

A Comparative Study of Student Performance When Using Minecraft as a Learning Tool

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by

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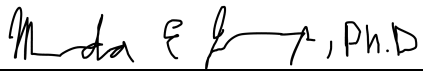
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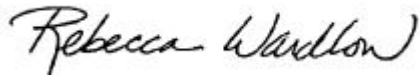
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## Abstract

Skepticism over the use of the video game Minecraft as a tool for learning has grown among parents and educators. Research regarding the effect on student performance of using Minecraft for learning is increasing, but has mostly focused on levels of student motivation and engagement. Therefore, by showing that Minecraft is connected to academic achievement, this study addressed the problem of parents' and teachers' skepticism regarding the efficacy of Minecraft as a valuable tool for learning.

Furthermore, the purpose of this quantitative comparative study was to evaluate student academic performance when using Minecraft as a learning tool. Participants in the study included students aged 6–12, from various parts of the United States, enrolled in an online Ancient History course that used Minecraft. Final course grades were used to determine whether students showed mastery of course content based on the program provider's criterion of 85% mastery. The data used for this study consisted of pre-existing archival numerical data obtained from the online program provider. Analysis of the data indicated there was no statistically significant difference between the final course grades of students who were and were not required to complete all course components. These results contribute to the field of education by providing evidence of increased student motivation and achievement when Minecraft is used. These findings provide information needed for parents and educators about the academic and motivational benefits Minecraft can have on academic performance when used as a tool for learning. Additional research investigating what effect the use of Minecraft has on parent and student perspectives and academic performance for students with disabilities is recommended for future research.

## Table of Contents

Chapter 1: Introduction .....	1
Background .....	3
Statement of the Problem .....	4
Purpose of the Study .....	5
Research Questions .....	6
Nature of the Study .....	7
Significance of the Study .....	10
Definition of Key Terms .....	12
Summary .....	14
Chapter 2: Literature Review .....	17
Documentation .....	18
Minecraft .....	19
Brief History of Assessment and Achievement .....	23
Types of Assessment .....	27
Content Mastery .....	29
Advancement of Instructional Approaches .....	32
Game-Based Learning .....	36
Theory and Video Games for Learning .....	41
Motivation, Engagement, and Video Games .....	44
Summary .....	54
Chapter 3: Research Method .....	59
Research Method and Design .....	64
Population .....	66
Sample .....	66
Materials/Instruments .....	67
Operational Definition of Variables .....	69
Final course grade (scores). .....	69
Graded and ungraded students. ....	70
Data Collection, Processing, and Analysis .....	70
Data Collection .....	71
Data Processing .....	71
Data Analysis .....	72
Assumptions .....	73
Limitations .....	74
Delimitations .....	75
Ethical Assurances .....	75
Summary .....	76
Chapter 4: Findings .....	79
Results .....	79

Assumptions.....	80
Research Question 1. ....	81
Research Question 2. ....	84
Evaluation of Findings.....	88
Research Question 1. ....	88
Research Question 2. ....	90
Summary.....	92
Chapter 5: Implications, Recommendations, and Conclusions .....	95
Implications.....	100
Research Question 1. ....	100
Research Question 2. ....	102
Recommendations.....	104
Practical applications. ....	104
Future research.....	106
Conclusion .....	108
References.....	111
Appendix A: Letter of Permission .....	123
Appendix B: Independent <i>t</i> test Results Table.....	124

## List of Tables

Table 1. <i>Assumption Results for the Three Average Scores' Distributions</i> .....	80
Table 2. <i>Independent t test Results for Differences Between Course Average Scores of Graded and Ungraded Students</i> .....	81
Table 3. <i>Independent t test Results for Differences Between Quiz Scores of Graded and Ungraded Students</i> .....	83
Table 4. <i>Independent t test Results for Differences Between Build Averages of Graded and Ungraded Students</i> .....	84
Table 5. <i>Independent t test Results for Differences Between Course Average Scores of Students Scoring &gt; 85% and &lt; 85%</i> .....	87
Table 6. <i>Comparison of Course Component Average for Graded and Ungraded Students</i> .....	88

## **Chapter 1: Introduction**

Video games can bring enjoyment and motivation to a learning environment that is not typically characterized as enjoyable and motivating (Cipollone, Schifter, & Moffat, 2014). Although video games can be a highly motivating source of enjoyment, the practice of integrating video games into the curriculum and the belief that students can learn in the process elicit disbelief from parents and educators (Cipollone, et al., 2014). Educators have established online tools that incorporate the use of video games for the purpose of affording opportunities to learn while appreciating learning (De-Marcos, Dominguez, Saenz-de-Navarrete, & Pages, 2014). The idea that using the video game Minecraft as a tool for learning could increase student motivation, engagement, and academic performance is exciting (Hamlen, 2014). Software companies and educational professionals collaborate to develop engaging online learning courses for students (Hill, 2015). Using constructivist learning theory, educators have realized the importance of engaging students in learning activities that encourage students to take an active rather than a passive role in learning (Afifi & Alamri, 2014). Teachers of students in online learning programs struggle to maintain student motivation and engagement in online courses (Barrett, 2013). For instance, researchers found that teachers who implement time-management activities presented in a game-like format for students boosted student engagement and the amount of time engaged in a course activity (Hess & Gunter, 2013). By the same token, video games as learning devices have proven successful in increasing student engagement (Bourgonjon, Valcke, Soetaert, & Schellens, 2010; Hess & Gunter, 2013). Retrofitted to incorporate learning standards, Minecraft, a sandbox game originally designed for a nonacademic entertainment, has expanded and is now used in



classrooms and learning programs globally (Bos, Wilder, Cook, & O'Donnell, 2014).

One parameter of this study was to analyze the efficacy of Minecraft as an instructional tool and determine whether it helped students to meet learning objectives set out by the content provider. According to Cipollone et al. (2014), Minecraft has no defined objective. That is to say, the game incorporates exploration and imagination through the strategic stacking and placement of virtual blocks, whereby clients create an online world. Also, the authors pointed out that this game provides players with the opportunity to be creative and to work cooperatively with others on the Minecraft server.

Furthermore, software companies have created courses and embedded curriculum into Minecraft courses in response to the mounting interest from school-aged children in playing Minecraft (Bos et al., 2014). As a result of the rising interest level and the corresponding increased incorporation of Minecraft into the school curriculum, students were found to be more engaged, motivated, and likely to problem-solve (Schifter & Cipollone, 2015). Yet little research is available that shows whether students who use Minecraft as an academic tool are meeting academic course objectives (Bos et al., 2014; Cipollone et al. 2014; Hill, 2015; Overby & Jones, 2015; Smolčec & Smolčec, 2014).

For as long as video games have been piquing the interest of youth, scholars have been trying to determine effective ways to combine this motivational tool with learning. Annetta, Mangrum, Holmes, Callazo, and Cheng (2009) found that teachers used video games to stimulate student learning but that they were not effective due to lack of student interest. Hidi and Renniger (2006) concluded that a person's interests influence his or her learning. Additionally, a study by Hamlen (2014) on the use of video games for learning that supports the constructivist learning theory implied that students experienced benefits

such as an increase in motivation and in self-regulation skills, and improved attention. Theoretical writings on the way students learn include works by Vygotsky and Piaget. According to these theorists, when tools are given to learners they are likely to acquire new skills. Further, it is the child's experimentation with his or her environment that drives learning. Using the video game Minecraft for learning provides a motivating environment in which students can learn (Cipollone et al., 2014). Consequently, whether students who are using Minecraft for learning meet specific objectives of a course is a question that requires further investigation. This dissertation assesses student performance when students use the video game Minecraft as a tool for learning. It also addresses whether students can meet course objectives set by the educational institution when they are using Minecraft to learn.

## **Background**

Software companies and educational professionals are collaborating to create engaging online learning opportunities for students (Hill, 2015). In an effort to meet the interest level of today's youth and marry the use of video games with traditional curriculum, companies have developed courses that include the use of a popular video game called Minecraft. Through the merging of traditional curriculum and video games, an innovative instructional tool has emerged that employs Minecraft. Although findings on the effectiveness of using Minecraft as a tool for learning are mixed, the prevalent view remains that using Minecraft for learning often results in increased levels of motivation, engagement, and problem-solving skills (Bos et al., 2014).

Existing studies on the use of Minecraft as a tool for learning focused on student interest and the ability to successfully integrate the curriculum into the Minecraft

environment (Overby & Jones, 2015). One study focused primarily on student levels of engagement, on motivation, and on the effect Minecraft has on learning (Smolčec & Smolčec, 2014). With technology and video games competing with traditional education, parents and educators struggle to maintain student motivation and engagement in learning (Bourgonjon, Valcke, Soetaert, de Wever, & Schellens, 2011). Additionally, Bourgonjon et al. (2011) found that online courses that use a high-interest video game such as Minecraft are surely the ticket to capturing the attention of learners while engaging them in game-like learning experiences. Hamlen (2014) concluded that the ability to capture student interest and ensure motivation and engagement in the learning process through the use of Minecraft is exciting. However, ensuring that students acquire skills through the academic content in an online course is a significant concern and one for which parents and educators must take responsibility (Dziuban & Moskal, 2011). Before an educational institution or parent commits to using an online course using a video game, learning objectives must be stated and instructors must be ready to use methods of assessment based on those objectives to determine whether specified levels of student performance are achieved (Overby & Jones, 2015).

### **Statement of the Problem**

Researchers showed that the use of the video game Minecraft increased student engagement, motivation, and problem-solving skills; yet Cipollone et al. (2014) found that educators are not using Minecraft as a tool for learning due to their skepticism about whether using this game leads to academic achievement. The research lacks evidence that academic achievement on the part of those using Minecraft rises as a result of that use. This lack of evidence contributes to parents' and teachers' skepticism about the efficacy

of Minecraft as a learning tool (Cipollone et al., 2014; Marino, Israel, Beecher, & Basham, 2013; Overby & Jones, 2015.). With the growth of online learning, the quality and effectiveness of courses that include games like Minecraft as a tool for learning are in need of further evidence-based research to prove to parents, educators, and course designers that using video games as a tool for learning can lead to increased student achievement (Bourgonjon et al., 2011; Schifter & Cipollone, 2015; Trespalacios, Chamberlin, & Gallagher, 2011). Although parents and educators offer support on the use of technology for learning, debate rages about whether the use of the game Minecraft leads to student achievement. By showing that Minecraft is connected to academic achievement, this study intends to address the problem of parents' and teachers' skepticism regarding the efficacy of Minecraft as a valuable tool for learning.

### **Purpose of the Study**

The purpose of this quantitative, nonexperimental comparative study was to determine whether student performance on course objectives in a Minecraft-supplemented Ancient History course reflected mastery of curriculum content. This determination was based on whether there was a statistical significance between the final grades of graded students who were required to complete all components of the course and the grades of those not required to complete all the components of the course. Although research focusing on the instructional use of video games for learning continues to develop, the majority of the research regarding the instructional use of Minecraft is limited to depicting increased student motivation and engagement in learning (Bottino, Ott, & Tavella, 2014). Additionally, a gap in the research focusing on student learning

and achievement outcomes in the context of using Minecraft as a learning tool contributes to skepticism about the efficacy of the method (Cipollone et al., 2014).

### **Research Questions**

This quantitative study sought to determine whether student performance on course objectives in a Minecraft-supplemented Ancient History course reflected mastery of curriculum content. The answer was determined based on whether the difference between the final grades of students required to complete all components of the course and the grades of those who were not required to complete all the components of the course were statistically significant. Based on the literature related to the use of Minecraft for learning and the data provided by the content provider, this study investigated the following questions:

- Q1.** Is there a statistically significant difference in final course grades between students who were graded for each individual Minecraft activity and students who were not graded?
- Q2.** Is there a difference in course averages between Core students scored below 85% and Core students who scored 85% or higher?

### **Hypotheses**

- H1<sub>0</sub>.** There is no statistically significant difference in final course grades between students who were graded for each individual Minecraft activity and students who were not graded.
- H1<sub>a</sub>.** There is a statistically significant difference in final course grades between students who were graded for each individual Minecraft activity and students who were not graded.

**H2o.** There is no significant difference in course averages between Core students scored below 85% and core students who scored 85% or higher.

**H2a.** There is a significant difference in course averages between core students who scored below 85% and core students who scored 85% or higher.

### **Nature of the Study**

In evaluating the academic performance of students using Minecraft as a learning tool, this study employed a quantitative method to determine whether students met course objectives in an online Minecraft history course. The data available for this study were expected to be numerical in nature, meaning a quantitative design was likely to be suitable for the study (Reeves, 2015). Three common approaches exist within quantitative research: experimental, quasi-experimental, and ex post facto designs. Equal consideration was given to each of these approaches, as advised by Reeves (2015) and by Delost and Nadder (2014). Because of the inability to manipulate students' instructional program, an experimental design was not chosen (Reeves, 2015). Similarly, a quasi-experimental design was unlikely to be chosen for this study due to grouping and the inability to manipulate the instructional program (Reeves, 2015). The approach most likely be chosen was the ex post facto design due to the groups' being previously chosen by the online program and the nature of the pre-existing archival data (Delost & Nadder, 2014). Delost and Nadder stated that the inability to control the independent variable, the instructional program, is consistent with comparative research and is a common design in educational research.

During the 2014–2015 school year, students from various locations throughout the United States enrolled in an online Ancient History course at GameEd Academy, an

online business that provides supplemental programs using Minecraft to enhance learning. In this course, the students could enroll at the Upper level or the Core level. Upper level refers to students enrolled who received a final course grade and were required to complete all activities in the course. Core level students could complete all activities, but some were optional, and they received a final course grade based on activities completed.

Because these groupings were already set when the study commenced, the independent variable was not manipulatable, a situation that is consistent with comparative research methods (Reeves, 2015). For this study, the dependent variable was student performance as demonstrated through the final course grade. This grade was based on activities that were both required and optional as well as on a quiz taken each week. Each student must take the quiz developed by the content provider, GameED, to determine mastery of content. Meeting course objectives is operationally defined as students receiving a final grade in online Minecraft history of 85% or higher. GamED Academy considers students who earn a final grade of 85% or higher as meeting course objectives.

The level of measurement used to answer both research questions was a ratio level due to the use of absolute zero as a base. The hypothesized value or constant tested is 85% because this is the criterion GamED uses to indicate mastery of course objectives. Since these data were pre-existing, which is also consistent with comparative research (Reese, 2015; Delost & Nedder, 2014), the researcher requested data from GamED Academy. Quantitative data collected were used to answer the research questions in the study. A quantitative approach was used in the study in efforts to determine whether

student performance on course objectives in a Minecraft-supplemented Ancient History course reflected mastery of curriculum content and whether using Minecraft as a tool for learning motivated students to do more than required. The determination was made based on whether differences between the final grades of graded students required to complete all components of the course and final grades of those not required to complete all the components of the course were statistically significant. Additionally, activities completed by the Core students were looked at to determine whether differences existed between the scores in this group when students were completing more than the required activities. The number of students enrolled in this session was set as determined by a G\*Power test at 210 students, with 105 Upper level and 105 Core level students. Furthermore, the researcher completed an independent  $t$  test to determine whether there was a statistically significant difference in the performance of students who were graded on all components of the course and that of students who were not graded. The definition of mastery cited by GamED was accepted: a score of 85% or higher. With the use of a G\*Power test, the sample determined for use was 210 students—105 Upper-level students and 105 Core-level students.

Once the collection of data was complete, the researcher performed the following steps. The data of the final grades of the components of the course from the learning management system were extracted and exported into an Excel spreadsheet. To protect student privacy, all data were free of identifiers and students were assigned a number. Excel was used to conduct a data analysis using the functions of simple descriptive statistics and independent  $t$  tests to answer both research questions. Additionally, with the use of a Pivot Table, a summary of means and standard deviation was generated from



each of the grades independently. Using Excel, the data were organized to represent the frequency of students who scored 85% or higher; the data were displayed in a frequency table.

Furthermore, the level of distribution, discerned using the  $p$  value and sample data, was used to produce inferences about the population. An independent  $t$  test was used to determine whether the two groups (Upper and Core) of students had the same mean. Equally important, the existence of any variance between the two groups was identified to determine whether the sample means differed from each other. Further, the independent  $t$  test was used to show whether there was a difference between the means of the two groups. To determine statistical significance probability ( $p$  value) of the test, statistic ( $t$ ) was determined. If there was a significant difference in the student grades, that  $p$  value was .05 or less; the researcher then rejected the null hypothesis and inferred that a statistically significant difference between the two groups' means was present. If no statistically significant difference was present, the  $p$  value was greater than .05; then the researcher did not accept the null hypothesis.

### **Significance of the Study**

Although the prevailing view is that using video games for learning increases student engagement and motivation but nothing else (Bourgonjon et al., 2010; Hess & Gunter, 2013), studies conducted by Schifter and Cipollone (2015) and by Bos et al. (2014) found that using video games for learning resulted in increased academic achievement. Similarly, Overby and Jones (2015) and Smolčec and Smolčec (2014) found that the integration of Minecraft into the curriculum increased not only student engagement and motivation but also problem solving in learning. Findings on the

effectiveness of using Minecraft as a tool for learning remain mixed. For that reason, further research on the topic is warranted (Marino et al., 2013; Wouters, van der Nimwegen, van Oostendorp, & van der Spek, 2013). Equally justified is research devoted to discerning whether online learning programs that include Minecraft are effective, whether student engagement rises when Minecraft is included, and whether students who use Minecraft as a learning tool meet course objectives (Means, Toyama, Murphy, & Baki, 2013). Means et al. (2013) found that using Minecraft for learning increased student engagement, motivation, and problem-solving skills. Although research indicates that students using Minecraft can meet the learning objectives of the course, educators remain unlikely to use this video game as a learning tool (Cipollone et al., 2014; Sadi & Uyar, 2013; Smolčec & Smolčec, 2014; Tromba, 2013).

For the larger community, the results of this study provide additional information in the larger debate on the ability of students to master course objectives and achieve academically with incorporation of Minecraft into the curriculum. Ultimately, the results of this study provided foundational information to parents, educators, software developers, and other online content providers about the potential of Minecraft as a learning tool to increase student motivation, engagement, and achievement. This topic was selected by the researcher because of her previous educational experience with the use of Minecraft in an alternative school setting. The personal experience of developing a course for students that increased attendance, engagement, and motivation in school led to curiosity about this topic and about whether students could also increase academic performance using this video game as a learning tool. Educators and leaders in education need to be mindful of mastery of content and follow current trends in education and

student interest to help students be successful in mastering the content. Therefore, the information collected and analyzed were based on an educational perspective.

