this revised scale based on the DSM-5 (APA, 2013) incorporates the most current criteria for Internet Gaming Disorder. The amount of time necessary to complete this scale is approximately 15 minutes. Approval has been given for use of this instrument in this study.

Assessment of Learner Satisfaction with Asynchronous Electronic Learning Systems

With the increasing use of Internet-based learning systems, the Assessment of Learner Satisfaction with Asynchronous Electronic Learning Systems was created (Wang, 2003). Prior to the creation of this instrument, there was no valid and reliable measurement for student satisfaction in an electronic, computer-based learning environment. Wang determined to measure electronic learner satisfaction, and designed the instrument to be applicable for a comprehensive variety of available e-learning systems. In order to determine the attitudes and
perceptions of students utilizing this growing field in education, electronic learner satisfaction has been an important factor to measure.

In the initial stage of development of the instrument, it contained 21 items, followed by the addition of 5 more items representing general measures of overall satisfaction and success. After factor analysis the final scale included a total of 17 items which represented four factors: learning community, personalization, content, and learner interface (Wang, 2003). The instrument is a continuous seven-point Likert scale with answer options ranging from 1, indicating “strongly disagree,” to 7, indicating “strongly agree.” The combined possible score is 119, with the lowest score of 7 indicating strong dissatisfaction, and the highest score of 119 indicating high satisfaction. The scores from the current study ranged from 17 to 119. This 17-item instrument has a Cronbach’s alpha of 0.93 (Wang, 2003). Cronbach’s alpha for the current study was .961. The amount of time to complete this assessment is approximately 10 minutes.

Final Scores

The final measurement in this study was the students’ total scores for the course, measuring the success rate of the computer-based math classroom. The points earned from each assignment were totaled resulting in a continuum from 0 to 1000 for each student. Students who withdrew from the course or failed to participate for 21 days were excluded from the success model; however these students remained in the student satisfaction model of the study. Scores ranged from 98.19 to 982.35.

Procedures

The researcher gained approval from the authors of the instruments that were used in this study, as well as from the Dean who oversees the Math Emporium and courses. Additionally, Institutional Review Board (IRB) approval was gained. The researcher was then given approval
by the University’s Business Intelligence Office to have access to the participants’ final scores for the course.

To encourage students to take part in this voluntary study, the researcher asked each course section’s primary instructor for a five minute period in the class session to provide a brief introduction of the study. The introduction to the study was given in-person by the instructors and research assistants to students in each of the math courses on the day that the instruments were offered. The IRB approved the script for the instructors’ introduction to the study (see Appendix C). The introduction to the study included the basic description of the research to be conducted and invited students to participate in the study by completing the surveys. In order to capture the participation of as many students as possible, the instructors provided this introduction during the students’ designated class period of the week. The students were also notified that they could withdraw from the study at any point during the research process.

Qualtrics, a computer program required for research at this university, was utilized to electronically administer these two assessments. During the eighth week of class in the spring semester, the Internet Gaming Disorder Scale and the Assessment of Learner Satisfaction with Asynchronous Electronic Learning was offered to the students through an online survey distributed through a Qualtrics link. These surveys were not given prior to the fourth week of class to allow for student withdrawals in order to avoid the need to discard many surveys due to students’ non-completion of the full study. Because the course is self-paced, there is not a set date for all students to complete the course, as the range in course completion time is between eight and sixteen weeks. Therefore, the surveys should be offered near the eighth week of the semester.
Students were introduced to the study and had the opportunity to take the brief survey during their designated class period. Students also had the opportunity to opt to continue their math lessons if they did not desire to participate in the study. This approach helped protect students’ autonomy by giving them a way to decline participation without feeling stigmatized or singled out. After reviewing and providing informed consent (see Appendix B), in which the students must agree to participate in the survey and allow the Business Intelligence Office to provide the researcher with the final scores for the class, participants provided demographic data (i.e., student ID number, gender, race/ethnicity, age, class, and student housing). Then, participants completed both instruments. Overall, the announcement and assessments took less than 10 minutes to complete. As an incentive, students were entered into a random drawing for one of 56 $10 Starbucks gift cards. There was a drawing for the gift card and a winner announced in each of the 56 course sections. The gift card was given by the end of the class period in each course section.

Finally, after the course end-date and final grades were posted, the final score for each student who participated in the study was drawn from reports created by the Business Intelligence Office in the Registrar’s Office. The scores were matched to individual students and their previous survey scores through their student ID numbers. In place of the researcher, a research assistant assisted with this process of matching scores so as to protect students’ confidentiality. In addition, once scores were matched, students were assigned a new, unique student identification number and their university student ID numbers were removed from the data file. A master document with two columns (study ID number and university ID number) is maintained in a locked file cabinet that is not in the same location as the data file.
Data Analysis

Power Analysis and Data Screening

Since a convenience sample was used in this study, a relatively large sample is needed to increase the possibility of generalizing the results to the greater population (Gall et al., 2007). An incentive to participate in the study was offered to all students. Previous surveys offered to freshman students at this university have elicited approximately 50% of student responses. Therefore this approach to gathering participants was expected to successfully recruit approximately 50% of the students in the classes, an estimated 590 students. A power analysis and assumption testing were conducted prior to the descriptive and multiple regression analyses that investigated the associations among the variables. The alpha (i.e., probability of type 1 error) was set at 0.05, and the power (1 – beta) was 0.8. To confirm that the size of the sample was adequate, Field (2013) recommended conducting a power analysis with G-power 3. The minimal sample size needed to detect a small effect was 565 participants, while detecting a medium effect required 77 participants. Although the size of the sample has reduced power for detecting a small effect, the number of participants far exceeded the minimum number needed to detect a medium effect (Gall et al., 2007).