### **Definition of Key Terms**

The following terms were defined for the purpose of this study.

**Achievement** is defined as students meeting the criterion of achieving a grade of 85% or higher on quizzes identified in the GamED Academy website course expectations, meaning they have achieved mastery (www.GamEDAcademy.com, 2016).

**Content provider** is defined as GamED Academy LLC, identified on the GamED Academy website as an online business that developed and provided a supplemental program for students in various curriculum areas utilizing Minecraft (www.GamEDAcademy.com, 2016).

**Course components** is defined as the total activities provided by GamED Academy for the Ancient History course for both graded and ungraded students. On the GamED Academy website, the activities available to all students are defined as Learn It, Quiz, Build It, Redstone Lab, Digging Deeper, Going Above and Beyond, and Team Up.

**Course objective** is defined on the GamED Academy website as students completing the five quizzes across the 6-week course with a grade of 85% or above (www.GamEDAcademy.com, 2016).

**Course structure** is defined as a course that has a natural order within the content. A course with good structure is considered to have course assignments that are categorized into groups and divided by topics and activities required. Course structure is needed for students to be successful (Duziban, 2011).

**Graded students** are defined as students who enrolled in and completed the online Minecraft history course and were required to complete each activity across the 6-week session and whose performance resulted in a grade's being issued to allow them to receive a letter grade from a brick-and-mortar school ([www.GameDacadey.com](http://www.GameDacadey.com), 2016).

**Individual interest** is defined as a person having a knowledge base or a skill that becomes a preference for future participation in an activity using that person's knowledge base or skill (Rotgans & Schmidt, 2014).

**Learning management system** is defined as server-based software that allows students to access activities, materials, quizzes, and discussions and allows teachers to provide feedback, give grades, and track student progress through a standard web browser (Wichadee, 2014).

**Mastery level** is defined as the point at which an individual reaches a set level of proficiency on specific content in the course. Mastery learning involves students' achievement of learning goals at their pace and demonstrating actual understanding of the concepts being taught (Lin et al., 2013).

**Minecraft** is defined as a sandbox game, originally designed for nonacademic entertainment, that is now used in classrooms and learning programs globally (Bos et al., 2014). This game incorporates exploration and imagination through the strategic stacking and placement of virtual blocks, for the purpose of allowing players to create an online world (Cipollone et al., 2014).

**Performance** is defined as a student's grade on an activity or quiz. A grade is used to validate student ability on a task (Plass et al., 2013).

**Sandbox game** is defined as a game in which the player controls the avatar freely, with some face-to-face interactions. The player has to carry out a sequence of quests that are either player created or designer created (Yildiz & Yildiz, 2011).

**Student engagement** is defined as the interest and motivation students have in their learning of course content (Hersman, 2014).

**Supplemental program** is defined on the GamED Academy website as Core-level courses and Upper-level courses that are designed to complement or supplement existing curriculum being accessed by students ([www.GamEDAcademy.com](http://www.GamEDAcademy.com), 2016).

**Ungraded students** are defined as students who were enrolled in and completed the online Minecraft history course and were assigned activities, some of which were required and some of which were categorized as optional, and who received a grade. The grade represented participation in and completion of course objectives; however, these students did not receive a grade that would translate into a letter grade from a brick-and-mortar school ([www.GamEDAcademy.com](http://www.GamEDAcademy.com), 2016).

## **Summary**

The use of video games for learning is growing as parents and educators recognize the need for supplementary tools to motivate and educate youth in this era of technology (Barrett, 2013; Cipollone et al., 2014; Hess & Gunter, 2013; Hill, 2015). At the present time, research on the effect on student performance of using the video game Minecraft for learning is also increasing but has mostly focused on levels of student motivation and engagement when they are using the game (Bos et al., 2014; Hill, 2015; Overby & Jones, 2015; Schifter & Cipollone, 2015; Smolčec & Smolčec, 2014). With this in mind, the need among parents and educators to find tools that increase the

motivation and engagement of an online learner while ensuring that the student is learning the content has brought programs that employ popular video games such as Minecraft to the forefront (Hill, 2015). The need for a shift in educational techniques is becoming apparent as parents and educators realize that today's youth need online programs that capture their attention and engage them in learning while also teaching them content like that found in traditional schools (Hamlen, 2014). Hill (2015) asserted that under those circumstances, using a high-interest video game like Minecraft, one that has curricula imbedded, may meet the needs of parents and educators.

Through this quantitative study, the researcher sought to determine whether student performance on course objectives in a Minecraft-supplemented Ancient History course reflected mastery of curriculum content. The determination was based on whether the difference between the final grades of students required to complete the activities or components of the course and those of students who were not required to complete all the components of the course is statistically significant. With this goal in mind, student performance was assumed using final course grades and student mastery of course objectives, defined as a grade of 85% or higher by GamED Academy. Once the collection of data from the 210 students, 105 at the Upper level and 105 at the Core level, was complete, the researcher extracted and exported the data comprising the final grades from the components of the course from the learning management system into an Excel spreadsheet. Additionally, to protect student privacy, all data were kept free of identifiers—students were assigned a number. Notably, the researcher used Excel to conduct a data analysis using the functions of simple descriptive statistics and independent  $t$  tests. Additionally, the researcher generated a summary of means and

standard deviation from each of the grades independently, after which data were organized based on the frequency with which students who received grades of 85% or higher were displayed in a frequency table. The sample data were used to construct inferences about the population. If the difference between the student grades is 0.05 or less, the researcher rejects the null hypothesis and the alternate hypothesis was accepted. If the difference was greater than 0.05, the researcher did not reject the null hypotheses.

Online learning is an area of education that continues to develop, provoking debate about its effectiveness. To date, no study has been conducted to determine whether a supplemental program such as Minecraft, offered through an online provider, increases or decreases student mastery of content. The findings of this study can inform parents, teachers, educational institutions, and software developers about using online video games to increase mastery of content and improve grades. In the next chapter, a review of literature outlines the timeline of educational trends with regard to the integration of online education, distance education, and the potential of using video games to enhance learning.

## **Chapter 2: Literature Review**

The purpose of this quantitative, nonexperimental comparative research study was to evaluate the student academic performance for online students enrolled in an Ancient History course using Minecraft as a learning tool. To assist in fulfilling the purpose of this study, existing literature was explored to determine what current research said about student academic performance and achievement levels when a video game, specifically Minecraft, was used for learning. The initial search of the literature yielded minimal material; as a result, the search was broadened to include the use of video games in online learning environments. The broadened search found studies that focused largely on factors of motivation and engagement. The information contained in the research provided a foundation for understanding the positive effects the use of video games can provide for students, including motivation, engagement, and increased problem-solving skills.

The literature review begins with a general explanation of what Minecraft is, followed by an examination of student performance and the impact student achievement has on the programs parents and educators choose to access for their students. The achievement of students and the instructional programs used to teach them have been priorities for parents and educators since as far back as the 1890s (Forte, 2010). A result of the laws enacted, such as the No Child left Behind Act, has been pressure on parents and educators to have high standards and open minds in their pursuit of effective programs for students (Watson, Watson, & Reigeluth, 2015).

Through review of the impact of educational policies, the literature review examines how software designers' and educators' perceptions evolved to meet the



demands of new educational policies. Under those circumstances, while various changes were intended for traditional programs, online learning emerged as an option for education. Subsequently, educational programs for nontraditional learners have been a part of educational systems since the 1870s (Caruth & Caruth, 2013). Historically, educational opportunities evolved through a distance learning model and as technology advanced, the distance learning models morphed as a response into online instructional models, and they continue to transform to meet the diverse needs of students (Anderson & Simpson, 2012; Hetzner & Leen, 2013).

As distance and online instructional models evolved, the need to keep students engaged and motivated in online learning programs emerged (Anderson & Simpson, 2012). With this in mind, the literature review continues by exploring the use of video games embedded in curriculum as a tool to enhance student learning (Marra, Jonassen, Palmer, & Luft, 2014; Orthner, Jones-Sanpei, Akos, & Rose, 2012). Results from studies also show that using video games as a tool for delivering academic content provides motivation and engagement for students, and the literature review examines other benefits and limitations of using video games in online learning K–12 environments (Annetta, Mangrum, Holmes, Collazo, & Cheng, 2009; Bos et al., 2014).

### **Documentation**

The literature searches for this study made use of resources provided by Northcentral University's library, such as EBSCOhost, ERIC, and ProQuest Dissertations and Theses. Google Scholar was used to complete additional searches. The literature searches conducted for this study retrieved the required scholarly, peer-reviewed articles, dissertations, and reports by professional organizations. The main search terms used for

the purpose of the topic included *distance education, online learning, video games for learning, Minecraft, educational technology, student achievement, student performance, and educational policy.*

### **Minecraft**

Researchers show that engagement can affect learning and motivation when video games are used for learning (Eseryel, Law, Ifenthaler, Ge, & Miller, 2014; Tromba, 2103). The effect has been observed that the use of video games can engage learner and facilitate learning, yet the question remains: Can video games enhance academic achievement (Young et al., 2012)? As game designers embedded games into curriculum, motivation and engagement were found to lessen in students playing the games (Przybylski, Rigby, & Ryan, 2011). An educational video game that uses Minecraft and presents learners with various learning scenarios and activities that allow students to navigate through the game demonstrating application of content learned and self-expression through creativity was the focus of this study.

The use of the video game Minecraft for learning is not foreign to the large game-based learning community. Like other sandbox games, Minecraft's success comes from the interaction within the virtual environment. Unlike other sandbox games, however, Minecraft has simplistic graphics and an opportunity for multiple players to interact within a virtual environment. Much of the Minecraft purpose is to mine and create shelters or dwellings for interactive play within the online environment. The initial game designer, Markus "Notch" Persson, designed Minecraft to be simplistic and to allow a player to interact with the open environment and with other players (Cipollone et al., 2014). Unlike other video games that have the purpose of capturing player attention with

intense 3-D effects and graphics, the entire environment of a Minecraft game, which includes trees, rivers, and homes, comprises  $1\text{m}^3$  blocks that resemble Lego™ bricks. The goal of Minecraft is to break apart and place blocks that are made of various elements (e.g., stone, diamond, glass, and wood) to create structures and shelters.

Minecraft provides two options for the game play: creative mode or survival mode. Within the creative mode, the player has an unlimited amount of resources with no fear of starving or dying. The goal in the creative mode is to explore and construct scenes to represent communities. This includes building the construction of landscapes and structures. This mode also provides opportunity for multiple players to work together within a virtual environment to create a story through personal expression. In contrast, survival mode is goal oriented, and players work together to survive using a limited amount of supplies, tools, and other resources. Additionally, the survival mode poses threats in the form of zombies and fire. Players must create a distance between the threats by developing underground cities and working together to free themselves from potential threats.

Minecraft's developer, Mojang, intentionally leaves contributions that leave survival and creation up to the individual players. The popularity of Minecraft can be seen among players of all ages and all levels of experience (Cipollone et al., 2014). The player community has created online supports through Minecraft tutorials and servers created specifically to support amateur players. Regardless of the modes used by a player, Minecraft requires players to use creativity and encourages collaborative exploration and design among players (Bos et al., 2014).

Minecraft was chosen for use in this study because of its flexible and open virtual environment that allows for embedding educational concepts (e.g., historical events and timelines in history). Most importantly, Minecraft supports a constructivist learning model, where learners are encouraged to use skills to experiment within the environment. Furthermore, software companies have created courses and embedded curriculum into Minecraft courses in response to the mounting interest from school-aged children in playing Minecraft (Bos et al., 2014). As a result of the mounting interest level, student levels of engagement, motivation, and problem-solving (Schifter & Cipollone, 2015) have increased. Therefore, the integration of Minecraft curriculum into the Minecraft environment has proved successful in increasing student engagement, motivation, and skills in problem solving; yet little research is available that shows whether students meet academic course objectives (Bos et al., 2014; Hill, 2015; Overby & Jones, 2015; Smolčec & Smolčec, 2014). The subject matter shown to be successfully integrated using Minecraft and with positive effects on student engagement, motivation, and learning has been limited to core subjects of Mathematics and English (Bos et al., 2014). According to Watson et al.'s (2011) history, video games also show increased levels of student engagement, motivation, and potential for retention of historical facts and dates. In contrast, a study by Young et al. (2012) indicated that few studies show whether students demonstrated academic achievement when history content was embedded into a video game. For this reason, a history course was chosen as the content for this study.

Various educational programs have been created using Minecraft as a tool for learning; an example can be seen at [Minecraft.edu](http://Minecraft.edu). This program is available for teachers to use in a classroom and provides lesson plans in various subject areas. Classrooms can

be set up on the server to host up to 40 students. Within this program is a student portfolio feature. Using this feature, students create and can share their work with the teacher and with other students. Minecraft.edu has proved to be a successful way for teachers to use Minecraft for learning and has shown benefit to student levels of engagement and motivation in learning (Sáez-López, Miller, Vázquez-Cano, & Domínguez-Garrido, 2015). Although considered for this study, this program did not meet the specific needs of the researcher; the researcher identified a self-contained program that also uses Minecraft as a tool for learning, called GamEd Academy. A collaborative effort of a team of educators and programmers brought about the application, which is intended to be a supplemental program for schools. GamEd Academy uses an open virtual world in which there is no plot or story; it allows students to explore and demonstrate understanding of educational content provided through application in building activities in the Minecraft world. GamEd Academy is constructed to provide students with a 6-week session of activities, beginning with delivery of educational content and including assessment to measure understanding and mastery of content, along with activities that allow for application of the learned educational content. This program uses the Minecraft creative mode rather than a survival mode. Additionally, this program incorporates cooperative learning through a Team Build activity. This activity allows students to enter into the server together with other students enrolled in the course and to work together on the session objective.

A study by Moshirnia and Israel (2010) recommended that when using video games for learning, educators should create games that use information delivery methods that are integral to the game experience. Additionally, these authors suggested that games

should also include elements that require reflection on historical information provided. Similarly, Young et al. (2012) suggested that when educators are using video games for teaching history, they must consider a design that fosters learning and allows students to be authors and to actively play through the history content rather than simply read through the content. Young et al. also recommended that educators ensure that game goals and instructional goals are aligned to assist students in meeting academic goals. The program used in this study, GamEd Academy, shows alignment between game goals and instructional goals. This program also offers students activities designed to facilitate active learning, authorship, and assessment of learning while allowing for reflection on the educational content. Although researchers are convinced that student engagement and motivation increase when Minecraft is used as a learning tool, they are not convinced that student learning occurs in that context, because few studies on this topic have been conducted (Bos et al., 2014; Cipollone et al., 2014; Hill, 2015; Overby & Jones, 2015; Smolčec & Smolčec, 2014). Consequently, this study was generated by the need to examine whether Minecraft's being used by online students in the content area of history can affect the learning process and show increased student performance through products of schools such as grades and mastery of content.

### **Brief History of Assessment and Achievement**

Concern about whether students are performing well academically has been a part of education beginning with the Committee of Ten. This group, established by the National Education Association in 1892, recommended that children receive 12 years of education. Once the amount of time was established, accreditation standards, graduation requirements, and course completion expectations followed shortly (Anderson &

Simpson, 2012). The primary focus of the Committee of Ten was to ensure that guidelines existed that allowed educational institutions to demonstrate student academic achievement (Anderson & Simpson, 2012). To demonstrate student achievement, educational institutions started testing students as far back as 1910, with the first achievement test given by Thorndike to assess student handwriting (Behizadeh & Engelhard, 2011). This was the birth of the use of assessments to test student achievement and evaluate the effectiveness of learning programs. The Elementary and Secondary Education Act, passed in 1965, provided funding for elementary and secondary education. It was at this time that standardized testing became mandatory to show student achievement and performance on state standards. Since the 1983 report *A Nation at Risk* appeared, student achievement in American public schools has been the focus of numerous studies, policy changes, and political decision making (Siu Cheung et al., 2014).

Fear arose that American students were falling behind in terms of academic achievement in comparison to other countries, so additional laws were put in place. These laws demanded reform and accountability in schools (Harris-Packer & Ségol, 2015). In 1990, the Individuals with Disabilities Education Act (IDEA) was enacted, placing a direct focus on students as individuals with diverse needs. This law, along with the 2001 No Child Left Behind Act (NCLB), provided funding to states for all students, regardless of diverse needs. In exchange for the continued funding, schools are required to provide proof of student achievement and performance (Forte, 2010). Based on the requirements of the law, currently schools are mandated to show increased levels of student performance by providing student grades from standardized tests in math and in English

language arts, and large-scale assessments used to guide educational policy in states (Harris-Packer & Ségol, 2015).

Under the mandates of the Elementary and Secondary Education Act, the revision of NCLB, states have expanded the scope and frequency of student testing, revamped their accountability systems, and begun striving to demonstrate annual progress in raising the percentage of students who are proficient in reading and math. Davidson, Reback, Rockoff, and Schwartz (2015), in a historical review of NCLB, showed how this law mandated accountability of schools to show yearly student growth in achievement and performance. Consequently, proficiency as demonstrated through assessments is used to determine student growth and the effectiveness of schools (Davidson et al., 2015).

Although schools are held accountable under federal mandate to show adequate yearly progress (AYP), many schools found loopholes and provided the data necessary to remain out of AYP trouble (Chiang, 2009). Additionally, schools were pushed to improve curriculum and instruction provided to students (Heubert & Hauser, 1999). However, the use of tests to determine performance levels in educational institutions has spurred much debate. Supporters applaud indicators of student performance that include objective measures and raise academic standards (Tsang, Katz, & Stack, 2008). Others argued that using test results as the only indicator of student performance can be detrimental to special populations (Kim & Sunderman, 2005).

The NCLB was replaced in December 2015 with the Every Student Succeeds Act (ESSA). This piece of legislation, signed by President Barack Obama, required that learning standards be developed and annual assessments be given to test student achievement and performance on the learning standards in grades 3–8 (Korte, 2015).



Korte (2015) noted that this law also put the responsibility on the states rather than on the federal government to determine the individual learning standards and how curricular decisions were made for their citizens. In addition, under this law, all American students must take mathematics and English language arts assessments to ensure that they are achieving the desired level of education specified by the state. Each state needs to submit a plan to the Education Department and have it approved to make sure that students are held to a level of proficiency. Every school in the United States participated with the state-approved assessment, which is administered annually, with test questions derived from the state standards. Progress monitoring takes place through informal assessments of the content by individual students (Forte, 2010).

Throughout history, assessment based on course content, either through standardized testing or individual testing, has been the tool used by educators to determine whether students are achieving adequately. The assessment scores have then been used to measure the effectiveness of the educational program (Harris-Packer & Ségol, 2015). Researchers in education indicate that the ultimate goal of any instructional program is to raise student achievement, which involves increasing student knowledge of the content, meaning that measuring that knowledge is important (Forte, 2010; Harris-Packer & Ségol, 2015). Maleyko and Gawlik (2010) suggested that assessments given to evaluate student achievement may help to reveal student performance levels; however, these researchers were convinced neither that the goal of student proficiency set by the federal legislation was a valid measurement nor that of 100 percent proficiency was attainable by schools. Analysis of student achievement often reveals, for educators, the different levels of performance between students in their programs (Harris-Packer &

Ségol, 2015). Additionally, the data collected on student achievement and individual performance guide parents and educators in determining the effectiveness of an educational program. Studies by Harris-Packer and Ségol (2015) and by Siu Cheung et al. (2014) showed that using student test grades as an indicator of student achievement can help educators formulate informed decisions about the effectiveness of student programs. Studies by Durak and Atazi (2016) and by Maleyko and Gawlik (2011) demonstrated that insufficient student achievement serves as a predictor of an ineffective educational program.

### **Types of Assessment**

The primary goal of the summative assessment is to determine student understanding and growth, and teachers use a variety of tools to administer it (Teach for America, 2011). Paper-and-pencil tests cannot measure every skill; nor would an extended interview be helpful (or practical) for gauging all learning. According to Teach for America (2011), tests and quizzes are a traditional and effective way for teachers to discern how good students are absorbing the information taught. They are also faster to design than some other assessment methods, although designing them is not easy, and scoring them is definitely difficult, but they offer a great deal of flexibility in terms of structure. But tests and quizzes are not the only option performance assessments can also be helpful. According to Baleni (2015), teaching and learning should be assessment driven in order to provide learners with the chance to demonstrate their level of mastery of skills taught. Researchers in this area insist that assessment influences learners and drives motivation in continued student learning (Baleni, 2015; Lemanski, 2011). Using assessments that require students to demonstrate their knowledge of content through

completion of a task requires the use of higher level problem solving skills rather than responding to a set of questions that could potentially be answered through memorization rather than through actual knowledge and understanding of the content (Teach for America, 2011). Further, Baleni (2015) found that when a summative assessment was used that drew from formative assessment, students showed increased mastery of course content. Formative assessments presented by teachers to assess student mastery of content through the use of multiple choice questions also had a positive impact on student achievement, according to Wilson, Boyd, Chen, and Jamal (2011). Additionally, Baleni found that when teachers use the results from the formative assessment to drive the development of course activities as well as to create the summative assessment, students showed increased achievement. As previously noted, courses using formative and summative assessment have been shown to have positive effects on student learning (Baleni, 2015). Successful conjoining of summative assessment and performance assessment by teachers was found in the use of student portfolios (Teach for America, 2011). According to Cheng and Chau (2016), e-portfolios contain evidence of student work that can be shared with teachers and peers in the online environment and allow students to demonstrate creativity, ability to show application of material learned, and overall mastery of content. According to Chen and Chau, e-portfolios increase student participation, motivation, and engagement in learning. Chen and Chau added that teachers can use e-portfolios as a summative assessment to demonstrate students' ability to apply the content learned in a way that is meaningful.

Giandi, Morrow, and Davis (2011) found that online formative assessment had a positive impact on teacher and student engagement in educational experiences. Sited

within the study by Giandi et al. (2011) was evidence provided by researchers Crisp and Ward (2008), who found that formative feedback from teachers to students regarding progress and levels of mastery based on the formative assessment increased student levels of engagement, improved achievement, and enhanced student motivation to learn. They also found that online formative assessment has an unquestionable impact on student learning experiences when results are used to create challenging and engaging activities for students that make activities relevant to students' lives. Substantiating these findings, researchers found that online formative assessment using varied assessment activities, such as using online tools for supporting inquiry and simulations, can enhance student learning and allow students to demonstrate their mastery of course content (Baleni, 2015; Gikandi, Morrow, & Davis, 2011; Vonderwell, Liang & Alderman, 2007). Assessment activities should be created that encourage students to use prior knowledge and experience, thereby supporting learners in their efforts to construct meaning and increase engagement in learning (Wilson et al., 2011). In this proposed study, the educational program identified used formative and summative assessment as well as enrichment activities that built on the educational content.

### **Content Mastery**

In education, the integration of student experiences and prior knowledge in the pursuit of new knowledge can result in individual mastery in learning (Dewey, 1913). A number of researchers have implied that there is a link between mastery learning and acquisition of knowledge (Arredondo & Block, 1990; Diegelman-Parente, 2011; Yudkowsky, Park, Lineberry, Knox, & Ritter, 2015). Mastery learning is an instructional method that is based on the awareness that students master a concept before moving

forward to other concepts (Diegelman-Parente, 2011). According to Hassel and Lourey (2005), teaching and learning should be a responsibility shared between teacher and student. Additionally, teachers are responsible for the design and reinforcement involved in learning programs. Similarly, students are responsible for their level of engagement in learning (Bloom, 1978; Hassel & Lourey, 2005). A study by Yudkowsky et al. (2015) indicated that teachers should set mastery standards in courses to ensure the effectiveness of the program and a positive outcome for student learning. Researchers have suggested that a common frustration for teachers is having students complete a course while showing little mastery of basic course concepts (Diegelman-Parente, 2011; Yudkowsky et al., 2015). Zimmerman and Dibeneditto (2008) cited Bloom (1974) in exploration of the mastery learning model-identified components essential to student success. According to Bloom (1974), teachers must first define the level of mastery expected of their students. With that said, it is the teacher's obligation to plan and teach for mastery. Consequently, when a plan for mastery is established, formative assessment is used to provide teachers and students with feedback about the level of mastery based on the defined learning objectives. Mastery of course content is considered to be the goal of good teachers (Yudkowsky et al., 2015).

According to Diegelman-Parente (2011), the use of the instructional method known as mastery learning allowed students to earn a grade that was in alignment with the teacher's goal regarding mastery of content. However, Zimmerman and Dibendetto (2008) also determined that a grade was not enough to motivate students to mastery and that teachers also had to inform students of the learning objectives and connect grades to achievement while binding all students to equal standards. According to Bloom (1978),

students who acquire mastery are considered to be at an achievement level of 80% or higher. Researchers in the field of education and student learning concurred with using an 80% achievement level as an indicator of mastery of learning (Azar, 2010; Yudkowsky et al., 2015). Within the mastery learning model, when students met the 80% mastery level, typically they were provided with opportunities for enrichment through activities that were designed to expand their learning experiences (Diegelman-Parente, 2011). Further research in mastery learning identified the need for students to assign a value to the tasks within the course (Azar, 2010). Within the Azar (2010) study, a framework identified by Elliot and Harackiewicz (1996) indicated that mastery goals, performance goals, and performance avoidance goals are needed for successful programming and mastery of learning. The expectation with the identification of mastery goals is that students demonstrate competence through task mastery. The drive to surpass the performance of others leads to mastery of learning. In contrast, performance avoidance goals led students to avoid tasks that might reveal their incompetence at a task (Elliot & Harackiewicz, 1996). When students viewed tasks as valuable, whether because of their intrinsic value or their extrinsic value, typically student motivation increased, which was followed by an increase in learning and academic achievement (Azar, 2010). In this study, the educational provider set learning objectives that were clearly identified at the beginning of the course. Additionally, the 85% mastery of learning criterion was used in alignment with the criterion identified in research. This paradigm of mastery learning inspires teachers to create course content with set levels for mastery and presents students with the opportunity to earn grades based on achievement.

## **Advancement of Instructional Approaches**

As technology has changed, instructional methods have also changed to meet the needs of diverse learners. Historically, instructional methods held the teacher as the center of the classroom. Traditional classrooms involved teachers delivering information to students through lectures, textbooks, written notes, and intense written assessments (Watson et al., 2015). Expectations included that students would complete work regardless of ability levels, and the use of differentiated instruction was something foreign (Monteiro & Morrison, 2014). Traditional instruction required students to attend instruction synchronously, that is, at the same place and time as the teacher (Watson et al., 2015). As technology advanced, the ability to provide education at a distance had greater potential (Anderson & Simpson, 2012). With the birth of the Internet, distance education morphed into educational opportunities known today as online education (Allen & Seaman, 2013; Caruth & Caruth, 2013; Hetzner & Leen, 2013). Similarly, acceptance of online learning has grown and is valued by institutions and students across the world. The desirable aspect of luring students and educators to online learning has been the flexibility and effectiveness this instructional method provides (Anderson & Simpson, 2012). To define the characteristics of a rich online learning experience, it is necessary to first define what learning is in this and any environment. According to Wan, Compeau, and Haggerty (2012), learning is the process of acquiring, enhancing, or modifying an individual's knowledge, skills, and values. A great learner is defined by these authors as an individual who is responsible for the management of his or her own learning process. Critical to the online learning environment is the necessity for the online learner to possess the characteristic of self-regulation. Wan et al. (2012) clarified

that the self-regulated learner can learn better than the non-self-regulated learner in the traditional academic and training setting since the former takes responsibility for the learning and views the learning as a process. In the context of success in the online environment, even more important than learners' characteristics are the characteristics demonstrated by institutions when they create programs for their online learners. Students and instructors alike often enter into the online learning environment with assumptions about how the online course works, and with online expectations. Afifi and Alamri (2014) recommended that online learning environments should be intentionally designed in such a way as to be meaningful to online learners; they suggested that what and how much learners learn is correlated with the learner's motivation to learn. According to Anderson and Simpson (2012), common assumptions made by students were that an online course was easier, was less rigorous, and took less time to complete than a traditional course. As a result, students often underestimated the amount of time required to complete course activities in an online course. These researchers found that upon starting the course, students who held these assumptions quickly realized that they were inaccurate. Studies by Means et al. (2013) and by Roseth, Saltarelli, and Glass (2011) found that online courses provided the same level of rigor and require the same amount of work as traditional courses. However, online courses were more flexible in terms of when the assignments must be completed. Additionally, Means et al. and Roseth et al. found that the flexibility of an online course did not mean that the course was any less rigorous or was easier to complete. Another assumption students were found to have about an online course was that the instructor was delivering the knowledge and students could be passive participants in the learning (Sadi & Uyar, 2013). Students realized they



were wrong when they understood that the instructor was a facilitator of learning and that they were in control of their own time and learning. A study by Bourgonjon et al. (2010) determined that the philosophy of teacher-centered learning can be found in an effective online course. Bourgonjon et al. found that this realization came as a surprise for students and that the role of the instructor was to support the student through the switch from the traditional teacher-centered learning to learner-centered learning.

Additionally, research indicates that learners' engagement and motivation increased correlatively when teachers presented courses in ways that were learner centered and relevant to learners' lives (Eseryel et al., 2014; Kovačević, Minović, Milovanović, de Pablos, & Starčević, 2013). A study conducted by Grosso, Smith, and Grosso (2012) revealed that many students enrolled in online learning did better in classes formatted in specific ways. Orthner et al. (2013) recommended using interactive lectures in the development of an online program. These interactive lectures provided students with a way to interact with the content of the course. Students often assumed that the instructor was readily accessible and would provide constant feedback and instruction. Pyari (2011) found that this may be true in a traditional course but that in an online course, the student had to rely on the interaction on an as-needed basis and in the form of instructor feedback on a particular response to a posting or feedback on an assignment. In other words, students must take responsibility for their learning. Additionally, Pyari found that instructors could increase the level of feedback and interactivity in courses by using various methods that were reasonable for them. Barrett (2013) found that one method popular among teachers was for the teacher to build questions into the content of the coursework. These questions helped provide data about

student understanding of the material and acted as a means to provide feedback to students regarding their level of understanding of the content presented throughout the course. Grosso et al. (2012) cited interactivity as an important component of instruction; in their study, the use of interactive questioning played a critical factor in increasing student learning. Similarly, creating rich online learning experiences involves teachers designing programs that provide feedback to the students on progress in the course. Aside from feedback, as Harsh and Young (2015) discovered, it is also important to create environments that incorporate all the learning styles and modalities that meet a learner's needs. Harsh and Young also found that relationships are critical to building programs and that institutions are responsible for the development of programs that are relevant, interactive, authentic, and organized. Simultaneously, Harsh and Young noted, programs should respect the understanding and expectations of the learners, providing choice in the learning environment and regarding how the learner is able to engage in the environment. Dziuban and Moskal (2011) found that institutions should address the common assumptions made by students and that instructors do well to provide clear expectations through the use of a well-written course syllabus. Providing highly interactive and supportive courses for students at the beginning of their online program would help build student success in future online courses. Furthermore, institutions should provide resources for self-help and encourage students to explore and find the answers they need to questions internally by reading the syllabus and by contacting the instructor or another classmate before they seek outside sources, according to Dziuban and Moskal.

Sadi and Uyar (2013) noted the need for additional research in the area of creating personalized learning and discerning how this learning can be conducted in an online

environment and still facilitate student achievement. Likewise, these authors suggested that providing as much information as possible to students before they begin their online course, perhaps through an orientation, could eliminate the assumptions and bring students into the realistic expectations of an online course. Online learning environments was found to provide learners with options and viable choices for learning in a way that fits individual needs (Barrett, 2013; Tao, Fore, & Forbes, 2011). Unlike scholars in traditional environments, online students were not found to be bound to synchronous instructional requirements (Roseth et al., 2011). According to research by Simonson, Smaldino, Albright, and Zvacek (2012), online learning allowed students to work at their own pace while providing the structure they needed to be successful. The authors added that the interaction between student and teacher in an online learning environment is much shorter and less frequent than in a traditional learning environment. Reinforcing these ideas, Simonson et al. (2012) also identified that a component lacking in numerous online environments was the student-to-student personal interaction associated with being a student in a traditional classroom. According to the research these authors contributed to the field, student-to-student interaction is viewed as an important component in ensuring that an online course is successful. As online programs have developed, the quest to find additional opportunities for students to interact while encouraging them to be engaged and motivated despite being in a relatively isolated learning environment has led to game-based learning (Bottino, Ott, & Tavella, 2014).

### **Game-Based Learning**

Designing online learning programs contributed to a major shift in how learning and teaching take place in the 21st century (Afifi & Alamri, 2014; Bos et al., 2014).

Additionally, expressed in these studies was the importance of educators' reflecting on how people learn and use the educational theories of learning as a foundation for creating effective and meaningful experiences for the learners in the online learning environment. A study conducted by Rowe and Rafferty (2013) indicated that online learning provided learners with the opportunity to access large amounts of information that they processed, made sense of, and applied to their lives. Additionally, online learning, including game-based learning, was found to be a learning environment that was learner centered and focused on the learner solving problems using a variety of resources and materials to accomplish the goal of learning (Bos et al., 2014; Koohang, Riley, Smith, & Schreurs, 2009; Marra et al., 2014).

The literature consistently documents constructivism learning theory as being an appropriate match for e-learning design, which encompasses game-based learning (Afifi & Alamri, 2014; Sicilia, Lytras, Alonso, Barriocanal, & Ros, 2011). The effectiveness of constructivism in the game-based learning environment was viewed through technology used with learners to allow them to construct meaning through interaction with the resources and curricula used (Ertmer & Newby, 2013). The constructivist learning theory suggested that the learner is to interpret and process what he or she is learning and construct meaning. Similarly, the game-based environment involves the learner being active in his or her learning and also encourages reflection on the learning process (Iskander, 2014). The learner spends time doing and participating in activities and reflecting and rethinking his or her actions in the process of learning. This process enables the learner to draw from previous experience and knowledge and to integrate these experiences with the new information (Sicilia et al., 2011). Sicilia et al. noted that

the constructivist model supports the process of e-learning, including game-based learning, and encourages collaboration and conversations between educators and learners. Additionally, game-based learning supports this learning theory through design as learners engage in processes of learning that are organized, structured, and emphasize collaboration and conversation among teachers and other learners.

The use of educational video games should engage learners and include intentional, meaningful, and cooperative activities (Marra et al., 2014; Szilas & Acosta, 2011). Additionally, stated in the study by Marra et al. (2014) was the need for programs to include components and design that help learners to recognize and solve problems along with comprehending new information while they construct meaning from the information learned. Aside from those components, learners set goals for learning and regulate their learning (Rowe & Rafferty, 2014). Incorporating a constructivist approach in the process of designing and implementing an effective game-based learning program can provide learners with the opportunity to construct meaning from their learning and to apply what they have learned to real-life situations (Greitzer, Kuchar, & Huston, 2007; Iskander, 2014; Jonassen, 1999). According to Koohang (2009), the instructional design in an online course that uses learning theories and principles will add to the success of the online learner. Furthermore, this study emphasized that it is the responsibility of the instructional designer to choose technology, strategies, and teaching methods that promote the success of the online learner. It is also the selection of an educational approach that becomes an important factor in the success of an online learner, not necessarily the technology used. Koohang (2009) explained that the theory of constructivism adds to the understanding of and provides guidance on how an online

learning program, including the use of video games for learning, designed for learners allows for success in the learning process. Moreover, Koohang (2009) stated that within the learning theory a set of guidelines and rules are present that are used by e-learning designers and educators to formulate decisions when designing activities and resources for e-courses. The guidelines of constructivism provide direction to educators in the facilitation of learning by using different conditions in addition to providing a guide regarding components of course organization and what works best for the learner (Sicilia et al., 2011).