It was further proposed that assumption tests would be conducted, employing SPSS 22.0. Skewness and kurtosis values were examined for normality. These values should be zero in a normal distribution, whereas values that are increasingly distant from zero indicate the severity of the non-normality. According to Field (2013), when skewness values are positive, the scores are dense on the left side of the distribution, and negative values indicate a heavy load of scores on the right side of the distribution. Positive values of kurtosis indicate a tall, heavy distribution, and negative values of kurtosis specify a flatter distribution. In large, with samples of 200 or
more, viewing the skewness and kurtosis values and the shape of the distribution is more important than calculating the significance of the values (Field, 2013). In this study, normality was reviewed through histograms, and multicollinearity utilized bivariate correlations with a cut-off of .8, and the variance inflation factor (Field, 2013). Cook’s distance and Mahalanobis distances were used to identify the influence of outliers. A priori, it was determined that outliers would be included in the analyses. While outliers can potentially bias the data, Field (2013) argued that each outlier represents an individual who has participated in the study and provided answers, thus providing a precedent for including their data in final analyses. Finally, correlations between residuals were examined by the Durbin-Watson test.

Table 1

Explanation of Data Analysis Tests

<table>
<thead>
<tr>
<th>Data Analysis Test</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hierarchical Multiple Regression</td>
<td>Examined the strength of the relationship between variables and the fit of the moderator model</td>
</tr>
<tr>
<td>Probability-Probability Plot</td>
<td>Assessed data for skewness, kurtosis, and multivariate normality</td>
</tr>
<tr>
<td>Histogram</td>
<td>Assessed distribution for skewness and kurtosis</td>
</tr>
<tr>
<td>Scatter Plots</td>
<td>Assessed data for linearity and homoscedasticity</td>
</tr>
<tr>
<td>Cook’s Distance</td>
<td>Identified multivariate outliers</td>
</tr>
<tr>
<td>Mahalanobis Distance</td>
<td>Identified multivariate outliers</td>
</tr>
<tr>
<td>Bivariate correlations</td>
<td>Assessed multicollinearity of predictor variables</td>
</tr>
<tr>
<td>Variance Inflation Factor</td>
<td>Assessed multicollinearity of predictor variables</td>
</tr>
</tbody>
</table>
Analyses

A series of multiple regression analyses were proposed. Data were analyzed using SPSS 22.0 for Windows software. To test hypothesis 1 and hypothesis 3, satisfaction was regressed on gaming addictive behavior, controlling for gender, housing, and GPA, and success was regressed on gaming addictive behavior, controlling for gender, housing, and GPA. Then, two moderator models were run to test hypotheses 2 and 4. In a simple linear causal relationship, X is presumed to predict the variable Y, the moderator variable, identified as M, is a covariate that may influence the association between variables X and Y (Barron & Kenny, 1986). In this study, video game addictive behavior (X) was presumed to influence levels of student satisfaction ($Y_1$) and success ($Y_2$) and will be moderated by gender (M). To test for moderation, hierarchical multiple regression was utilized. In step one, the covariates housing and GPA were entered. In step two, addictive behavior (centered) and gender were entered. Then, in step three, the interaction (addictive behavior * gender) were entered. The change in $R^2$ was assessed, as well as individual betas and partial correlations. A model predicting satisfaction was tested, as was a model predicting student success.

Missing Data

In light of the method of analysis and program limitations, listwise deletion was used in all analyses. Final numbers for the models differ due to missing data on different variables. For example, a student may have a student satisfaction score, but not a final grade. This student would be included in the analysis for satisfaction but would be excluded in the analysis for student success. The number of participants with missing student satisfaction data was 77. Following Hayes’s (2013) argument for eliminating missing data, the data from the 77
participants were removed from the student satisfaction analysis. Conversely, there were 100 participants who lacked student success data. Again, following Hayes’s argument, the student success data of these participants were removed from the analysis, but their remaining data was included in the student satisfaction analysis.
CHAPTER FOUR: FINDINGS

The purpose of this multivariate correlational study was to examine the association between college students’ levels of gaming addictive behavior and their levels of course satisfaction and success in a computer-based content delivery math classroom at an evangelical Christian university. This study also examined gender as a potential moderator of the association between gaming addictive behavior and student outcomes (i.e., satisfaction and success). Chapter Four presents the data analyses that were utilized in this study, including: (a) assumption testing, (b) descriptive data, (c) hypothesis testing results, and (d) bootstrapping analysis. Multiple regression was utilized for analyzing the hypotheses with SPSS 22.0. Moderator models were tested following the steps delineated by Baron and Kenny (1986).

**Null Hypothesis 1:** There will be no statistically significant association between the level of gaming addictive behavior among college students in a computer-based content delivery math course and their levels of success in the course, while controlling for gender, GPA, and student housing, as measured by the Internet Gaming Disorder Scale and the students’ total scores for the course.

**Null Hypothesis 2:** Gender will not significantly moderate the association between gaming addictive behavior and success, while controlling for GPA and student housing, as tested using the Baron and Kenny (1986) steps.

**Null Hypothesis 3:** There will be no statistically significant association between the level of gaming addictive behavior among college students in a computer-based content delivery math course and their levels of satisfaction of the course, while controlling for gender, GPA, and student housing, as measured by the Internet Gaming Disorder Scale and the Assessment of Learner Satisfaction with Asynchronous Electronic Learning Systems (ALSAELS).
**Null Hypothesis 4:** Gender will not significantly moderate the association between gaming addictive behavior and satisfaction, while controlling for GPA and student housing, as tested using the Baron and Kenny (1986) steps.