Constructivism in e-learning and the use of video games for learning encourages the design of courses and activities that build on the learner's previous knowledge through active participation, not just through inactively receiving instruction, according to Afifi and Alamri (2014) and Szilas and Acosta (2011). These researchers revealed that in a constructivist model, the role of the learner is one where the learner uses self-regulation and takes control of his or her learning. While doing this, the learner remains actively engaged in the learning process, takes risks, and uses guided discovery to experience new learning (Rowe & Rafferty, 2013). Online learners must also use collaboration and communication to clear up inconsistencies in their learning and look beyond their opinions and views (Koohang, 2009). The constructivist theory reinforces the premise that learners need e-learning content to be effective and encompass various informational resources, knowledge, and tools useful for communication and collaboration (Iskander, 2014). According to Sicilia et al. (2011), when using an e-learning program utilizing video games, it is important to use effective teaching methodologies. Additionally, the constructivist model encourages educators to tailor their

teaching methods and strategies to the learner as they encourage the learner to analyze, interpret, and predict information in the learning process. Under this model, educators must promote dialogue among other learners through the use of open-ended questions and use curricula customized to the learner's experience all while embedding opportunities for hands-on learning through simulations throughout the game (Marra et al., 2014).

In a study conducted by Iskander (2014), the role of the learner is identified as one that holds presence at the center of learning and is in control of the process of the learner's learning. Additionally, this study highlighted the process for educators of realizing that their role in an online learning environment is that of a facilitator, a guide, and the monitor of the learning process. Similarly, in game-based learning, as the online educator creates activities and opportunities for learners in the online learning environment under a constructivist model, it is the student who creates his or her own learning goals that align with activities created by the educator (Sicilia et al., 2011). For this reason, using the constructivist model, learning activities and opportunities in the online learning environment should comprise relevant and realistic learning situations and should include having the learner use problem-solving skills as he or she constructs meaning and extracts purpose from the activities (Tsai, 2011). Subsequently, effective game-based design was found to necessitate using teaching methods that are learner, scenario, and problem based (Afifi & Alamri, 2014; Iskander, 2014; Wu et al., 2012). Supporting the constructivist model by employing scenario-based learning affords learners a reason for learning. In addition, doing so gives a learner an opportunity to role play, or simulate the learning challenge, and to construct meaning from it (Iskander,

2014). According to Afifi and Alamri (2014), learners were found to be more likely to remain actively engaged in their learning when they were given activities that involved frequent interactions and opportunities to apply newly learned information. A desire for clarity about whether learners meet the learning objectives set out by course instructors when curricula are embedded in an educational video game has resulted in numerous studies being conducted (Wouters, van der Nimwegen, van Oostendorp, & van der Speck, 2013; Szilas & Acosta, 2011).; these studies had conflicting outcomes.

### **Theory and Video Games for Learning**

Identified through the constructivist learning theory was the premise that educators hold the ultimate responsibility of providing learners with opportunities intended to encourage motivation and engagement (Sadi & Uyar, 2013; Simoncelli & Hinson, 2010). Also, designing courses that exercise strategies and tools while capturing student interest was found to be problematic for teachers in a society driven by technology (Barrett, 2013; Elliott, 2014). Thus, from a constructivist lens, teachers must pursue strategies and devices that facilitate student engagement, in addition to fostering student accountability and responsibility for learning; this necessity led to the development of e-learning opportunities through the use of video games in the classroom (Du Plessis & Webb, 2011; Huang, 2011). The use of Minecraft as a tool assists with cognitive development because it provides learners with an opportunity to construct meaningful outcomes as knowledge of content is acquired. For example, a student may be able to create an artifact within the Minecraft game world that demonstrates the understanding of a concept present in the educational content. Such theorists as Vygotsky



(1978) and Piaget and Inhelder (1969) suggested that the elements that drive the acquisition of skills are central to the learning and developmental process.

Constructivism is a theory based on the process of constructing meaning in learning (Schifter & Cipollone, 2015). Unlike the behaviorist view, the constructivist view depicts the learner as one who is active in the process of learning and brings into the environment knowledge of previously acquired content (Jonassen, 1999). According to Ertmer and Newby (2013), the rudimentary stance of constructivism is that new information is connected to prior knowledge that brings with it learners' opinions and biases. Vygotsky (1978) and Bruner (1996) contributed to constructivism by revealing their belief that a learner has altered interpretations and has constructed meaning that results from new information regardless of the accuracy of the information, and that the learner brings information into each new learning environment. In a study regarding learning and constructivist theory, Poncy, McCallum, and Schmitt (2010) determined that students also learn best by making sense of what they are learning. Additionally, these authors clarified that the role of the teacher should be focusing on assisting students with making connections between facts proven with evidence while fostering a new understanding. This perspective differs from behaviorism in that the teacher is a guide and a facilitator rather than the deliverer of knowledge. Furthermore, as described in the research by Poncy et al. (2010), the teacher provides reinforcement to the learner as lessons are built around previously learned material. Ertmer and Newby (2014) determined that unlike the behaviorist model, in which reinforcement is provided to a learner, in a constructivist model self-reinforcement takes place as learners construct meaning and take control of their own learning, and self-reinforcement is observed and

measured as learning takes place (Iskander, 2014). This dynamic occurs in an online learning environment when video games are used for learning. Furthermore, whereas mistakes are considered failures of learning in a behaviorist model, the constructivist model views errors not as failures to respond to the stimuli, but rather as an opportunity for the learner to gain insight into his or her previous knowledge and to correct the inconsistencies. Further contributions by Moore (2013) indicate that in a constructivist model, assessment of students takes place through methods woven into the teaching or the activities, whereas from the perspective of a behaviorist model, the assessments given verify that learning happens while learners' responses are evaluated. According to Vygotsky's (1978) theory, acquisition of knowledge occurs without the influence of the social world. Similarly, Piaget focused on the idea that a child learns through interaction with his or her environment and through experimentation (Piaget & Inhelder, 1969). In addition, the Piagetian theory supports the notion of providing children with the tools and space to play, learn, and challenge their current understanding while developing more complex schema. The role of the learner, according to a constructivist model, is to be the center of the learning process; and all instruction should center on the learner's experience (Poncy et al., 2010). Further interpretations of constructivism by researchers identified learning as a process of discovery for which preservation of the natural learning environment is important. Behaviorism, on the other hand, involves the altering of the natural learning environment, and learning and measurement transpire through analysis of what happens to the behavior as a result of the alteration (Ertmer & Newby, 2013; Wu et al., 2012). According to Voskoglou (2010), constructivism involves linking previous information taught with new information and focuses on behaviors observed,

such as a learner's thoughts, perceptions, and problem-solving ability. Comparatively, from a learning theory perspective, the production of knowledge comes from interaction, so the use of Minecraft as a learning tool supports the constructivist epistemology. Furthermore, the digital representation of blocks children can manipulate using creativity, problem-solving skills, and knowledge acquired from the educational content supports the concept of experimentation consistent with constructivism. Additionally, Minecraft provides a valuable opportunity for learners to relate content learned to the virtual environment and to acquire new learning when motivated by and engaged in the learning environment.

### **Motivation, Engagement, and Video Games**

According to Roseth et al. (2011), gaining and maintaining engagement seems simple in a traditional classroom environment; however, in an online program, this is not a simple endeavor. E-learning is independent, and the intention is to allow students to move through the course at their own pace. Engaging students in an online learning program requires that the educator plan more, use better communication strategies, acquire continuous feedback, engage in constant monitoring, and be creative (Plass et al., 2013). Studies by Eseryel et al. (2014), Omar, Hassan, and Atan (2012), Orthner et al. (2013), and Plass et al. (2013) demonstrated that using activities that promote interaction within the online course can increase engagement. These authors found that to effect engagement, activities should be designed effectively. Courses need to capture the students' attention and require more skills and attention than just clicking and dragging or replying with one-sentence responses (Conrad & Donaldson, 2004). Similarly, the content of the online course must also be made engaging using various forms of media

and eye-catching design; using video games within the content of the course also was found to work to engage students. Sicilia et al. (2011) found that building student curiosity is a way to encourage excitement and engagement in learning. As students experience interactive activities, they further build their curiosities, which sparks connections to learning. Moreover, these curiosities keep students connected to the content, the course, and the teacher. According to Edwards, Rule, and Boody (2013), an online course has three types of interactivity. The first type involves interaction between learners. Edwards et al. found that because of the isolating nature of the online program, this type of interaction provided students with the opportunity to get to know their peers. As a result, they were able to build a sense of community as they interacted with each other, solving problems and sharing their opinions. With this in mind, activities that allow for interaction through discussion boards, student forums, or student-only chat rooms reinforce the importance of this level of interactivity in a course (Caruth & Caruth, 2013). A study by Simonson et al. (2012) found that providing students with the opportunity to lessen the isolating nature of the online environment via teacher-facilitated connection and communication was helpful, in addition; other learners could prove to be beneficial to the students' success in online courses. More importantly, encouraging students to interact and maintain a sense of community could lead to higher levels of course engagement and to the students' happiness and success in the course (Cavanaugh, Repetto, Wayer, & Spitler, 2013).

Simonson et al. (2012), while studying student interaction and engagement, also identified a second type of interaction between the learner and instructor. This type of interaction encourages the instructor to provide feedback to the student, facilitate his or

her learning, provide clarification when needed, and provide a simplified interpretation of the content. A study by Edwards et al. (2013) identified the role of the instructor as supporter; the teacher is no longer the center of the learning experience in this type of interaction. Comparatively, in traditional learning environments, the teacher's role is to deliver the specific material to students, and students are the passive recipients of the information; whereas in the online learning environment, students control their learning, and it is through the course activities that students gain the knowledge of the content. A study conducted by Eseryel et al. (2014) confirmed the need for the activities to be interactive to motivate and engage students to be active participants in their learning. Simonson et al. (2012) further defined the third type of interaction in an online program as the interaction between the learner and the content. Often seen as a critical interaction, this is where student learning takes place. Studies by Hess and Gunter (2013) and by Plass et al. (2013) indicate that using simulations helps the learner to absorb the material more efficiently and increases engagement. Moreover, the findings show that simulations allow students to practice skills in a realistic scenario that can be simple or complex in design, depending on the creator of the activity.

Reinforcing these ideas, Omar et al. (2012) found that in an online course, the goal is to gain and keep the learner's attention. Furthermore, engaging learners by using activities that captured their attention and built on their previous knowledge and interests was beneficial to the students' growth in the course. To facilitate student engagement and motivation, teachers should provide constant and consistent feedback, which includes questions and activities that spark reflection (Larsen, 2012). Another critical element in designing an effective online course is reflection (Iskander, 2014). Larsen (2012) found

that one method of creating effective interactivity is to incorporate activities using reflection. Using reflection, learners communicate how the content relates to their own lives, to any prior knowledge they may have about the content (Verpoorten, Westera, & Specht, 2011). Activities using reflection effectively can be simple, by for example having the teacher create “dig deeper”-type questions for the students to answer about the content of the lesson. Additional studies by Barrett (2013) and Grosso, Smith, and Grosso (2012) found that effective online teachers facilitated deeper thinking by posing additional questions to students as they answered the initial questions. That is to say, using “How?” and “Tell me more “type questions encouraged students to fully engage in the understanding of the material and in making connections between their experience and the material presented. Connections built between their previous knowledge and the new information resulted in students’ being more likely to retain the information for future reference to additional activities in the course, which may require that they demonstrate their knowledge and application of the new material learned (Barrett, 2013).

One study indicates that what works best for the population of students in the online course is the process of engaging students through communication, connection, and collaboration (Cavanaugh et al., 2013). In addition, using the levels of interactivity, teachers can understand how better to engage students in the online course. A study by Aqel (2013) on levels of interactivity in relation to levels of student motivation and engagement identified four different levels of student interaction.

The first level presents a learner who does not fully participate with the content and instead primarily pushes buttons and interacts minimally with the graphics. In this type of interaction, Aqel (2013) found that the student can be unengaged and still fulfill

the requirements of the activity and pass the course. However, Aqel identified being unable to use the material or attach a value to it as a potential cause of future failures in a course.

The second level Aqel (2013) identified was the learner who has limited interaction. Further explanation indicated that the learner at this level may watch content unfold through video or listening to audio components of the course. Although more engaged, this learner does not retain much of the material. For the purpose of engagement, Aqel indicated that the benefit of these levels of interactivity is that the learner still gains access to the required material for the purpose of fulfilling any assessments. Additionally, studies on engagement and motivation by Cavanaugh et al. (2013) and Marino et al. (2013) demonstrated that this level of interaction in a course may serve a purpose for those learners who have impairments and have limited capabilities to participate in a course with a higher level of interaction.

The third level of interactivity is that of a student with moderate interaction. Aqel (2013) showed that at this level, learners interact with content that is more challenging and complex in terms of what is required to promote engagement. With this in mind, the level of interactivity is considered to be efficacious in the e-learning environment due to the ratio between the time spent in development and that spent in engaged and active learning (Aqel, 2013; Larsen, 2012; Marino et al., 2014). A course that uses this level in its design potentially uses animated videos, audio recordings, simulations, and scenario-based problems throughout the course or integrated into various activities within the course (Aqel, 2013). These activities keep the students motivated and engaged as active participants in their learning.

The final type of interactivity identified by Aqel (2013), considered to be highly efficacious, is simulation- and game-based learning. Using video games in learning has proven to be highly effective in increasing student engagement and student motivation (Hess & Gunter, 2013). The benefit of this type of interaction is that students are learning in real time and are using the first three levels of interactivity mentioned previously. By using simulations and gaming, students remain engaged in educational content through investigating and problem solving with the use of a digital avatar that keeps their attention and provides meaning and connectivity to the content (Kovačević et al., 2013). Although this type of interaction used in the online courses is a novelty at first, students often lose interest later; thus, Eseryel et al. (2014) found, educators often needed to identify additional motivators for students. Also, a potential drawback identified by Alexander, Truell, and Zhao (2012) is the lack of parent support for using gaming as a part of and a tool for learning. Although research proves the effectiveness of using gaming, parents and students were found to be reluctant to support the use of games as a learning tool (Bourgonjon et al., 2011; Bourgonjon et al., 2010; Kovačević et al., 2013).

Research shows that the positive attributes of interactivity in online courses lead to increasing student engagement and that when using the right types of interactivity and levels, learners improved retention (Delen, Liew, & Willson, 2014). Likewise, studies show that greater retention leads to greater success of the course activities and overall greater student satisfaction in the course (Durak & Ataizi, 2016; Dziuban & Moskal, 2011). Expressing agreement, Afifi and Alamri (2014) and Barrett (2013) found that using the levels and types of interactive activities within the course met the goal of



engaging students by using connections and effective communication among the student, the teacher, and the other students in the course.

Studies indicate that one strategy for maintaining and increasing student engagement in online learning is addressing the challenges concerning lack of student engagement (Alexander, Truell, & Zhao, 2012; Carroll, 2013; Driscoll, Jicha, Hunt, Tichavsky, & Thompson, 2012; Edwards et al., 2013). These challenges were identified in research as issues with poor instructional design. For example, Alexander et al. (2012) found that student engagement and motivation in an online learning program were significantly less when the content did not move at a pace that was fast enough for the student. These findings were also evident when learners were unable to go back to previously learned content, when the opportunity to repeat and review content was not available, or when the instructions for each activity were not clearly defined. If any or all of these challenges exist, the research says, students disengage from the material being presented (Conrad & Donaldson, 2004). Studies by Grosso et al. (2012), by Hersman (2014), and by Harris-Packer & Ségol (2015) contributed to research strategies to overcome challenges regarding lack of student engagement that involve having the delivery of content organized into chunks. This strategy demonstrates that when students have less material presented to them at one time and are afforded the opportunity to review and repeat material, they are more likely to remain engaged and motivated in their learning. Additionally, giving clear instructions for each activity, along with making expectations clear from the beginning, offered students who do not complete an activity correctly the opportunity to fix errors (Grosso et al., 2012). Conrad and Donaldson (2011)

provided activities that built on the skills taught and allowed students more time to interact with the content and to practice application of the skills learned.

In addition to using these strategies to increase engagement, teachers can require the online student to set personal learning goals in an effort to promote self-evaluation throughout the course and at the completion of the course (Iskander, 2014; Larsen, 2012). Studies by Kovačević et al. (2013) and Moore (2013) show that using performance-based assessment to evaluate course activities gives the teacher great information about student interests and levels of motivation. Also, found in the research was the importance of effective course design, such as including several activities for a student to choose from that cover the same content (Dziuban & Moskal, 2011; Rowe & Rafferty, 2013). For the purpose of increasing motivation and engagement, researchers in the field also recommended using activities that meet the students' learning styles and needs (Elliott, 2014; Eseryel et al., 2014; Hamlen, 2014). Jaggars and Xu (2016) showed that the use of activities involving active problem solving and reflection is effective in increasing student engagement and motivation.

Software companies and educational professionals collaborate to develop engaging online learning courses for students (Hill, 2015). Using constructivist learning theory, educators realized the importance of engaging students in learning activities that encourage them to play an active rather than a passive role in learning (Afifi & Alamri, 2014). Teachers of students in online learning programs were found to struggle with preserving student motivation and engagement in online courses (Barrett, 2013). For instance, research implies that teachers who implement time-management activities presented in a game-like format for students boosted both student engagement and the

amount of time students spent engaged in a course activity (Hess & Gunter, 2013). By the same token, using video games as learning devices proved successful in increasing student engagement (Bourgonjon et al., 2010; Hess & Gunter, 2013).

Researchers suggested that using video games as a tool for learning had a positive impact on student engagement and motivation in learning (Hamlen, 2014; Marino et al., 2014). Moreover, evidence suggests that using video games for learning amplified student performance; yet to be determined is whether students met the course objectives while using video games (Hess & Gunter, 2014). In further support of the findings, research shows that using a video game as a tool for learning can also increase student interest in the curricular area being taught (Kovačević et al., 2013). Consequently, using video games in courses that teach math, science, humanities, and reading while having the teacher facilitate was successful in increasing student interest and motivation in these subject areas (Bos et al., 2014; Carroll, 2013).

So that students show increased motivation, engagement, and interest, several studies found, educators must also craft games and activities within the course to ensure that the course is relevant to students' lives (Cavanaugh, et al., 2013; Elliott, 2014; Hamlen, 2013; Kovačević et al., 2013). Additionally, researchers recommended that educators take into consideration parent and student perceptions in the process of selecting an appropriate video game (Bourgonjon et al., 2011; Bourgonjon et al., 2010; Kovačević et al., 2013).

Using video games that are of interest to students resulted in an increase in levels of student engagement and motivation (Du Plessis & Webb, 2011; Eseryel et al., 2014). As a result, some parallels are evident among increased student interest, verification of

engagement, and motivation; yet to be established is whether students who use video games for learning increase their achievement and mastery of course objectives (Hamlen, 2014; Ke, 2013; Larsen, 2012). Additionally, studies found that when students were given choices that matched their learning styles, students took greater responsibility for their learning and demonstrated more accountability, thus supporting the constructivist theory of learning (Dziuban & Moskal, 2011; Ruggiero, Garcia de Hurtado, & Watson, 2013). Courses designed to incorporate components of the student learning style also showed increased levels of student engagement and motivation (Dziuban, 2011; Elliott, 2014; Eseryel et al., 2014). Ultimately, students who had choices in their learning attained better achievement and progress (Cavanaugh et al., 2013). Tragically, Whitton (2012) found that educators and course designers continue to leave out the critical elements of learning style and student interest when designing courses for students using video games.

In an investigation of strategies for including student choice and preference in the design of a course, Hamlen (2014) discovered that conducting a survey for students provided essential information about what types of games students preferred and determined that there was a correlation between preference and experience in the games chosen by students (Trespacios et al., 2011; Watson et al., 2011; Whitton, 2011). Without doubt, students tended to choose games that allowed them to be creative, solve problems, and feel successful and motivated to mastery (Lin et al., 2013). Although significant research supports the findings of student success when using video games for learning, little research shows a correlation between the use of a video game and the mastery of course objectives established by the instructor (Marino et al., 2014).

Interest is growing in the possibility of using the video game Minecraft as a tool for delivering curricula in various content areas (Tromba, 2013). Of course, research verifies that Minecraft use increases student engagement and motivation; however, the question of whether students meet course objectives when using a Minecraft game to learn the curriculum requires further exploration (Hersman, 2014; Plass et al., 2013). In short, the focus of this study was to explore whether students who were taking an online history class that used Minecraft met the mastery of course objectives by achieving the criteria of 85% set by GamEd Academy. Also explored was whether Core students met course objectives and whether there was a difference in scores between those students who completed more activities than they were required to complete.

### **Summary**

As options for program delivery have evolved over the last 100 years, so have the instructional methods and philosophy used to teach students. As technology has advanced, so has the opportunity to meet the advancements with creative and innovative methods of instruction. Research that emerged in the late 1950s comparing American students with those of foreign countries sparked a nationwide effort to increase student performance levels in math and sciences. This effort resulted in increased federal legislation and the development of educational policies that required educational institutions to measure and report student performance and achievement through yearly mandatory testing (Caruth & Caruth, 2013). Although educational policies focused primarily on traditional learning models, distance learning models also fell under the same guidelines for reporting student achievement (Caruth & Caruth, 2013).

Again, as technology has changed, instructional methods have also changed to meet the needs of diverse learners. Historically, instructional methods held the teacher as the center of the classroom. The majority of traditional classroom arrangements involve teachers delivering information to students through lectures, textbooks, written notes, and intense written assessments (Watson et al., 2015). Traditional instruction requires students to attend instruction synchronously, that is, at the same place and time as the teacher (Watson et al., 2015). But as technology advanced, the ability to provide education at a distance had greater potential. With the birth of the Internet, distance education morphed into educational opportunities known today as online education (Caruth & Caruth, 2013).

As with any instructional model, distance learning has disadvantages and challenges. Online learners face challenges that students in traditional learning environments do not encounter. One such challenge is the level of isolation that comes with online learning because teachers and students are not always interacting in a classroom or in a lesson simultaneously (Afifi & Alamri, 2014). According to Duziban and Moskal (2011), a quality online course should be well organized, with clear learning objectives and appropriate levels of communication between the instructor and the student.

Reinforcing these ideas, Afifi and Alamri (2014) found that the goal in an online course is to gain and keep the learner's attention. Furthermore, engaging learners by providing activities that capture their attention and build on their previous knowledge and interests was found to be beneficial to the students' growth in the course. Afifi and Alamri found that facilitating student engagement and motivation necessitates

encouraging teachers to provide constant and consistent feedback, which includes questions and activities that spark reflection. Based on research regarding what works best for students in an online course, theorists have suggested that there is merit in the process of engaging students through communication, connection, and collaboration (Cavanaugh et al., 2013). The use of video games as a tool for delivering academic content provides motivation and engagement for students, and the literature review examined other benefits and limitations of using video games in online learning K–12 environments (De-Marcos, Dominquez, Saenz-de-Navarrete, & Pages, 2014).

Software companies have created courses and embedded curriculum into the video game Minecraft in response to the mounting interest from school-aged children in playing this particular game (Bos et al., 2014). This game provides players with the opportunity to be creative and to work cooperatively with others on the Minecraft server (Cipollone, Schifter, & Moffat, 2014). Incorporating Minecraft into the curriculum has been shown to increase student levels of engagement, motivation, and problem-solving (Schifter & Cipollone, 2015). However, little available research shows whether students who use Minecraft as a learning tool meet academic course objectives (Bos et al., 2014; Cipollone et al., 2014; Hill, 2015; Overby & Jones, 2015; Smolčec & Smolčec, 2014).

Using the video game Minecraft for learning provides a motivating environment in which students can learn (Cipollone et al., 2014). However, whether students who are using Minecraft for learning meet specific objectives of a course is a question requiring further investigation. This dissertation assessed the performance of students who were using a video game, Minecraft, as a tool for learning. It also addressed whether students could meet course objectives set by the educational institution. Also investigated in this

study were student achievement and performance in a Minecraft course using the constructivist learning theory. With the growth of online learning, the quality and effectiveness of courses using games like Minecraft as a tool for learning are in need of further evaluation and research because there is a lack of empirically based evidence on the topic. Specifically, the need for additional research exists that explores whether students who use Minecraft in a course show mastery of course objectives through analysis of student performance on course activities. Parents and educators were found to be skeptical about the use of video games for learning due to a dearth of evidence indicating that students demonstrate an increase in knowledge of content when there is a unification of video games and curriculum (Overby & Jones, 2015; Marino et al., 2013).

The literature consistently documents constructivist learning theory as being an appropriate match for e-learning design, which encompasses game-based learning (Afifi & Alamri, 2014; Sicilia et al., 2011). In the game-based learning environment, constructivism is used by learners to allow them to make meaning through interaction with the resources and curricula used (Ertmer & Newby, 2013). The constructivist learning theory suggests that learners are to interpret and process what they are learning and construct meaning. Similarly, the game-based environment involves the learner's being active in his or her learning and also encourages reflection on the learner's learning process (Iskander, 2014). From a learning theory perspective, the production of knowledge that comes from interaction with Minecraft supports the constructivist epistemology. Of course, research verifies that Minecraft use increased student engagement and motivation; however, the question of whether students meet course



objectives when using a Minecraft game to deliver the curriculum requires further exploration (Hersman, 2014; Plass et al., 2013).

### **Chapter 3: Research Method**

Failure to use video games for learning may hinder the raising of student levels of engagement and motivation for learning in the online learning environment (Bos et al., 2014). Although research identifies that the use of the video game Minecraft increases student engagement, motivation, and problem-solving skills, parents and educators remain skeptical about the use of this game for learning and whether its use leads to academic achievement (Cipollone et al., 2014). Creating courses using high-interest video games for learning has shown positive effects on motivation and student engagement; however, research on the topic of whether students master course objectives when using the video game Minecraft as a learning tool is sparse (Marino et al., 2014; Wouters et al., 2013). Although parents and educators support the use of technology for learning, they continue to be skeptical about whether the use of the game Minecraft leads to student achievement. This study intended to allay that skepticism by showing that Minecraft is a valuable tool for learning.

GamED Academy is a privately owned online company based out of Michigan that provides joy-based learning for students around the globe. Students enrolled range in age from 6 to 16. Participants are required to have Minecraft experience, which is delivered online through a learning management system. Students must be able to read at a third-grade level. Students have the choice to register in an Upper or Lower designation. According to the GamED Academy website, [www.GamEDacademy.com](http://www.GamEDacademy.com), the design of the course is intended to supplement or replace existing curriculum. Students are enrolled in each course for a 6-week session with a recommended minimum of a 2- to 4-hour per week commitment. Equally important, each week students complete

a learning activity that combines reading, video, and critical thinking. All students take a quiz and complete a long-answer essay activity. Using a Minecraft server, students complete exciting build assignments and additional activities to show transference of content, including team builds and other cooperative learning activities. Additionally, GamED Academy offers two enrollment options, Upper and Core, with six to seven weekly activities. Interestingly, students in both courses receive a final course grade; however, Upper students are required to complete all components of the course, whereas Core students have some activities that are considered optional.

The assumption for the purposes of this research was that student performance would be assessed using final course grades and student mastery of course objectives, with a passing grade being 85% or higher, which is considered mastery by GamED Academy standards. Additionally, the researcher extracted the sample group from Ancient History courses that took place in the Fall Session of September 21, 2015, through December 30, 2015. The number of students enrolled in this session was set as determined by a G\*Power test at 210 students, with 105 Upper level and 105 Core level students. Furthermore, a researcher completed an independent  $t$  test to determine whether there was a statistically significant difference between the performances of students who were graded on all components of the course and that of students who were not graded.

This study examined students enrolled as graded and ungraded students as the independent variable. Before providing the data samples, the content provider extracted all identifiers and variables from the results, such as student age, gender, and academic levels, to protect participant confidentiality. With the use of a G\*Power test, the researcher intended to derive the sample size of the study (Faul, Erdfelder, Lang, &

Buchner, 2007). For this study, the dependent variable was student performance as demonstrated by the final course grade. Student performance included participation in required and optional activities along with the results of a weekly quiz. GamED developed the quiz and students took the assessment to determine mastery of content. To illustrate further, mastery of content involved students' receiving a final grade in online Minecraft history of 85% or higher. GamED Academy considers students who earn a final grade of 85% or higher as meeting course objectives. The findings of this study not only provide parents and educators with the foundational data needed to inform decision making about using Minecraft for learning, but also added information to the larger debate regarding the effectiveness of the use of video games, specifically Minecraft, for learning.

The purpose of this quantitative study was to determine whether student performance on course objectives in a Minecraft-supplemented Ancient History course reflected mastery of curriculum content by determining whether there existed a statistically significant difference between final grades of graded students who were required to complete all components of the course and final grades of those who were not required to complete all the components of the course. Additionally, there are gaps in the literature regarding the nature of academic achievement when using Minecraft as a learning tool. Due to this gap, there is a lack of evidence that shows whether students demonstrate academic performance and meet course objectives when Minecraft is used to supplement the curriculum (Cipollone et al., 2014). Within this context, this study was grounded in the constructivist learning theory, holding the premise that educators have the responsibility to provide learners with educational programs that are motivating and

engaging and that increase student learning (Sadi & Uyar, 2013; Simoncelli & Hinson, 2010).

In this study, achievement levels in an online Ancient History course using Minecraft were used to determine whether there was a difference between final course grades of students who completed all components of the course and final course grades of students who were not required to complete all course components. This study focused not only on the elements of motivation and engagement, but also on student achievement as determined through final course grades. Determining the effectiveness of an online learning program and measuring student engagement and mastery of course objectives requires educators' diligence and likewise necessitates unceasing research (Means et al., 2013). Using Minecraft for learning has been shown to increase students' engagement, motivation, and problem-solving skills. Without research indicating that students can meet the learning objectives of the course, educators are less likely to use this video game as a learning tool (Cipollone et al., 2014; Sadi & Uyar, 2013; Smolčec & Smolčec, 2014; Tromba, 2013). With the growth of online learning, the quality and effectiveness of courses using games like Minecraft as a tool for learning are in need of further evaluation and research due to a lack of empirically based evidence about the results. Specifically, additional research is needed to explore whether students who use Minecraft in a course show mastery of course objectives through analysis of student performance as defined by final course grades.

Although Minecraft has been shown to be effective in motivating and engaging students, it is equally important to determine whether students master course objectives when Minecraft operates as a tool for learning. The purpose of this quantitative study was

to determine whether student performance in course objectives in a Minecraft-supplemented Ancient History course reflects mastery of curriculum content. Based on the literature related to the use of Minecraft for learning along with the data provided by the content provider, this study investigated the following research questions:

- Q1.** Is there a statistically significant difference in final course grades between students who were graded for each individual Minecraft activity and students who were not graded?
- Q2.** Is there a difference in course averages between Core students scored below 85% and Core students who scored 85% or higher?

### **Hypotheses**

- H1<sub>0</sub>.** There is no statistically significant difference in final course grades between students who were graded for each individual Minecraft activity and students who were not graded.
- H1<sub>a</sub>.** There is a statistically significant difference in final course grades between students who were graded for each individual Minecraft activity and students who were not graded.
- H2<sub>0</sub>.** There is no significant difference in course averages between Core students scored below 85% and Core students who scored 85% or higher?
- H2<sub>a</sub>.** There is a significant difference in course averages between Core students scored below 85% and Core students who scored 85% or higher?

This chapter continues with a description of the research model and details about the characteristics of the study. Specifically, the researcher evaluated various models to determine the type of model appropriate for this study. The chapter explains how the

researcher decided to use a nonexperimental, comparative research design for this study. The characteristics provided for the population and sample are detailed.

The population in this study consisted of students enrolled in the Fall 2015 session of an online Ancient History course that used Minecraft through GamED Academy. The sample of this study comprised 210 students assigned to the Minecraft Ancient History course. Specifically, 105 students were taking the course as Upper-level (graded) students and 105 were taking it as Core-level (ungraded) students. The data collection instruments in the study are defined in this chapter, and details of the inferential and descriptive analysis are provided. The instrument used to collect the data for this study was an Excel spreadsheet with archival data provided by GamED Academy. The data sample contained final course grades for each student in addition to course activity grades across the two sessions of the Ancient History course. The chapter concludes with the study's assumptions, limitations, delimitations, and ethical assurances.

### **Research Method and Design**

To evaluate student performance using Minecraft as a learning tool, this study used a quantitative method to determine whether students meet course objectives in an online Minecraft history course. The data available for this study, were numerical in nature, were better suited for a quantitative design (Reeves, 2015). Within quantitative research there are three common approaches: experimental, quasi-experimental, and ex post facto designs; the researcher gave equal consideration to each of these approaches (Reeves, 2015; Delost & Nadder, 2014). Due to the inability to manipulate students' instructional program, the researcher chose not to use an experimental design (Reeves, 2015). Similarly considered yet rejected was a quasi-experimental design for this study

due to grouping and the inability to manipulate the instructional program (Reeves, 2015). The approach chosen by the researcher was the ex post facto design due to the group's previously having been chosen by the online program and to the nature of the pre-existing data (Delost & Nadder, 2014). The inability to control the independent variable, the instructional program, is consistent with comparative research and is a common design in educational research (Delost & Nadder, 2014).

In this case, two independent groups of enrollees in the Ancient History course using Minecraft were previously established by GamED Academy. The two groups had similar educational content provided to them in the Learn It activity. Both groups were required to take a quiz to test their understanding of the Learn It activity. Additionally, both groups completed the Quiz and Build It activity to prove their understanding and application of the educational content from the Learn It activity. In general, students enrolled as graded are required to complete all components of the course, which consists of six to seven activities. Students enrolled as ungraded are required to complete the Learn It, Quiz, and Build It components, and all other components are optional. Students obtain a final course grade with the required course mastery level of 85% or higher set by GamED Academy.

Additionally, GamED Academy assigned a number sequentially from 1 to 105 for each individual group. Student achievement as represented by the data previously collected by GamED Academy was used to test the hypotheses. GamED Academy were responsible for calculating the grades from each activity to provide the researcher with final course grades in addition to course activity grades, along with the total possible for each activity. The researcher had no participation in the calculation of the final course



grades. The research question focuses on student achievement as demonstrated by the school product of final course grades and quiz scores to determine whether mastery of course objectives was achieved. This research question was addressed by determining whether there is a statistically significant difference between the final course grades of students who were graded on each individual Minecraft activity and students who were not graded on each activity. To determine whether a statistically significant difference exists in the means of final course grades achieved by the two groups, graded student and ungraded student means, an independent  $t$  test was administered.

### **Population**

The sample group for the study was derived from two Ancient History courses in the Fall Session of September 21 through December 30, 2015. The data provided came from 210 students enrolled in the course for two consecutive 6-week sessions through an online course provider named GamED Academy. Notably, students enrolled range in age from 8 to 16 and are enrolled in a K-12 educational program in the United States. Delivery of content takes place online through a learning management system, and participants are required to have Minecraft experience. To protect the security of student information, removal of all identifiers, including specific age, grade, sex, location, and Minecraft username, was fulfilled by GamED Academy prior to the researcher's obtaining the data.

### **Sample**

During the 2014–2015 school year, students from various locations throughout the United States enrolled in an online Ancient History course at GameEd Academy, an online business that provides supplemental programs using Minecraft. In this course, the

students could enroll as Upper level, also referred to as graded, or Core level, referred to as ungraded. Namely, Upper level refers to students enrolled who received a final course grade and were required to complete all activities in the course. A Core-level student has access to all course components or activities, but some are optional, and these students received a final course grade based on the required Learn It, Quiz, and Build It activities. In order to provide a specific request for data from the GamED Academy without adding undue hardship to the company, the researcher used a G\*Power software to determine the sample size needed for the study prior to obtaining the random data sample (Faul et al., 2007). To address the research question, a power analysis for an independent  $t$  test with an effect size of 0.25, an error probability of 0.05, power of 0.80, was conducted and resulted in the sample size of 210 students with an actual power of 0.80. Thus, the researcher requested that GamED Academy provide sample data that included a random data sampling of 105 graded students and 105 ungraded students.

### **Materials/Instruments**

For the most part, the primary instrument used to collect data was an Excel Spreadsheet. GamED Academy uses a learning management system (LMS) for tracking completion of course activities and student progress. GamED Academy's data from the Learning Management System are stored in an Excel spreadsheet. Ultimately, the researcher had access to archival data directly downloaded from the LMS to the spreadsheet. The archival data previously collected from a past Ancient History course were pre-numbered by GameEd Academy and, again, were free of all identifiers.