**Assumption Testing**

Preceding the analyses of the hypotheses, the data were cleaned, and assumption testing was conducted to evaluate the linearity, independence, and normality of the sample distribution. The data for gaming addictive behavior and student satisfaction were not normally distributed, as demonstrated by an evaluation of the variables’ histograms, and skewness and kurtosis values. The skewness value for gaming addictive behavior was 2.232, and the kurtosis value was 5.609, which was statistically significant indicating non-normality, as indicated by Field (2013). The skewness value for student satisfaction was -.817 and the kurtosis value was .811 also indicating non-normality. Again, both values indicated a level of non-normality. Measures of central tendency for the predictor and criterion variables are presented in Table 2. Due to the fact that a diagnosis of gaming addiction is limited to a small population of individuals, it is reasonable that the data were positively skewed in a typical college population. In addition, satisfaction ratings are often negatively skewed (Oja, 2011). It is important to note the non-normality of these data, since conducting multiple regression with data that are not normally distributed may increase bias in parameter estimates and influence the null hypothesis significance testing (Field, 2013). Therefore, after running the originally proposed analysis (Baron & Kenny, 1986), bootstrapping analyses were conducted using Hayes’s (2012) PROCESS macro in SPSS 22.0. This method of analysis is more robust against non-normality, and can be used when assumptions have been violated (Field, 2013; Preacher & Hayes, 2008). The findings from the bootstrapping analysis and the initial regression analysis did not differ; therefore, the original results from the regression
analysis are provided. In assessing the influence of outliers, the maximum Cook’s distance was less than 1 (.043). Thus, there appeared to be no impact by the outliers on the model. The Mahalanobis distances were reviewed and none of the values indicated significant multivariate outliers. The residuals appeared to be uncorrelated, as suggested by the Durbin-Watson test value, which was close to 2 (Field, 2013). Multicollinearity was assessed using bivariate correlations, resulting in all variables under the cut-off of .8 (Field, 2013). In addition, the variables’ variance inflation factor (VIF) values were under 10 and tolerance values were above .2 (Field, 2013).

Table 2

Central Tendency Measures

<table>
<thead>
<tr>
<th>Variable</th>
<th>( M (SD) )</th>
<th>Median</th>
<th>Mode</th>
<th>Min/Max</th>
<th>Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addictive Behavior</td>
<td>9.394(14.031)</td>
<td>3.000</td>
<td>0.000</td>
<td>0.00/81.00</td>
<td>.930</td>
</tr>
<tr>
<td>Student Satisfaction</td>
<td>85.181(19.746)</td>
<td>88.000</td>
<td>102.000</td>
<td>17.00/119.000</td>
<td>.961</td>
</tr>
<tr>
<td>Final Scores</td>
<td>737.857(197.107)</td>
<td>808.968</td>
<td>579.890</td>
<td>98.19/982.350</td>
<td></td>
</tr>
<tr>
<td>GPA</td>
<td>2.853(0.619)</td>
<td>3.000</td>
<td>3.000</td>
<td>0.00/4.000</td>
<td></td>
</tr>
</tbody>
</table>

Demographic Data

After accounting for student withdrawals and student extensions for the courses, the total enrollment for all sections of Math 100 and Math 110 was 1056 students. A total of 502 students responded; however, 15 did not actually complete the survey and there were a total of 13 duplicate submissions. The second submission was deleted for these 13 students, leaving a total sample size of 474 students. The response rate of the survey was 44.89%.

Of the participants, 52.1\% (n = 246) were female and 47.9 \% (n = 226) were male. Additionally, 22.3\% (n = 105) of the participants lived off campus, and 77.7\% (n = 364) lived on
campus in dormitories. Demographics of ethnicity included the following: (a) Caucasian, 71.9% (n = 340), (b) African American, 17.1% (n = 81), (c) Hispanic 5.1% (n = 24), (d) Asian, 2.3% (n = 11), and (e) 3.6% (17) indicated other ethnicities (see Table 3).

Table 3

<table>
<thead>
<tr>
<th>Participant Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Variable</strong></td>
</tr>
<tr>
<td><strong>Gender</strong></td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td><strong>Race/ethnicity</strong></td>
</tr>
<tr>
<td>African American</td>
</tr>
<tr>
<td>Asian</td>
</tr>
<tr>
<td>Caucasian (White)</td>
</tr>
<tr>
<td>Hispanic</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td><strong>Housing</strong></td>
</tr>
<tr>
<td>Off Campus</td>
</tr>
<tr>
<td>On Campus</td>
</tr>
<tr>
<td><strong>Classification</strong></td>
</tr>
<tr>
<td>Freshman</td>
</tr>
<tr>
<td>Sophomore</td>
</tr>
<tr>
<td>Junior</td>
</tr>
<tr>
<td>Senior</td>
</tr>
</tbody>
</table>

Results of Gaming Addictive Behavior Models

**Student Success**

A regression analysis was performed to examine the addictive behavior moderator model for student success (Baron & Kenny, 1986; MacKinnon, 2008). The number of participants who had missing student success data was 100. Thus, only data for 374 participants were included in the model.
The control variables of student housing and GPA were included in Block 1. This model accounted for 10.4% of the variance in student success, $R^2 = .104$, and adjusted $R^2 = .100$, which was statistically significant, $F(2, 371) = 21.608, p = .000$. Within Block 1, both housing and GPA had a statistically significant association with student success. The results indicated that living on campus was associated with high success in the course, $\beta = -.138, p = .005$. Furthermore, results indicated that a high GPA was associated with high student success (i.e., final grade in the course), $\beta = .281, p = .000$.

Block 2 included the predictors of gaming addictive behavior (centered) and gender. (Note that all continuous predictors were centered to ease interpretation, as recommended by Field (2013), Hayes (2013), and MacKinnon (2008)). Block 2 accounted for 11% of the variance, $R^2 = .114$, and adjusted $R^2 = .104$, in student success, which was statistically significant, $F(4, 369) = 11.850, p = .000$. Within Block 2, housing, GPA, and gender were statistically significant; however, gaming addictive behavior was not statistically significant, $\beta = .022, p = .665$. Results indicated that living on campus was associated with high success in the course ($\beta = -.138, p = .005$), high GPAs were associated with high student success ($\beta = .266, p = .000$), and the female gender was associated with high success in the course ($\beta = .103, p = .048$).

Block 3 included the interaction between gaming addictive behavior and gender. Model 3 described 11% of the variance, $R^2 = .115$, and adjusted $R^2 = .103$. Although the overall model was significant ($F(5, 368) = 9.535, p = .000$), the change in $R^2$ was not significant, indicating that the interaction between gaming addictive behavior and gender did not improve model fit. Overall, while the model did fit the data due to the covariates, adding the primary predictor, gaming addictive behavior, and the interaction between gaming addictive behavior and gender did not improve the model fit (see Table 4).
Hypothesis 1. Within the student success model, it was specifically hypothesized that students’ levels of gaming addictive behavior will be associated with their level of success rate in a computer-based content delivery course, while controlling for gender, GPA, and student housing. Hypothesis 1 was not supported by the data analysis and the level of gaming addictive behavior was not significantly associated with success in the course, $\beta = .022, p = .665$. However, high GPA, housing (i.e. on-campus), and gender (i.e., female) were associated with high student success in the course (see Table 4).
**Hypothesis 2.** In Hypothesis 2, it was suggested that gender would moderate the interaction between students’ levels of gaming addictive behavior and their levels of course success, while controlling for GPA and student housing. It was assumed that gender would influence the association between the predictor and criterion; however, there was no significant interaction. The interaction between variables was not a significant predictor of students’ final scores in the course, $\beta = .039, p = .551$ (see Table 4). However, GPA, housing, and gender were again found to be associated with student success, with high GPA, on campus residency, and the female gender associated with high success rates.

**Student Satisfaction**

A regression analysis was also performed to examine the gaming addictive behavior moderator model for student satisfaction (Baron & Kenny, 1986; MacKinnon, 2008). The number of participants with missing student satisfaction data was 77. Therefore, only data for 397 participants were included. Overall, the moderator model did not fit the data. Model 1 included the control variables of student housing and GPA. Block 1 accounted for approximately .2% of the variance, $R^2 = .002$, and adjusted $R^2 = -.003$, in student satisfaction. The model was not statistically significant, $F(2, 394) = .373, p = .689$, indicating that it did not fit the data. Within Block 2, the predictor of gaming addictive behavior was centered and included with the variable gender. (Note that all continuous predictors were centered to ease interpretation, as recommended by Field (2013), Hayes (2013), and MacKinnon (2008)). This model accounted for .3% of the variance, $R^2 = .003$, and adjusted $R^2 = -.008$, in student satisfaction, and was not statistically significant, $F(4, 392) = .247, p = .911$. Block 3 included the interaction of the variables gaming addictive behavior and gender. Model 3 described .3% of the variance, $R^2 = .003$, and adjusted $R^2 = -.0100$, in student satisfaction, which was not statistically significant $F(5,$
In addition, across all models, the change in $R^2$ was not significant, indicating that the addition of predictors and the interaction did not improve the model. Findings failed to support hypothesis 3 that gaming addictive behavior would be associated with satisfaction in the course as well as hypothesis 4, which predicted an interaction between gender and gaming addictive behavior on student satisfaction (see Table 5).

Table 5

<table>
<thead>
<tr>
<th>Variable</th>
<th>Block 1</th>
<th></th>
<th>Block 2</th>
<th></th>
<th>Block 3</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$B$</td>
<td>$SE$</td>
<td>$\beta$</td>
<td>$B$</td>
<td>$SE$</td>
<td>$\beta$</td>
</tr>
<tr>
<td>Housing</td>
<td>2.051</td>
<td>2.386</td>
<td>.043</td>
<td>2.062</td>
<td>2.391</td>
<td>.044</td>
</tr>
<tr>
<td>GPA</td>
<td>.237</td>
<td>1.624</td>
<td>.007</td>
<td>.174</td>
<td>1.646</td>
<td>.005</td>
</tr>
<tr>
<td>Gender</td>
<td>-.121</td>
<td>2.108</td>
<td>.003</td>
<td>-.071</td>
<td>2.115</td>
<td>.002</td>
</tr>
<tr>
<td>Addiction</td>
<td>-.036</td>
<td>0.073</td>
<td>-.026</td>
<td>-.058</td>
<td>0.095</td>
<td>-.042</td>
</tr>
<tr>
<td>Interaction</td>
<td>0.055</td>
<td>1.151</td>
<td>.024</td>
<td>(-2.587, -6.860)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R$^2$</td>
<td>0.002</td>
<td></td>
<td>0.003</td>
<td></td>
<td>0.003</td>
<td></td>
</tr>
<tr>
<td>Model $F$</td>
<td>$F(2, 394) = 0.373$</td>
<td></td>
<td>$F(4, 392) = 0.247$</td>
<td></td>
<td>$F(5, 391) = 0.224$</td>
<td></td>
</tr>
<tr>
<td>F for change in $R^2$</td>
<td>0.002</td>
<td></td>
<td>0.001</td>
<td></td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>p-value</td>
<td>.689</td>
<td></td>
<td>.884</td>
<td></td>
<td>.716</td>
<td></td>
</tr>
</tbody>
</table>

* $p \leq .05$  
** $p \leq .01$  
*** $p \leq .001$

**Hypothesis 3.** Within the student satisfaction model, it was hypothesized that there would be an association between students’ level of gaming addictive behavior and their level of course satisfaction in a computer-based content delivery course, while controlling for gender, GPA, and student housing. Findings failed to support this hypothesis. The level of gaming addictive behavior was not a significant predictor of students’ satisfaction of the course, $\beta =$ -
.026, $p = .626$ (see Table 5). In addition, GPA, student housing, and gender were not significant
predictors.