To summarize, GamED Academy is an online program that provides supplemental material in core academic areas for students ages 6–12. Students must

enroll and pay for the Upper-level course that gives a final grade for course completion. The Upper-level course supports a third-grade reading level and up. The expectation of this level in the course is that students can respond to questions in writing, communicating with other classmates by typing responses. The class also involves a 4- to 12-hour weekly commitment. Additionally, all students enrolled in the Upper level must have prior Minecraft experience. Retrofitted to incorporate learning standards, Minecraft, a sandbox game originally designed for nonacademic entertainment, is now used globally in classrooms and learning programs (Bos et al., 2014). According to Cipollone et al. (2014), Minecraft has no defined objective. In other words, the game incorporates exploration and imagination through the strategic stacking and placement of virtual blocks, for the purpose of allowing players to create an online world. The authors pointed out that this game provides players with the opportunity to be creative and to work cooperatively with others on the Minecraft server.

The GamED Academy courses are made up of activities that provide academic content in various subject areas and give a summative assessment at the end of each content-based activity. Within the course activities, students use a Minecraft server to complete building assignments that use the curriculum content from other activities. The Upper-level course in this study is an Ancient History course and, like other courses available through GamED Academy, it is made up of six to seven activities and five quizzes. The quizzes have 10 to 14 multiple choice questions and are intended to prove student understanding of the content of the previous activity. Each quiz holds a value of 10 to 14 points. Generally speaking, students are considered to have met the course objectives when passing quizzes and activities with a grade of 85% or higher. With this in

mind, students can take the quiz more than once, and teachers use the highest grade in the grade book. GamED Academy uses a learning management system to organize and track student progress and provide scoring of activities and quizzes. Additionally, according to GamED Academy standards for mastery of course objectives, students are considered to have met the course objectives when the final course grade is an 85% or higher.

### **Operational Definition of Variables**

The primary constructs associated with this study were student final course grades and the two different student groupings of graded and ungraded students. The final course grades were quantitative numerical data, and the two groups were categorical.

**Final course grade (scores).** For the purpose of this study, the dependent variables were an interval and the students' final course grades for the online Minecraft Ancient History course. The grade was determined by GamED Academy and was based on the cumulative grades from completed course activities. The final course grades were an interval measurement with a minimum grade of 0% and a maximum grade of 100%. GamED Academy set 85% as the mastery level criterion for all students and courses. For the reason that the grade represents mastery of course objectives and is based on student performance of the cumulative grades from completed activities, the final course grade is an indicator of student achievement in the Minecraft course. A student, whether graded or ungraded, who did not complete the minimum required components of the course would receive a minimum grade of 0%, while a student who completed all required components could receive a maximum of 100% and would be considered to have met the course objectives. The final course grade was reported for each student, and the grade indicated a student's level of understanding of the academic content and mastery of course

objectives. The final course grades were used to calculate the group mean for comparison between graded and ungraded students.

**Graded and ungraded students.** The categorical, independent variable was students enrolled in the online Ancient History Minecraft course. Within this variable were two distinct groups: graded and ungraded students. The final course grades were used to answer the research question and test the hypotheses of the study.

### **Data Collection, Processing, and Analysis**

The popularity of Minecraft among school-age children drove the researcher's interest in finding an online learning program that provided educational content and used Minecraft as a tool for learning to conduct this study. The researcher began reviewing the websites to find programs that used Minecraft and provided educational content. After exploring courses that met the criteria of an integrated curriculum and student level of engagement, motivation, and problem-solving in an online platform, the researcher selected GamED Academy's supplemental courses for K-12 that employ Minecraft as a learning tool. The goal was to identify a K-12 online program that uses Minecraft as a tool and includes a course structure with a natural order within the content, with a stated course objective and the use of summative assessment to determine whether students have learned the required content. The necessary criteria were that the course must have a specific structure, must have a stated course objective, and must use summative assessment to gather archival data samples from an Ancient History course completed several months before this study was conducted.

**Data Collection**

The owner of GamED Academy, contacted through e-mail, granted the researcher permission to use archival data from two sessions of the course offering called Ancient History: Castle and Cannons (see Appendix). GamED Academy agreed to provide the data due to its interest in the research topic. No monetary requirement was made. The archival data extracted from GamED's learning management system consisted of scores derived from all course components or activities and final course grades for students, categorized as graded and ungraded enrollees in an online course already completed. All identifiers were removed from student scores. Data were compiled by GamEd Academy and were provided on an Excel spreadsheet.

**Data Processing**

The data provided by GamEd Academy were examined for completeness and accuracy. The scores came from a random sampling of students enrolled in two sessions of an Ancient History course from the session beginning September 21 and lasting until December 15, 2015, that included a sample size determined by a G\*Power test to be 209 students enrolled in the course and 105 students represented in each group of graded and ungraded students. It was determined after discussion with GamED Academy that due to the large numbers of students enrolled in one course, specific data representing a larger population as a sample size would be requested. With the use of a G\*Power test, a sample size of 210 students was decided upon and the data were provided by GamED Academy as a random sample from the sampling frame. To safeguard confidentiality, the data requested were free from any personally identifiable information. No demographic data

or other identifiers were included. The data used for this study were stored in an encrypted, password-protected file.

### **Data Analysis**

The performance scores (grades) for both student groups were used to compare the means of both groups and determine whether there is a statistically significant difference between the final course grades of students graded for each individual Minecraft activity and students not graded. In addition, to answer the second research question, the researcher compared the mean of the final scores of Core students who completed all activities with those of Core students who did not complete all activities. Final course grades for both groups of students were entered into the SPSS statistical analysis software program and analyzed using an independent *t* test of statistical significance. Based on the results and analysis, the researcher could reject the null hypothesis or reject the null hypothesis and accept the alternative hypothesis.

To conduct the statistical test, the researcher used archival student scores (grades) from students enrolled in two online Ancient History courses that use Minecraft during Fall 2015 sessions. After receiving the score summary, the researcher used SPSS program to enter and analyze student data. The first step of the analysis was creating headings on the SPSS worksheet. The first column shows the independent variable in the study: graded (Upper level) and ungraded (Core) student groups. The second column identifies the final course scores (dependent variable) of the participants. The third, fourth, and fifth columns identify the cumulative scores of all course activities required for both groups, and the final column gives the scores for optional course activities completed by the ungraded (Core) students. The course scores (grades) had an ordinal numerical value on

the measure option. The confidence interval was set at 85% and the alpha level was .05. Once the data were entered, the researcher conducted an independent  $t$  test. The mean and the standard deviation were analyzed. To examine research questions one and two, the independent  $t$  test was conducted to determine whether there was an overall difference between the scores of the two categorical independent variables: students who are graded and ungraded.

The analysis of data measured the independent variable at an interval level. Student performance were measured at an interval level of 0 to 100. The intent was to show that there was no relationship between observations in each group, and it were assumed that no participant was in more than one group. After ensuring that the data met the assumptions of the independent  $t$  test, the researcher used SPSS statistics to test further assumptions within the data pattern to ensure that there were no outliers. That is to say that no data were used from students who scored above 100. It was assumed that the dependent variable was normally distributed for each category of the independent variable. Further, to test the normality of the variable, SPSS statistics software were used.

### **Assumptions**

The primary assumption of the study was that data provided by the GamED Academy were accurate and were representative of an average course's data. Also assumed was that the grouping of graded and ungraded students based on paid enrollment was accurate. Consequently, the researcher for this study assumed that GamED Academy provided course grades that were correct and accurate. In addition, this study assumed that the learning management system was fully functioning and was accurately reporting data to the GamED Academy. This study also assumed that, for the most part, the



students enrolled in this course had prior Minecraft experience and that they had fulfilled any prerequisites for the course. An additional assumption was that the GamED teachers graded the course activities following a rubric that was consistent with the 85% criterion for mastery. Because of the ex post facto nature of the study, it was not possible to manipulate the variables of the study. Additional assumptions included that all students enrolled could read at at least a third-grade level, knew how to play Minecraft, could access the Internet, could write paragraphs, and could navigate an online learning platform. These were the requirements for enrollment in the class noted on GamED Academy's web page.

### **Limitations**

The ex post facto nature of this study resulted in limitations that are common with a quantitative design. Two limitations of this study emerged in the context of the researcher's inability to control the independent variable and the unknown accuracy of student enrollment in the two designated groups. An additional limitation resulted from the fact that GamEd Academy was the only online program used in this study. Furthermore, in order to meet the recommendation of the G\*Power test of a sample of 210, it was necessary to pull data from two different sessions of the same course. In addition, information gathered from GamED Academy's website indicates that a quiz given to students can be taken several times, and that teachers use the highest score. Not represented in the data set is the number of times a student took the quiz. Similarly, due to the structure and design of a session in the course covering only a 6-week period, no extension for completion of quizzes or activities was provided. The non-accredited GamED Academy does not give letter grades and provides only percentages for final

course scores, yet it categorizes enrollees as “graded” or “ungraded.” Information supplied by the company to the researcher poses a possible threat to validity due to the researcher’s relationship to the information: The researcher had previous experience working with a program that uses Minecraft, which may have added personal bias regarding the motivational effects of using Minecraft for learning.

### **Delimitations**

Delimitations identified included that the participants identified in the study were solely from an Ancient History course. The decision to delimit this study to an Ancient History course was made to reduce the effect of extraneous variables related to other subject areas, such as math and language arts. Additional delimitations were that the video game used in the study had to be Minecraft; any other video games that may also have been popular among school-aged children were excluded. This study used only one online program, GamED Academy, to pull the data and determine whether students could master the course objectives. Additionally, a delimitation involves the role of the researcher: This researcher has had the experience of using Minecraft for learning in an educational setting.

### **Ethical Assurances**

Prior to collecting any data, the researcher gained approval from an Institutional Review Board (IRB). GamED Academy provides data via e-mail; the e-mails did not contain any identifiable information. To ensure security and confidentiality, any data sent from GamED Academy were encrypted and in a password-protected file. Written permission for the exchange of data was obtained by the owner of GamED Academy. The researcher provided a written request for data to the GamED Academy that included

specific details outlining the purpose of the research, the intended use of the data, and the method of data storage and security used; additionally, a copy of the study results was provided to GamED along with a report of findings.

### **Summary**

Although research shows the use of the video game Minecraft increases student engagement, motivation, and problem-solving skills, parents and educators remain skeptical about the use of this game for learning and about whether its use leads to academic achievement (Cipollone et al., 2014). Creating courses using high-interest video games for learning has shown positive effects on motivation and student engagement; however, whether students master course objectives when using the video game Minecraft as a learning tool is an area not confirmed and requiring further research (Marino et al., 2014; Wouters et al., 2013). Although parents and educators support the use of technology for learning, they continue to be skeptical about whether the use of the game Minecraft leads to student achievement. The intent of the researcher in conducting this study was to demonstrate whether Minecraft was a valuable tool for learner. The purpose of this quantitative study was to determine whether student performance on course objectives in a Minecraft-supplemented Ancient History course reflected mastery of curriculum content by determining whether a statistically significance difference existed between final grades of graded students who were required to complete all components of the course and final grades of those who were not required to complete all the components of the course. Additionally, gaps in the literature exist regarding the nature of academic achievement when using Minecraft as a learning tool. Due to this gap, there is a lack of evidence that shows whether students demonstrate academic

performance and meet course objectives when Minecraft is used to supplement the curriculum (Cipollone et al., 2014).

To evaluate student performance resulting from using Minecraft as a learning tool, this study used a quantitative method to determine whether students met course objectives in an online Minecraft history course. The data available for this study, which were numerical in nature, were better suited for a quantitative design (Reeves, 2015). The research question focused on student achievement, using final grades and quiz scores to determine whether mastery of course objectives was achieved. This research question was addressed by determining whether there was a statistically significant difference between the final course grades of students graded for each individual Minecraft activity and students who were not graded on each activity. Finally, using an independent  $t$  test, the researcher determined whether a statistically significant difference existed between the means of final course grades of two groups: graded students and ungraded students.

Due to the ex post facto design of the study, threats to internal and external validity may have been present. Assurance that the data came from the learning management system assisted with increasing internal validity. Minimal ethical issues were present as a result of the ex post facto design. Data were gathered from the courses by GamED Academy, and the researcher had no contact with human participants. All personal information was removed from the data prior to the researcher's obtaining the data from GamED Academy. All files holding the data obtained are being saved for a minimum of 5 years; they are encrypted and password protected. The researcher had clear and consistent communications with GamED Academy, including acquiring permissions

for data, conducting exchanges regarding the intent of the study, and clarifying the intended use of data and the process for its destruction.

## **Chapter 4: Findings**

The purpose of conducting this quantitative, nonexperimental comparative research was to evaluate the student academic performance of online students enrolled in an ancient history course using Minecraft as a learning tool. The intent behind this quantitative study was to determine whether student performance on course objectives in a Minecraft-supplemented Ancient History course reflected mastery of curriculum content by determining whether a statistically significant difference existed between the final grades of graded Upper students, who were required to complete all components of the course, and the final grades of Core ungraded students, who were not required to complete all the components of the course. Presented in this chapter is information related to the research questions, results, and evaluation of findings.

### **Results**

From the data sample provided of 209 students enrolled in the GamEd Academy Ancient History, course results reported that 83 students were graded (Upper) and 126 students were ungraded (Core). The characteristics of the sample are shown in Table 1. The graded group ( $n = 83$ ) and the ungraded group ( $n = 126$ ) completed the Ancient History online course using Minecraft. Based on GamEd Academy requirements, the members of the graded group, referred to as Upper students, were required to complete all course activities, including instructional lessons, quizzes, and application activities (builds). Members of the ungraded group, referred to as Core students, were required to complete instructional lesson and quizzes. Application activities of completing builds using Minecraft were not required for the ungraded group.

Table 1

*Assumption Results for the Three Average Scores' Distributions*

Score	Skewness test for Normality	<i>F</i> test – equal variances	<i>p</i>
Course average	-.924	2.05	.068
Quiz average	-.306	1.25	.590
Build average	2.264	1.75	.153

The analytical goal was to assess whether a statistically significant difference existed between the means of final course grades of the two groups: graded and ungraded students. The descriptive statistics, independent samples *t* tests, and effect size calculated to achieve this goal are shown in Table 2. The course means and the standard deviation were found for both the graded and the ungraded group. A *t* test was used to learn whether the difference between the means of the graded and ungraded groups was statistically significantly different and therefore to accept or reject the null hypothesis. The possibility of a Type I error that deals with possible false rejection of the null hypothesis is identified in research as being the result of the use of repeated *t* tests (Gay, 2011). For this reason, a simple independent *t* test was run to confirm the results and to check for a Type I error.

**Assumptions.** The assumptions for the *t*-tests showed that the data is normally distributed and the variances were equal for the two groups. Normality was tested by looking at the skewness statistics (Table 1). If the skewness falls between -1 and +1, the distributions is considered approximately normal. The skewness for the Course Average score (skew = -.924) and the Quiz Average (skew = -.306) score fell between -1 and +1,

indicating that the distributions can be considered normal. The skew for the Build Average was 2.264, which does not fall between -1 and +1, indicating that the distribution is not approximately normal. The  $t$  test and ANOVA are considered robust with respect to the distribution not being normal.

Table 2 (Appendix B)

*Independent t test Results for Differences Between Course Average Scores of Graded and Ungraded Students*

<b>Student</b>	<b><i>n</i></b>	<b><i>M</i></b>	<b><i>SD</i></b>	<b><i>t</i></b>	<b><i>p</i></b>
Graded	83	94.26%	3.5%		
Ungraded	126	94.26%	3.3%	.013	.990

*Note.* \* $p < .05$       \*\* $p < .01$

$F$  tests were conducted to determine whether the variances of the two groups were equal for the three average scores (course, quiz, build). The null hypothesis was that the variances were equal. The test statistics ( $F$ ) for Course Average ( $F = 2.05$ ,  $p = .068$ ), Quiz Average ( $F = 1.25$ ,  $p = .590$ ), and Build Average ( $F = 1.75$ ,  $p = .153$ ) were not significant and thus the null hypothesis was not rejected. For all three average scores, the variances for the two groups were equal. The hypothesis of homogeneity was supported.

Further, the assumption of normality was supported for Course Average and Quiz Average. This assumption was not supported for Build Average. Because the assumption of homogeneity was supported for all three distributions and the assumption of normality is robust for  $t$  tests, the analysis was continued using this data.

**Research Question 1.** The first research question focuses on whether there is a statistically significant difference in the final course grades between students who were



graded for each individual activity and students who were not graded in the Ancient History course using Minecraft. The hypothesis for this research question stated that there was no statistically significant difference between the final course scores of graded and ungraded students. To test this hypothesis, the average course scores for both groups were compared using an independent  $t$  test. The results of the  $t$  test showed there was no statistically significant difference between the group mean scores of the graded and the ungraded students. To determine whether the variances were equal and to corroborate the results from the  $t$  test, a simple  $F$  test was used. Because it was determined that the variances were equal, the  $t$  test was the appropriate statistical test for this purpose (Gay, 2011). Based on the independent  $t$  test,  $H_{10}$  (null) was accepted and  $H_{1a}$  was rejected. Considering the results of the statistical tests, achievement of ungraded students showed no difference in achievement between graded and ungraded students. Although ungraded students were not required to complete all components of the Ancient History course using Minecraft, they completed all activities, none of which showed a difference in final course scores when compared to graded students.

**Course average scores.** The  $t$  test results were  $t(207) = .013$ ,  $p = .990$  (Table 1). The  $p$  value was  $> .05$  (Table 2); therefore, the null was not rejected, indicating there was no significant difference between the mean course scores of graded and ungraded students. The mean course score for graded students was 94% with a standard deviation of 3%. The mean course score for ungraded students was 94% with a standard deviation of 3%.

**Quiz average scores.** The  $t$  test resulted in  $t$  being 0.199 (Table 3). A two-tailed test was conducted and the  $p$  value was found to be .843. The  $p$  value was compared to

.05 to determine whether to accept or reject the null. Because  $.8426 > .05$ , the null was not rejected and an inference of no difference between the quiz scores of graded and ungraded students was made.

In this study, GamEd Academy required students, whether graded or ungraded, to complete and pass all quizzes with a score of 85% or higher. Data on quiz scores for graded and ungraded students were gathered for further analysis. The mean and the standard deviation of the quiz scores were found for both groups. The mean for graded students ( $n = 83$ ) was 89.6% with a standard deviation of 5.9%. The mean for ungraded students ( $n = 126$ ) was 89.8% with a standard deviation of 5.9%, as is shown in Table 3.