**Hypothesis 4.** It was hypothesized that there would be a significant interaction between
level of gaming addictive behavior and gender, while controlling for GPA and student housing.
Specifically, it was predicted that gender would moderate the association between levels of
gaming addictive behavior and students’ course satisfaction. Analyses revealed that the
interaction between gender and gaming addictive behavior was not a significant predictor of
students’ satisfaction of the course, $\beta = .024, p = .716$, (see Table 5). Furthermore, the covariates
GPA, student housing, and gender were also not significantly related to student satisfaction.

**Summary**

Results from the statistical analyses (including bootstrapping analyses) failed to support
the hypothesized moderator models. Moreover, gaming addictive behavior was not associated
with student success or satisfaction. Several covariates were significantly associated with high
student success: (a) student on-campus housing, (b) high GPA, and (c) students of the female
gender. As a whole, these findings failed to support gaming addictive behavior and the
interaction between gaming addictive behavior and gender as significant predictors of student
success and student satisfaction. Chapter five provides an in-depth discussion of the results
presented in Chapter Four. Specifically, the discussion will (a) address findings of this study
within the context of the field of addiction, (b) report limitations of the study, and (c) provide
suggestions for future research.
CHAPTER FIVE: DISCUSSION

The purpose of this study was to examine the association between college students’ levels of gaming addictive behavior and their levels of course satisfaction and success, while controlling for gender, housing and GPA in computer-based content delivery math courses. In addition, moderation analyses explored whether the interaction between gaming addictive behavior and gender was associated with student outcomes (i.e., satisfaction and success). Research on Internet gaming addiction and the overuse of gaming continues to expand, as technology advances and enables more convenient opportunities to engage in gaming. The current literature suggests lower scholastic achievement among gaming addicted students (Haghbin et al., 2013; Skoric et al., 2009). Additionally, the literature on innovative, technological approaches to teaching and learning is also growing (Johnson et al., 2014a.) However, very limited research has been conducted on gaming addicted students and their scholastic achievement with technologically-based, or computer-based, teaching. The findings of this study extended the body of literature related to gaming usage and addiction and its association with learning, specifically of undergraduate students engaged in a computer-based learning classroom. This study examined whether the level of gaming addictive behavior predicted student success rates and satisfaction rates of a computer-based, blended learning model. Further, gender was investigated for its potential to serve as a moderator between gaming addictive behavior and student success and satisfaction.

Summary of Findings

Findings of this study indicated that students’ level of gaming addictive behavior did not significantly influence their success or satisfaction in the course. Hypothesis 1 was not supported. Students’ level of addictive behavior did not reveal a positive or negative association
with student success in the computer-based courses. However, covariates including type of student housing, gender, and GPA were found to be significant predictors of student success in the Math Emporium. Hypothesis 2 was not supported, as the interaction between gaming addictive behavior and gender was not found to be a statistically significant predictor of student success. Furthermore, Hypothesis 3 did not result in statistically significant findings. The level of gaming addictive behavior was not associated with students’ satisfaction of the computer-based course. Finally, the results did not support Hypothesis 4, as the interaction between addictive behavior and gender on student satisfaction was not found to be statistically significant.

**Discussion of Findings**

Building upon previous research, it was expected that students who have higher levels of gaming addictive behavior would have lower success rates in a computer-based content delivery math course, while controlling for gender, GPA, and student housing. Particularly, it was assumed that higher levels of gaming addictive behavior would present a negative association with the students’ final scores in the course. Further, a significant interaction between students’ levels of gaming addictive behavior and their levels of course success was expected when gender was used as a moderator, while controlling for GPA and student housing, as tested using the Baron and Kenny (1986) steps. It was also expected that students who have higher levels of gaming addictive behavior will have lower levels of course satisfaction in a computer-based content delivery math course, while controlling for gender, GPA, and student housing. It was expected that gender would significantly moderate the association between students’ levels of gaming addictive behavior and their levels of course satisfaction, while controlling for GPA and student housing, as tested using the Baron and Kenny (1986) steps.
The results from the hierarchical regression suggested that one of the models (student success) fit the data, while the other model (student satisfaction) was a poor fit for the data. It is worth noting that the model for student success was only significant due to the influence of the covariates. Gaming addictive behavior as the primary predictor did not significantly improve the models. The lack of statistical significance for the primary predictor variable of interest may have resulted from a number of reasons. Most notably, the primary predictor (i.e., gaming addictive behavior) is a construct that is (a) extremely uncommon in high levels, especially to the degree of addiction, and (b) prone to participant denial. The percentage of individuals who present problematic behavior related to gaming is small. Furthermore, the number of individuals who would be considered addicted, according to the DSM-5 (APA, 2013) criteria, is considerably lower. While the university environment appears to provide ample opportunity for high levels of gaming addictive behavior among students, the environment also may be inclined to promote shame for students who are struggling in their course work while suffering from Internet gaming addiction. Furthermore, for students who are addicted to gaming, denial, a common characteristic of addiction, may have influenced survey results (Young, 1998). Consequently, level of gaming addictive behavior may have been substantially under-reported in this sample.

It is also worth noting that this study resulted in findings that are dissimilar to the findings of a comparable study regarding gaming addiction and academic achievement. This present study did not find a significant association between gaming addictive behaviors and student success and satisfaction, possibly due to the very small number of gaming addicted individuals in a normal student population. However, Skoric et al. (2009) found a significant association between gaming addiction and academic achievement in their study of 333 eight to
twelve year-old students. In their study, they specifically emphasized the difference between high engagement and addiction in online gaming. Skoric et al. utilized two instruments: (a) a scale that specifically measured excessive play, and (b) a scale that measured addiction. The instrument they used to measure addiction was based on Charlton’s (2002) Engagement-Addiction scale. This scale involves four of the seven criteria from Brown’s (1991) addiction checklist. Skoric et al. (2009) asserted that the criteria of tolerance, salience, and euphoria were related to excessive gaming and not addictive gaming. Therefore, they did not include these criteria in their analysis of addiction; thus, their instrument necessitated fewer criteria to meet a diagnosis of gaming addiction. The Lemmens et al. (2013) instrument utilized in the present study is based on the current DSM-5 criteria, which is comprised of nine distinct criteria for diagnosis. This requirement far supersedes the number of criteria required by Charlton’s (2002) scale. Thus, the significant results of Skoric et al. (2009) may be somewhat related to the instruments utilized to measure addiction. Hence, the differences in results between studies may be largely due to an incongruity in the definition of gaming addiction.

Although the overall model of this present study did not result in statistically significant findings, the covariates (i.e., housing, gender, and GPA) within the model were associated with student success in the Math Emporium. Specifically, gender was a significant predictor in this model. Females had significantly better success rates in the courses. In initial considerations, this finding was expected, as female students tend to outperform their male classmates in college (Conger & Long, 2010; Voyer & Voyer, 2014). However, math has historically been a male-dominated subject area in academics (Fennema & Penelope, 1985; Leder & Forasz, 2008). While it appears that the gap between genders in math achievement is decreasing, men still excel to a greater extent than women, possibly due to the task-oriented, independent nature of math
comprehension, which is specifically helpful in problem solving (Fennema & Penelope, 1985). The Math Emporium offers a computer-based, self-paced learning environment which is more autonomous than the traditional classroom. However, the findings of this particular study did not coincide with the findings of the previous research regarding math performance of male students, as men did not outperform women in this environment. Interestingly, Leder and Forasz (2008) emphasize curriculum and instructor attitudes toward women and math as a contributor to women’s lack of success in math courses. While the computer-based approach offers a more autonomous learning environment which lends to better problem-solving (Fennema & Penelope, 1985), it may also decrease the instructor’s influence. Whereas the computer program delivers the majority of the content, instructors have limited time teaching students. Thus, potentially negative instructor attitudes towards women in math courses may be reduced due to the computer-based learning approach. Therefore, students experiencing a shortened amount of time and learning with their instructors could reduce the instructors’ potentially negative influence on female students. This lack of instructor influence may have been a factor influencing female students’ higher success in the Math Emporium.

Because gaming addiction is a newer area of research, the current study was an exploratory study that sought to further the knowledge of gaming usage and gaming addiction among college students. Outcomes regarding the study’s covariates were unexpected, yet valuable. While the results did not demonstrate significant findings regarding gaming addiction, this study can be a catalyst for future studies involving university students and gaming.

**Limitations**

There are multiple limitations to this study that should be discussed. First, a convenience sample was utilized. Participants were undergraduate students enrolled in an evangelical
Christian university. Further, the participants were enrolled in developmental math courses. Developmental math courses have a unique population of students which could be viewed as a limitation for this particular study. Developmental courses are offered for students who have not demonstrated college level comprehension of the subjects (Ashby et al., 2011; Havill et al., 2004). Thus, the sample for this study had previously been identified as a population of students who are in need of remedial help, as demonstrated by their lower scores in high school math courses or college placement tests. When investigating the effect of students’ gaming addictive behavior on their learning outcomes in math, examining a sample taken from developmental courses in which students have already been identified as having lower math comprehension, could impact the results regarding addiction theories. While this study may offer valuable implications for developmental math students, the sample may not have been a beneficial sample for receiving results that could further the knowledge of gaming addiction.

Moreover, the study did not control for the math course in which the students were enrolled. While only Math 100 courses and Math 110 courses were included in the study, the survey did not include a question for students to designate their course enrollment. Therefore, it was not possible to decipher in which class participants were enrolled. It is possible that controlling for the course could have altered the findings, and results could differ between the courses. Additionally, the convenience sample was largely homogeneous. The sample was primarily Caucasian (71.9%). In expanding this study, future research should incorporate students that represent a broader spectrum of the population, including students enrolled in different courses at different institutions and with varying ethnicities. Generalizability is limited due to the use of this convenience sample.
Correlational designs are limited in demonstrating a causal relationship between the predictor and criterion variables (Gall et al., 2007). While an experimental study could provide strong causality results, it can be unethical to conduct some experiments involving particularly sensitive populations. Experimenting with a sample which includes potential addicts leads to increased risk for harm (Gall et al., 2007). As such, this study lacked temporal precedence for the student success model and failed to eliminate alternative explanations for findings (e.g., motivation, selection bias, homogeneity, measurement limitations).

The instruments utilized in this study may also have produced limitations. The ALSAELS (Wang, 2003) measures student satisfaction of e-learning. However, measurements of student satisfaction tend to have a ceiling effect. The IGD scale (Lemmens et al., 2013) was given in this study, however, this instrument specifically measures gaming addiction. Due to the fact that the number of gaming addicts is considerably low (Hussain et al., 2012; Lemmens et al., 2009) and the study’s sample was largely normal and homogeneous, the instrument was limited in its ability to assess the variable of gaming addictive behaviors. The population that displays the criteria necessary for diagnosis is very small. A scale that specifically measures excessive gaming instead of addictive gaming would likely have been better suited for this population.