Table 3

*Independent t test Results for Differences Between Quiz Scores of Graded and Ungraded Students*

<b>Student</b>	<b><i>n</i></b>	<b><i>M</i></b>	<b><i>SD</i></b>	<b><i>t</i></b>	<b><i>P</i></b>
Graded	83	89.6%	5.9%		
Ungraded	126	89.8%	5.9%	0.199	.8436

*Note.* \* $p < .05$       \*\*  $p < .01$

Findings from the group course average shown in Table 3 include an average of quiz scores and application activities. The application activities were developed by GamEd Academy with the intention that students would demonstrate an understanding and mastery of the content of the curriculum presented. The results of analysis of course averages and quiz averages indicated no statistically significant difference between the performance of graded and ungraded students. Further, to answer the additional research questions of this study, the researcher conducted a further analysis of average scores of

the application activity (builds) between the groups. Based on the requirements of the course, ungraded students were not required to complete this component of the course.

**Build average scores.** The build component of the course involved the use of Minecraft to complete the activity. For the purpose of answering the research questions in this study, data from average build scores were used to determine the significance of the motivational factor regarding whether students did more than they were required to do in the activity using Minecraft. Data were gathered for scores on builds from both groups. The descriptive statistics and independent samples *t* tests calculated to achieve this goal are shown in Table 4.

Table 4

*Independent t test Results for Differences Between Build Averages of Graded and Ungraded Students*

Student	<i>n</i>	<i>M</i>	<i>SD</i>	<i>T</i>	<i>p</i>
Graded	83	98.9%	2.4%		
Ungraded	126	98.8%	2.5	0.435	.664

Note. \* $p < .05$     \*\*  $p < .01$

A *t* test resulted in  $t = 0.435$  and a *p* value (two-tailed) of .664. Given that .664 > .05, the decision was not to reject the null and to infer no difference between the build scores of the graded and the ungraded groups. The mean for graded students ( $n = 83$ ) was 98.9% with a standard deviation of 2.4%. The mean for ungraded students ( $n = 126$ ) was 98.8% with a standard deviation of 2.5%.

**Research Question 2.** The second research question focused on whether course objectives were met through the analysis of course average for the Core (ungraded)

group. The question focused on whether there existed a statistically significant difference in course averages for Core (ungraded) students that were less than 85% compared with the Core (ungraded) students whose course average was 85% or more. The purpose of this analysis was to determine, using course averages, whether Core students met course objectives of 85% or higher. The hypothesis for this research question stated that there was no significant difference between the course average of those students whose score was less than 85% and those whose average was 85% or more. From the data sample provided of 209 students enrolled in the GamEd Academy Ancient History course, results indicated that 83 students were graded (Upper) and 126 students were ungraded (Core). For the purpose of answering the research question, the sample for this analysis was a reduced sample consisting of the Core (ungraded) group. The ungraded group with course averages of  $< 85\%$  ( $n = 21$ ) and the ungraded group with course averages  $> 85\%$  ( $n = 105$ ) were used. Based on GamEd Academy requirements, course averages consisted of scores from required instructional lessons, quizzes, and nonrequired application activities.

The analytical goal was to assess whether a statistically significant difference existed between the means of the final course grades of the two groups of ungraded students. The descriptive statistics, independent samples  $t$  tests, and effect size were calculated to achieve this goal, as portrayed in Table 4.

The course means and the standard deviation were found for both the ungraded group whose score was  $> 85\%$  and the ungraded group whose score was  $< 85\%$ . A  $t$  test was used to learn whether the difference between the means of the two groups was statistically significantly different and therefore to accept or reject the null hypothesis.

The possibility of a Type I error that deals with possible false rejection of the null hypothesis was identified in research to be the result of use of repeated  $t$  tests (Gay, 2011). For this reason, a simple independent  $t$  test was run to confirm the results and to check for a Type I error.

**Course average scores.** The mean course score for  $> 85\%$  students was 95% with a standard deviation of 2.7%. The mean course score for  $< 85\%$  students was 89% with a standard deviation of 1.9%. An  $F$  test was conducted to determine whether the variances of the two groups were equal. The variance of the  $> 85\%$  group course average was .0007 and a variance of the  $< 85\%$  student group was .0003. Test statistic  $F$  was determined to be 2.05 with a  $p$  value of .0675. Because the  $p$  value  $> .05$ , the null was accepted and variances were showed to be equal, indicating that assumption of equal variances was supported. The  $t$  test results were  $t(124) = .9.07, p = .067$  (see Table 4). The  $p$  value was  $> .05$ ; therefore, the null was not rejected, indicating there was no significant difference between the mean course score of students scoring  $< 85\%$  and those scoring  $> 85\%$ . To test the hypothesis for the second research question, the researcher conducted a data analysis on the course averages of ungraded (core) students and compared the averages to determine whether the core group met the course objectives of 85% or more set by GamEd Academy (see Table 5).

A  $t$  test was used to determine whether there was a statistically significant difference between those who scored 85% or less and those who scored 85% or higher. The results of the  $t$  test showed there was no statistically significant difference between the group mean scores. To determine whether the variances were equal and to corroborate the results from the  $t$  test, an  $F$  test was used. Because it was determined that the

variances were equal, the  $t$  test was an appropriate statistical test for this purpose (Gay, 2011). Based on the independent  $t$  test, the null was not accepted. Considering the results of the statistical tests, mastery of course objectives of ungraded (core) students whose averages were  $> 85\%$  and  $< 85\%$  showed no difference. Based on the results of the data analysis, core students showed 85% mastery of course objectives. Although the sample size was different in this analysis, the results indicate that the variance was equal.

Table 5

*Independent t test Results for Differences Between Course Average Scores of Students Scoring  $> 85\%$  and  $< 85\%$*

<b>Student</b>	<b><i>n</i></b>	<b><i>M</i></b>	<b><i>SD</i></b>	<b><i>t</i></b>	<b><i>P</i></b>
Core $> 85\%$	105	95.3%	2.7%		
Core $< 85\%$	21	89.6%	1.8%	-9.07	.000

**Course component summary.** The researcher further analyzed the comparison data of the graded and the ungraded groups and provides a summary of the course components in Table 6. The quiz average for the graded group was 89%; the average for the ungraded group was 89% ( $p = .9662$ ). The build component, considered to be the application of the skills learned, showed a graded group average of 98.9% and an ungraded group average of 98.7% with a  $p$  value of  $.5073 > .05$ . As noted in the analysis of research question 1, the course average for the graded group was 94%. The ungraded group had a course average of 94% ( $p = .5956$ ). The analysis for both research questions suggested no significant difference existed between the graded and ungraded students in relation to achievement and motivation when Minecraft was used for learning.

Table 6

*Comparison of Course Component Average for Graded and Ungraded Students*

	<b>Graded</b>	<b>Ungraded</b>	<b><i>p</i> Value</b>
Quiz Average	89%	89%	.9662 > .05
Build Average	99%	99%	.5073 > .05
Course Average	94%	94%	.5956 > .05

### **Evaluation of Findings**

The purpose of this quantitative study was to determine whether student performance on course objectives in a Minecraft-supplemented Ancient History course reflected mastery of curriculum content by determining whether a statistically significant difference existed between the final grades of graded students who were required to complete all components of the course and the final grades of those who were not required to complete all the components of the course. The findings were compared and contrasted with the prior research on the use of the video game Minecraft as a tool for learning and are presented in terms of the research questions.

**Research Question 1.** The first research question focused on whether there was a statistically significant difference between the final course grades of students who were graded for each individual activity and students who were not graded in the Ancient History course when all students used Minecraft.

## Hypotheses

**H1<sub>0</sub>.** There is no statistically significant difference between the final course grades of students who were graded for each individual Minecraft activity and students who were not graded.

**H1<sub>a</sub>.** There is a statistically significant difference between the final course grades of students who were graded for each individual Minecraft activity and students who were not graded.

The hypothesis for this research question stated that there was no statistically significant difference between the final course scores of graded and ungraded students. To test this hypothesis, the average course scores for both groups were compared using an independent *t* test. Based on the independent *t* test, H1<sub>0</sub> (null) was accepted and H1<sub>a</sub> was rejected. Considering the results of the statistical tests, achievement of ungraded students showed no difference in achievement between graded and ungraded students, which was similar to the findings of Hamlen (2014), who found that when Minecraft was used as a tool for learning, students showed an increase in motivation, engagement, and academic performance. Similarly, the findings from the current study imply that even though ungraded students were not required to complete all components of the Ancient History course using Minecraft, they completed all activities and showed no difference in final course scores when compared with those who were graded and were required to complete all components of the course. These findings were also in agreement with the findings of Bos, Wilder, Cook, and O'Donnell (2014), who found that students showed increased motivation to complete academic tasks where Minecraft was imbedded into curriculum. Similarly, the research question 1 results were parallel to the findings of Hill



(2015) and of Overby and Jones (2015), who also found that students who used Minecraft as a tool for learning showed increased levels of motivation, engagement, and academic performance in subject areas in which the game was used. In contrast, Wouters, van der Nimwegen, van Oostendorp, and van der Spek (2013) found that using video games for learning was no more motivating than using other instructional methods and posited that intrinsic motivation led to increased academic performance levels, which differed from the findings implied by the hypothesis 1 outcome in the current study.

**Research Question 2.** The second research question focused on whether course objectives were met through the analysis of course average for the Core (ungraded) group. The question focused on whether there existed a statistically significant difference in course averages for Core (ungraded) students who scored less than 85% compared with the Core (ungraded) students whose course average was 85% or more. The purpose of this analysis was to determine, using course averages, whether Core students met course objectives of 85% or higher.

### **Hypotheses**

**H2<sub>0</sub>.** There is no significant difference between course averages of Core students who scored below 85% and Core students who scored 85% or higher.

**H2<sub>a</sub>.** There is a significant difference between course averages of Core students who scored below 85% and Core students who scored 85% or higher.

The hypothesis for this research question stated that there was no significant difference between the course average of those students whose score was less than 85% and those whose average was 85% or more. The course means and the standard deviation were found for both the > 85% and the < 85% ungraded groups. A *t* test was used to learn

whether the difference between the means of the two groups was statistically significantly different and therefore to accept or reject the null hypothesis. The results of the  $t$  test showed there was no statistically significant difference between the group mean scores. Based on the independent  $t$  test,  $H_{10}$  (null) was accepted and  $H_{1a}$  was rejected. Considering the results of the statistical tests, mastery of course objectives of ungraded (core) students who had averages of  $> 85\%$  and of  $< 85\%$  showed no difference. Based on the results of the data analysis, core students showed 85% mastery of course objectives, which was similar to the findings of Hill (2015), who found that students were highly engaged in learning when Minecraft was used and mastered learning tasks presented. Similarly, students showed increased academic achievement and task completion when Minecraft was used as a supplement to curriculum (Overby & Jones, 2015). Research question 2 results were also in agreement with the findings of Smolčec & Smolčec (2014), who posited that using curriculum that includes Minecraft can lead to increased student achievement and mastery of course objectives.

***Course component summary.*** The researcher further analyzed the comparison data of the graded and the ungraded groups and provided a summary of the course components (see Table 6). The quiz average for the graded group was 89%; the average for the ungraded group was 89%. The build component, considered to be the application of the skills learned, showed a graded group average of 98.9% and an ungraded group average of 98.7%. The ungraded group had a course average of 94%. The analysis for both research questions suggested no significant difference existed between the graded and ungraded students in relation to achievement and motivation when Minecraft was used for learning.

Similarly, research question 2 results were parallel to the findings of Sáez-López, Miller, Vázquez-Cano, and Domínguez-Garrido (2015), who found that students showed improved learning through mastery of course components when a course held specific objectives that included application of concepts learned. The current study used course averages consisting of course components, including assessment and application activities, to determine mastery of course objectives; these components were also in agreement with the findings of Harsh and Young (2015), who found that academic achievement can be attained when activities are designed to facilitate active learning, authorship, and assessment of learning while allowing for reflection on the educational content. The findings in this study imply that students met course objectives, and suggests through completion of optional course components that motivation was presented as a result of the Core (ungraded) students' completing more than was required of them. In contrast, Marino (2013) found no evidence suggesting whether using video games as a tool for learning contributes to students' learning that results in mastery of course objectives or merely acts as reinforcement that leads to completion of course components; these findings differed from the findings implied by the hypothesis 2 outcomes in the current study.

### **Summary**

The goal of this quantitative, nonexperimental comparative research was to evaluate the student academic performance of online students enrolled in an ancient history course using Minecraft as a learning tool. A sample of 209 students enrolled in an online Ancient History course that uses Minecraft was studied. This study intended to determine whether student performance on course objectives in a Minecraft-

supplemented Ancient History course reflected mastery of curriculum content through the determination of whether a statistically significant difference existed between course grades of graded (Upper) students who were required to complete all components of the course and final grades of ungraded (Core) students who were not required to complete all the components of the course. The study addressed two research questions. The first question asked whether there was a statistically significant difference between the final course grades of graded and ungraded students who were given scores for each activity. The second question asked whether the ungraded (Core) student group showed mastery of course objectives as demonstrated through comparison of the Core group who had course average scores of 85% and less with the Core group who had course average scores of 85% or more. The purpose of this analysis was to determine, using course averages, whether Core students met the course objective of scores of 85% or higher. The hypothesis for this research question stated that there was no significant difference between the course average of those students who scored less than 85% and that of those whose average was 85% or more. From the data sample provided of 209 students enrolled in the GamEd Academy Ancient History, course results indicated that 83 students were graded (Upper) and 126 students were ungraded (Core). For the purpose of answering research question 2, the sample for this analysis was a reduced sample consisting of the Core group.

The data used to evaluate the research questions consisted of archival data provided to the researcher by GamEd Academy from an Ancient History course that used Minecraft in the 2014/2015 Fall session. SPSS was used to analyze the data. Descriptive statistics,  $t$  tests, and  $F$  tests were used in the study. A table of critical value for

significance was used in conjunction with conducting the  $t$  test. The  $F$  test allowed for the equality of two sample variances to be tested. Testing the variance when comparing quiz averages between the two groups of Core students provided a  $p$  value needed to accept the null and determine that variances were equal. The results indicate that students complete all the course components when Minecraft is used as a tool for learning, regardless of the requirement to complete the course components with a course average of 85% or more.

For the purposes of this study, achievement was demonstrated through course averages and was depicted through the study results showing that when using Minecraft as a tool for learning, students are able to master course objectives and complete more than the minimum required. For GamEd Academy, the findings indicate that using Minecraft as a tool in an online Ancient History course produced students who were motivated, were engaged in learning, and demonstrated achievement. The findings provide parents and educators with the data necessary to show that students who participate in a course using Minecraft for learning achieve course objectives and experience increased motivation and engagement.

## **Chapter 5: Implications, Recommendations, and Conclusions**

Research shows that the use of the video game Minecraft increased student engagement, motivation, and problem-solving skills; yet parents and educators are not using Minecraft as a tool for learning due to their skepticism about whether using this game leads to academic achievement (Cipollone et al., 2014). Evidence suggesting that academic achievement on the part of those using Minecraft rises as a result of that use is lacking. This lack of evidence contributes to parents' and teachers' skepticism about the efficacy of Minecraft as a learning tool (Cipollone et al., 2014; Marino, Israel, Beecher, & Basham, 2013; Overby & Jones, 2015.). With the growth of online learning, further evidence-based research is required on the quality and effectiveness of courses that include games like Minecraft as a tool for learning to prove to parents, educators, and course designers that using video games as a tool for learning can lead to increased student achievement (Bourgonjon et al., 2011; Schifter & Cipollone, 2015; Trespalacios et al., 2011). Although there is support from parents and educators for using technology for learning, questions remain about whether the use of the game Minecraft leads to student achievement. By showing that Minecraft is connected to academic achievement, the problem this study addressed was the skepticism of parents and educators regarding the efficacy of Minecraft as a valuable tool for learning. In support of the constructivist learning theory, using video games for learning encourages educators to consider the design of courses and activities that build on the learner's previous knowledge through active participation, not just through inactively receiving instruction (Afifi & Alamri, 2014; Majgaard, 2014). Research reveals that a constructivist model of the role of the

learner is one in which the learner uses self-regulation and takes control of his or her learning (Afifi & Alamri, 2014; Szilas & Acosta, 2011).

The purpose of this quantitative, nonexperimental comparative study was to determine whether student performance on course objectives in a Minecraft-supplemented Ancient History course reflected mastery of curriculum content. This determination was based on whether a statistical significance was found to exist between the final grades of graded students who were required to complete all components of the course and the final grades of ungraded students who were not required to complete all the components of the course. To fulfill the purpose of this study, pre-existing data from a GamEd Academy Ancient History course were evaluated. The sample for the study consisted of 210 online students enrolled in the Fall 2014–2015 session. Additionally, the research questions addressed whether there was a statistically significant difference between the course grade averages of those students who were not required to complete all components of the course and whether the grades could indicate the presence of motivation, engagement, and achievement.

For this study, the independent variables were Upper (graded) and Core (ungraded) students, and the dependent variable was student performance as shown through the final course grade. This grade was based on components of the course that included Learn It, Quiz, Build It, Redstone Lab, Digging Deeper, Going Above and Beyond, and Team Up. The quiz developed by the content provider, GameED, was required to be taken by each student to determine mastery of content. Meeting course objectives was operationally defined as students receiving a final grade in online

Minecraft history of 85% or higher. GamED Academy considers students who earn a final grade of 85% or higher to have met course objectives.

In this research, two research questions were evaluated for the purposes of determining student performance and evaluating a course using Minecraft as a tool for learning. The questions of the study examined whether a statistically significant difference existed between the means of the final course grades of two groups of graded (Upper) and ungraded (Core) students enrolled in an online Ancient History course using Minecraft as a learning tool. To evaluate the first, the hypothesis was tested using an independent  $t$  test and effect size. Based on the results of the independent  $t$  test ( $P = > .05$ ), the null hypothesis was accepted, indicating there was no significant difference between the mean course scores of graded and ungraded students. The second question examined whether there was a statistically significant difference between ungraded students with a course average  $> 85\%$  and ungraded students with a course average  $< 85\%$ . To evaluate the second question, an independent  $t$  test and effect size were used. Based on the results of the independent  $t$  test ( $p = > .05$ ), the null hypothesis was accepted, indicating there was no significant difference between the mean course score for ungraded (Core) groups with scores of  $> 85\%$  and of  $< 85\%$ . Further, based on the results of the data analysis, core students showed the 85% mastery of course objectives that was set for and expected of graded (Upper) students.