Conducting a study related to potential gaming addiction in a typical undergraduate student population is a high-risk study. However, while the non-normality of the data was probable, in this particular study the skewness values were greater than expected. One explanation might be the use of a self-report instrument. This is a particularly important limitation because individuals who have an addiction are characteristically in denial of their unhealthy lifestyle (Howard et al., 2002; Rinn, Desai, Rosenblatt, & Gastfriend, 2002). While denial is a significant problem and a detriment to the successful recovery of alcoholics and drug
addicts, it is also a problem for gaming addicts (Young, 1998). Consequently, when completing the survey, some students may not have honestly answered the questions or may not have been able to identify their own gaming behaviors as problematic. Therefore, due to the nature of the self-reporting instruments used in this study, the extremely low results in gaming addictive behavior could be partially due to denial, a characteristic that can be common among addicts.

Furthermore, external validity is affected by non-response bias (Cozby & Bates, 2011), an additional limitation to this study. Participants who completed the survey may thoroughly differ from the non-participating students. For example, since the math courses are somewhat self-paced, students who were behind in the material may have been less likely to take the time to complete the survey. Additionally, such personal characteristics as altruism or a desire to please the instructor would affect the rate of participation. Students who did not participate in the study may feel less connected to the university and have minimal desire to please their instructor. Non-response bias could also be prevalent due to social pressure. Although the survey was voluntary and students were given the option to continue with their math course work instead of participate in the study, the survey was offered during class time. Thus, some students may have been reluctant to participate if they observed that their classmates were not completing the survey. Conversely, some students may have experienced feelings of pressure to participate if they observed their classmates completing the survey. Finally, the survey was offered one week prior to a math exam. Students who were behind in their course work or students who felt the need to spend the time studying may have been less inclined to participate. Additionally, math anxiety can interfere with the normal process of student learning (Ashcraft, 2002; Maloney, 2012), which could have contributed to a lower participation rate. Thus, there are many aspects of this study that could lead to non-response bias.
Implications

While there are many limitations to this study, there are beneficial implications, as well. Although this particular study did not identify gaming addictive behavior as a potential predictor for student success or student satisfaction in a computer-based, blended, learning environment, the study did provide meaningful information regarding the Math Emporium. Among the statistically significant findings, type of housing and gender, and their associations with student success, are variables that could be particularly noteworthy. The student success model identified the students’ type of housing as a strong predictor of student success in the Math Emporium. High final scores were associated with students who lived on campus and in close proximity to the Math Emporium. Due to the fact that the Math Emporium offers a somewhat autonomous, self-paced learning environment, it appears that students who live on campus and can easily access the Math Emporium, possibly due to their close proximity, may be more apt to attend their class sessions and complete their hours in the Math Emporium. Conversely, students who live off campus may be less likely to attend their classes. To further investigate this assumption, identifying the number of hours that students are in the class and logged into their math course in the Math Emporium could provide valuable insight. Additionally, students’ motivation levels may vary due to their proximity to this autonomous learning environment within the Math Emporium. From an administrative perspective, the findings suggest that further considerations be given regarding the location of the Math Emporium in vicinity to the student housing. From an instructional standpoint, the findings suggest that pedagogical thought incorporate additional emphasis on motivation theories. As technology becomes more prevalent in education, an emphasis on motivation and experiential learning theories is thought to be essential to the development of successful computer-based learning (Attali & Arieli-Attali, 2015;
Goehle, 2013; Kebritchi et al., 2010). Technological teaching approaches such as gamification utilize external motivators and award systems, which are already incorporated into the educational gaming programs (Goehle, 2013; Kebritchi et al., 2010; Villagrasa et al., 2014). Hence, in assessing housing options, it appears that proximity, motivation, and experiential learning may be influential factors for academic achievement.

The significant association found between gender and student success in the Math Emporium is also noteworthy. There is reason to continue investigating the gender gap in math, and whether computer-based learning in a blended format such as in the Math Emporium is helping to close the gender gap. Equally, whether or not this autonomous approach to teaching math is detrimental to male students’ success should be a topic that is explored further.

**Recommendations for Future Research**

Due to the fact that the topic of Internet gaming addiction is a relatively new area of study, and little research is available particularly on the college student population, there is ample opportunity to further the knowledge of this topic. Additionally, there are various approaches to studying the population of students who game extensively. Identifying an appropriate sample that corresponds well with the design of the study is essential. Due to the fact that gaming addiction is rare, examining a specific group of students, as opposed to utilizing a convenience sample, is recommended. Future studies could incorporate a sample of students who are involved in a campus gaming club or who attend a conference pertaining to gaming and comics. Utilizing a sample of students who already identify themselves as gamers could provide a more robust study.

Qualitative approaches to studying this population are recommended, as well. Individuals who play games extensively are often reluctant to share their experiences with
researchers, as studies on gaming appear to induce suspicion and distrust (Griffiths, 2009; King, Delfabbro, & Griffiths, 2009). However, a qualitative research design, such as utilizing a phenomenological or ethnographic approach, could enable the researcher to access a sample of gamers in a non-offensive approach (Griffiths, 2009). While still maintaining a level of objectivity and reticence, researchers could endeavor to better understand gamers’ commonalities regarding their educational motives and achievements.

**Conclusion**

This study was an exploratory study based on behavioral addiction theory, and specifically emphasizing gaming addiction. Although it was hypothesized that gaming addictive behavior would serve as a predictor of student success and student satisfaction, this was not the case. This exploratory study also hypothesized that gender would serve as a moderator for the association between gaming addictive behavior and student success, and between gaming addictive behavior and student satisfaction; however, the current results did not support these hypotheses. Future research should continue the examination of the association between students’ gaming addictive behavior and their learning outcomes. The learning outcomes of technology-addicted students will continue to be an area of concern for educators, parents, and health providers. As the gaming addiction body of literature continues to expand, and research results lead to more concrete conclusions, the research will eventually need to focus on factors that will help addicted students succeed in their education. The bridge between entertainment technology and educational technology will likely become stronger, yet researchers will need to assess whether the technology in education is providing the necessary, long-term help for students who struggle with a technology addiction.
The current study, although exploratory, was one step in the process of answering the call to further expand the body of literature on gaming addiction and academic achievement in order to help the gaming addicted population of students succeed. Researchers must continue to make progress in identifying the symptoms and causes of problematic gaming usage. Furthermore, researchers must then identify treatment plans and appropriate pedagogical approaches so that these individuals have the opportunity to reach their highest potential.
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APPENDIX A

February 26, 2015

Marlene Carrilho
IRB Approval 2125.022615: The Relationship between Gaming Addictive behavior, Satisfaction, and Success Rates in a Computer-Based, Content-Delivery, Education Format

Dear Marlene,

We are pleased to inform you that your above study has been approved by the Liberty IRB. This approval is extended to you for one year from the date provided above with your protocol number. If data collection proceeds past one year, or if you make changes in the methodology as it pertains to human subjects, you must submit an appropriate update form to the IRB. The forms for these cases are attached to your approval email.

Your IRB-approved, stamped consent form is also attached. This form should be copied and used to gain the consent of your research participants. If you plan to provide your consent information electronically, the contents of the attached consent document should be made available without alteration.

Please retain this letter for your records. Also, if you are conducting research as part of the requirements for a master’s thesis or doctoral dissertation, this approval letter should be included as an appendix to your completed thesis or dissertation.

Thank you for your cooperation with the IRB, and we wish you well with your research project.

Sincerely,

Fernando Garzon, Psy.D.
Professor, IRB Chair
Counseling

(434) 592-4054

LIBERTY UNIVERSITY.
CONSENT FORM

Gaming Usage, Course Satisfaction, and Success Rates in a Computer-Based Classroom.

Marlene Carrilho, Ed.S.
Liberty University
Psychology Department

You are invited to be in a research study on video game usage, course satisfaction, and course success rate related to this class. You were selected as a possible participant due to your enrollment in this Math Emporium class. We ask that you read this form and ask any questions you may have before agreeing to be in the study.

Marlene Carrilho, a faculty member in the Department of Psychology at Liberty University, is conducting this study.

Background Information:

The purpose of this study is to better understand the relationship between gaming usage, student satisfaction, and course success in a computer-based learning environment such as the Math Emporium.

Procedures:

If you agree to be in this study, we would ask you to complete the following online survey consisting of 50 questions. The survey should take you no more than 15 minutes to complete. Please reflect upon the questions and genuinely choose the answer that most accurately corresponds with your level of agreement or disagreement.

By participating in this study, you agree to allow the Business Intelligence Office of Liberty University to provide your final score in the class, which will be included in the study. Please note: all information will remain confidential.

Risks and Benefits of being in the Study:

The study has few risks. Some of the questions on the survey may be difficult to answer, but emotional disturbance is unlikely. If you do become distressed, please contact Marlene Carrilho, and she can direct you to local agencies that can help. No one is required to participate, and you
may discontinue your participation at any time without penalty. There are no direct benefits to participating in this study; however, your answers can provide possible benefits to our understanding of the use of technology in the classroom and gaming usage. In addition, this research has potential implications for improving the format of technology-driven classrooms, and subsequently improving student’s academic success and satisfaction within such classes.

Compensation:

By completing this survey, you will be entered into a drawing for a $10 gift card to Starbucks, and the winner will be announced at the end of this class period.

Confidentiality:

The records of this study will be kept private. In any sort of report we might publish, we will not include any information that will make it possible to identify a participant. You will be required to input your student identification number to begin the survey. However, prior to reviewing the data from your survey, your Liberty student identification number will be eliminated by a neutral third party, and the researchers will have no access to any identifiable information. Research records will be stored securely and only researchers will have access to the records after all identifying information has been removed. Data are gathered only through the online survey and the report from Business Intelligence, and will be stored only with the researchers. No one outside the researchers (who do not know who you are) will see the information you submit for the online survey.

Voluntary Nature of the Study:

Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with Liberty University, the Psychology Department, or the Math Emporium. If you decide to participate, you are free to not answer any question or withdraw at any time.

Contacts and Questions: The research team conducting this study is led by Marlene Carrilho. If you have questions, you are encouraged to contact her in the Department of Psychology, DeMoss 4008DH, 1971 University Blvd, Lynchburg, VA 24515 or email at mcarrilho@liberty.edu.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, you are encouraged to contact the Institutional Review Board, 1971 University Blvd, Suite 1837, Lynchburg, VA 24515 or email at irb@liberty.edu. You may print a copy of this information to keep for your records.
Statement of Consent: By selecting “agree,” you affirm that you have read and understood the above information. You have asked questions and have received answers. You consent to participate in the study.

If you agree to participate, please click “I agree” to begin the survey.
APPENDIX C

Verbal Announcement to Be Given in Class

We would like your help in a study we are conducting regarding the Math Emporium. The Liberty University Psychology Department, under the supervision of Marlene Carrilho, is conducting research on video game usage, course satisfaction, and course success rates related to this class. Today, all students enrolled in this course have the opportunity to take a survey that will take approximately 15 minutes. All information you provide will be kept confidential. By taking this survey you will be entered into a random drawing for a $10 gift card to Starbucks. Each class will have a winner, and that winner will be announced here before the end of this class period. By participating, you are increasing our understanding of the effectiveness of the Math Emporium and technology in learning.

You can access the survey link through the Blackboard page of this course. This is a voluntary survey. If you choose not to participate, you may proceed with your work.

Additional information is available in the informed consent form (page 1 of the survey), so please be sure to read the form before agreeing to take the survey.

Thanks so much! If you would like to take the survey and be entered to win the Starbucks gift card, please access Blackboard for the announcement and survey link.