Identifying whether there were statistically significant differences in course average scores between graded and ungraded students was important in answering the research question of whether students who completed all the components of the course and those who were not required to complete all course components (ungraded students)



showed motivation through completion of all components when Minecraft was used. Educators hold the responsibility not only of making certain students are motivated and engaged in their learning but also that they are meeting learning objectives of the course (Duziban, 2011; Elliott, 2014).

The ex post facto nature of this study resulted in limitations that are common with a quantitative design. Two limitations of this study emerged with the inability of the researcher to control the independent variable and the unknown accuracy of student enrollment in the two designated groups. Additional limitations include that GamEd Academy was the only online program used in this study. Also, in order to meet the recommendation of the G\*Power test of a sample of 210, it was necessary to pull data from two different sessions of an Ancient History course. In addition, information gathered from GamED Academy's website indicates that a quiz given to students can be taken several times, and that teachers use the highest score. Not represented in the data set is the number of times a student took the quiz. Similarly, due to the structure and design of a session in the course covering only a 6-week period, no extension for completion of quizzes or activities was provided. The nonaccredited GamED Academy does not give letter grades and provides only percentages for final course scores; yet it categorizes enrollees as "graded" or "ungraded." Information supplied by the company to the researcher posed a possible threat to validity due to the researcher's relationship to the information: The researcher had previous experience working with a program that uses Minecraft, which may have added personal bias regarding the motivational effects of using Minecraft for learning.

Prior to the collection of data, approval for the study was obtained from GamEd Academy and Northcentral University's IRB. This study examined archival data from online sessions of a history course with Minecraft embedded into the course components. Due to the nature of the archival study, all personally identifiable information was removed prior to the researcher's receiving the data from GamEd Academy. The data examined in this study represented online course enrollees, so the researcher did not interact with any participants. The data received from GamEd Academy was encrypted and stored in a password-protected file. The researcher chose the qualitative method because of her inability to manipulate students' instructional program, and chose not to use an experimental design (Reeves, 2015). Additionally, the ex post facto design was chosen because the groups were previously selected by the online program and data provided consisted of pre-existing scores (Delost & Nadder, 2014). The research questions were chosen in an attempt to understand whether the scores of the two groups indicate that a course using Minecraft was motivating enough that students would choose to do more than they were required to do. Additionally, the questions were intended to demonstrate whether there was a difference between the two groups in meeting course objectives in the course. The purpose of this study was not to measure student motivational levels or engagement but to evaluate whether students demonstrated academic achievement, as denoted by the online provider, through their performance. The researcher began by analyzing the data and determining the means of each student group. Tests of statistical significance were run to determine whether a difference existed between the two groups in terms of final course grades. Final course grades were chosen because all the course components referenced earlier were included in the grade.

The remainder of this chapter describes the implications of this research. The two research questions and the recommended application of the findings are described. The chapter closes with a summary of the conclusions.

### **Implications**

For parents and educators, finding online academic courses that motivate, engage, and increase student achievement has been difficult. Although research shows the use of the video game Minecraft increases student engagement, motivation, and problem-solving skills, parents and educators remain skeptical about the use of this game for learning and about whether its use leads to academic achievement (Cipollone et al., 2014). The debate over the effectiveness of using video games for learning and about whether they result in an impact on student achievement is ongoing (Marino et al., 2014; Wouters et al., 2013). The need to find courses that increase student engagement, motivation, and problem-solving skills has led to the discovery of courses that use video games for learning. The video game targeted for the purpose of this study was Minecraft. Whether students who use Minecraft as a tool for learning show academic achievement and master course objectives was investigated in this research by addressing two research questions and their associated hypothesis. The implications of the hypothesis outcomes are addressed in this section.

**Research Question 1.** The results of the study indicate that there was no statistically significant difference ( $p > .05$ ) between the final course scores of Upper and Core level students enrolled in an online Ancient History course that uses Minecraft. Based on the results of research hypotheses 1, the null hypothesis was accepted and the alternative rejected given that there was no statistically significant difference between the

final course scores of the two groups of students. The finding paralleled findings of prior studies that showed students that enrolled in an online course using Minecraft demonstrated increased problem-solving skills, motivation, and engagement in learning (Bottino, Ott, & Tavella, 2014; Schifter & Cipollone, 2015).

According to the relevant literature, the prevailing view is that using video games for learning increases student engagement and motivation but nothing else (Bourgonjon et al., 2010; Hess & Gunter, 2013); yet studies by Schifter and Cipollone (2015) and by Bos et al. (2014) found that using video games for learning resulted in increased academic achievement. Overby and Jones (2015) and Smolčec and Smolčec (2014) pointed out that integrating Minecraft into the curriculum increased not only student engagement and motivation but also problem solving in learning.

Although the results of this study indicate that final course scores of students who were graded for all course components and those who were ungraded with requirements to complete a few required components demonstrated no statistically significant difference, the differences that exist between the skill level and the prior academic achievement of the groups needs to be considered. Due to the limitations of this study, the composition of the sample groups was not provided, so the findings of this study cannot be fully attributed to skill level or grade level. According to existing literature by Basham and Becht (2014), creating courses using high-interest video games for learning has positive effects on motivation and student engagement; however, whether students master course objectives when using the video game Minecraft as a learning tool was a question prompting this study. In studies by Overby and Jones (2015) and by Wouters et al., (2013), the academic performance of students who used Minecraft was found to be

related to their skill level. In these studies, the academic performance through application of learned content was higher in students who had previously played Minecraft.

According to the research, achievement gaps were present in courses where there was a lack of knowledge and negative disposition about the use of Minecraft by parents and educators (Barrett, 2013; Cipollone et al., 2014; Hess & Gunter, 2013; Hill, 2015). Due to the limitations of this study, the skill level of individual students was not provided; so the findings of this study cannot be fully attributed to the effectiveness of Minecraft on increasing student performance.

**Research Question 2.** The second research question focused on whether course objectives were met through the analysis of course average for the Core (ungraded) group. The question focused on whether there existed a statistically significant difference in course averages for Core (ungraded) students who scored less than 85% on average compared with the Core (ungraded) students whose course average was 85% or more. The purpose of this analysis was to analyze, using course averages, whether Core students met course objectives of 85% or higher. The hypothesis for this research question stated that there was no significant difference between the course average of those students whose score was less than 85% and of those whose average was 85% or more.

The second research question evaluated specifically the ungraded (Core) group and asked whether there was a statistically significant difference between the course grades of ungraded students who achieved scores of 85% or less and those of ungraded students who scored 85% or higher. This research found that there was no significant difference between the grades of the two groups of Core students. The hypothesis was

supported and showed that the Core group completed more than was required of them and met course objectives at the same requirement of 85% as the graded students. These findings support prior study results that indicate students master course objectives when using Minecraft as a tool for learning (Hamlen, 2014). Additionally, the idea that using the high-interest video game Minecraft as a tool to enhance student learning and to motivate students to complete more than required as implied through the findings of this study parallels findings in studies by Bos et al. (2014) and by Smolčec and Smolčec (2014) indicating that using curriculum that includes Minecraft can lead to increased student achievement and mastery of course objectives.

The results of this study indicate that students who were graded (Upper) met course objectives and that no significant difference existed between their mean scores. The ungraded (Core) student scores indicate that this group completed more than was required of them while also meeting the course objective of 85% set by GamEd Academy. Consequently, this study aligned with the studies by Schifter and Cipollone (2015) and by Bos et al. (2014) that showed students can achieve academically when using the video game Minecraft as a tool for learning. In contrast, studies by Moshirnia and Israel (2010) posited that in each video game, the content and rigor used for learning differs between providers and provides no guarantee of accurately providing students with academic skills needed for success. Although determining causation is difficult in an ex post facto study, the overall findings of this research support the view that students who use the video game Minecraft as a tool for learning show academic achievement and mastery of course objectives, which is consistent with the findings of Hamlen (2014), Ke and Abras (2013), Kovačević et al. (2013), Larsen (2012), Means et al. (2013), and

Watson et al. (2011). The results from the current study provide additional information about the potential impact using a video game for learning can have on student achievement and motivation while providing additional information for parents and educators about the effectiveness of using Minecraft for learning.

### **Recommendations**

For parents and educators who are skeptical about the educational and motivational impact on students when the video game Minecraft is used for learning, this study produces evidence similar to that found in the literature, indicating that students were motivated and engaged in their learning and often completed more than was required in the course learning (Sáez-López et al., 2015; Smolčec & Smolčec, 2014). Additionally, students were found to demonstrate achievement through the mastery of academic course objectives. The findings provide foundational data needed for parents and educators to make informed decisions about whether to enroll their students in online courses that include Minecraft. The results of this study also add to the greater debate on the effectiveness of online courses that use Minecraft as a tool for learning.

**Practical applications.** The search for effective learning tools that can increase motivation, engagement, and student achievement can be frustrating for parents and educators. Using Minecraft as a tool for learning can help parents and educators reach students by providing them with a motivating, high-interest way to learn. The results of research question 1 shown in Table 6 demonstrate that there is no significant difference between the course component averages of students who were graded for all course components and those who were not graded yet completed all components, which may indicate the motivational contributions Minecraft brings to learning. The result paralleled

studies by Eseryel et al. (2014) and Tromba (2013), who found that when students were interested in a video game used for learning, they showed increased motivation, engagement, and academic achievement.

As a result, the first recommendation for practice is for parents and educators to ensure students are interested in the video game being used as the tool for learning. Additionally, research indicates that learners' engagement and motivation increased correlatively when teachers presented courses in ways that were learner centered and relevant to learners' lives (Eseryel, 2014; Kovačević et al., 2013). This recommendation is supported by the findings of Grosso et al. (2012), who revealed that many students enrolled in online learning did better in classes formatted in specific ways that piqued their interest. The use of high-interest video games for learning was also supported by Marra et al. (2014) and by Szilas and Acosta (2011), who also recommended that educational video games used should engage learners and include intentional, meaningful, and cooperative activities. The use of high-interest video games for learning was also supported by Hill (2015), who found that students who have had experience with and enjoyed playing a particular game showed an increase in learning potential, a notion that was supported by the current study's findings that, when taking a course that included Minecraft, students mastered course objectives above the set 85% criterion of mastery, whether graded or not.

A second recommendation is for educators and institutions providing courses that use Minecraft as tool for learning to provide data to parents who are considering enrollment of their students regarding the effectiveness and the educational value their program can provide to students. The current study's answers to research questions 1 and



2 indicate that there was no difference in performance between those who were graded and those who were ungraded in the Ancient History course using Minecraft. It is suggested that institutions, irrespective of the course content being offered, provide parents and students with potential learning outcomes that can be expected upon completion of the course, such as increased motivation, engagement, and self-directed learning, and, most importantly, academic achievement. This information may ensure that the academic value of courses using Minecraft can have on students is relayed to parents and could eliminate parent and educator skepticism (Cipollone et al., 2014; Marino, Israel, Beecher, & Basham, 2013; Overby & Jones, 2015.).

**Future research.** Research question 1, as is shown in Tables 2 and 6, yielded results that demonstrated no significant difference between the academic performances of students who were graded and students who were ungraded. These findings support the first recommendation for future research: to perform a more inferential study to further examine the current study's findings. A quantitative, comparative study on student identifiers of age and skill level for each group is recommended, with an aim of furthering knowledge regarding the potential impact skill level has on the course average scores between the two groups. This future study may also provide evidence of the impact skill level can have on academic performance when Minecraft is used as a tool for learning.

The second recommendation for future research is to perform a qualitative phenomenological study to explore parent and student perceptions and experiences after students have completed an online course that includes Minecraft (Alexander, Truell, & Zhao, 2012); Bourgonjon et al., 2011; Bourgonjon et al., 2010; Kovačević et al., 2013).

As such, these views from parents and students may further knowledge about the impact Minecraft can have on learning from a personal perspective.

A third recommendation for future research is to conduct a quantitative descriptive study evaluating student performance when Minecraft is used as a tool for learning for students with disabilities (Marino et al., 2014; Simoncelli & Hinson, 2010). In addition, the adaptability and simplicity of Minecraft for students with disabilities should be evaluated in future research, because courses that use Minecraft can have varying objectives and offer optional course components for students. The current study's finding for research question 2 involved investigating whether ungraded students who were given optional course components to complete, essentially components modified from those expected by students enrolled as graded, met course objectives at 85% or above. A recent study by Overby and Jones (2015) showed that courses including Minecraft brought advantages of learning to students due to the simplicity and adaptability the game provides. The inclusion of students with disabilities should be considered to provide opportunities for further understanding of the benefits using Minecraft can have on social and academic learning opportunities.

The fourth recommendation for future study is to replicate the current quantitative comparative study using a different online company and a different academic area. The results of research questions 1 and 2 presented in the current study involved collecting data from a single online company, GamEd Academy, where the focus was on an Ancient History course that used Minecraft as a supplement to the curriculum. The results of this study may differ if data are collected from other companies and other content area

courses that use Minecraft, and a larger sample may expand the data for more conclusive results.

## **Conclusion**

In conclusion, parents and educators have focused on providing online learning opportunities for students that are motivating and engaging and increase achievement. This research project was developed to address a need for a quantitative, comparative study examining student performance in an online course that includes Minecraft. Students who were enrolled as ungraded and who had fewer requirements than graded students in the course completed all the optional components in addition to the required components. This was what was predicted by some interpretations of constructivist learning theorists that implied that students experienced benefits such as an increase in motivation and increased achievement as a result of the videogame's being embedded in the curriculum. The sample of this study comprised 210 online students enrolled in an Ancient History course using Minecraft. The participants were divided into two groups; one group was required to complete all components of the course, and the other group had access to all the required components of the first group, with some being required and others optional.

Two research questions were evaluated for the purpose of this study. The first research question focused on student achievement, using final grades and quiz scores to determine whether mastery of course objectives was achieved. This research question was addressed by determining whether there was a statistically significant difference between the final course grades of students who were graded for each individual Minecraft activity and students who were not graded on each activity. Finally, using an

independent  $t$  test, the researcher determined that no statistically significant difference existed between the means of the final course grades of two groups: graded students and ungraded students. The second research question focused on whether course objectives were met through the analysis of course average for the Core (ungraded) group. The ungraded student group was divided into two groups: One group had course scores of  $< 85\%$  and the other group had course scores of  $> 85\%$ . The question focused on whether there existed a statistically significant difference between course averages of Core (ungraded) students who scored less than 85% and Core (ungraded) students whose course average was 85% or higher.

Due to the ex post facto design of the study, threats to internal and external validity may have been present due to the use of archival data. Assurance that the data came from the learning management system assisted with increasing internal validity. Minimal ethical issues were present as a result of the ex post facto design. Data were gathered from the courses, and the researcher had no contact with human participants. Limitations of this study included that it used a single online course provider and that the researcher was unable to manipulate the groups. The inability to control the independent variable and to randomly assign participants into the groups restricted the findings of this study. Further research evaluating student achievement, motivation, and engagement of students who are enrolled in courses from other Minecraft providers could support the findings of this study. Recommendations for future research could also evaluate parent and student perspectives regarding levels of achievement upon completion of a course that includes Minecraft. Additionally, discerning whether students with disabilities could benefit academically and socially from courses using Minecraft is a topic recommended

for further research. Parents and educators should consider that every child is worthy of learning opportunities for education, whether through traditional methods or through online learning using video games. For that reason, parents and educators do well to consider courses that include Minecraft as a learning tool, thereby increasing students' motivation, engagement, and academic achievement.

## References

- Afifi, M. K., & Alamri, S. S. (2014). Effective principles in designing E-course in light of learning theories. *Turkish Online Journal of Distance Education*, 15(1), 128–142. doi:<http://dx.doi.org/10.17718/tojde.43806>
- Alexander, M. W., Truell, A. D., & Zhao, J. J. (2012). Expected advantages and disadvantages of online learning: Perceptions from college students who have not taken online courses. *Issues in Information Systems*, 13(2), 193–200. Retrieved from [http://iacis.org/iis/2012/114\\_iis\\_2012\\_193-200.pdf](http://iacis.org/iis/2012/114_iis_2012_193-200.pdf)
- Allen, I. E., & Seaman, J. (2013). *Changing course: Ten years of tracking online education in the United States*. Wellesley MA: Babson College/Quahog Research Group.
- Anderson, B. & Simpson, M. (2012). History and heritage in distance education. *Journal of Open, Flexible, and Distance Learning*, 16(2), 1–10. Retrieved from <http://journals.akoatearoa.ac.nz/index.php/JOFDL/article/viewFile/56/151>
- Annetta, L., Mangrum, J., Holmes, S., Collazo, K., & Cheng, M. (2009). Bridging reality to virtual reality: Investigating gender effect and student engagement on learning through video game play in an elementary school classroom. *International Journal of Science Education*, 31(8), 1091–1113. doi:10.1080/09500690801968656
- Aqel, M. (2013). The effect of different interaction levels on instructional design learners. *Procedia - Social and Behavioral Sciences*, 103(13th International Educational Technology Conference), 1035–1043. doi: 10.1016/j.sbspro.2013.10.429
- Arredondo, D., & Block, J. (1990). Recognizing the connections between thinking skills and mastery learning. *Educational Leadership*, 47(5), 4–10. Retrieved from [http://www.ascd.org/ASCD/pdf/journals/ed\\_lead/el\\_199002\\_arredondo.pdf](http://www.ascd.org/ASCD/pdf/journals/ed_lead/el_199002_arredondo.pdf)
- Baleni, Z. G. (2015). Online formative assessment in higher education: Its pros and cons. *Electronic Journal of E-Learning*, 13(4), 228–236.
- Barrett, B. (2013). Enabling students with disabilities with computing interaction and empowerment though enhanced strategic instructional course design. *Electronic Journal of Information Systems Evaluation*, 16(3), 163–172. Retrieved from <http://www.ejise.com/main.html/>
- Behizadeh, N., & Engelhard, J. G. (2011). Historical view of the influences of measurement and writing theories on the practice of writing assessment in the United States. *Assessing Writing*, 16(3), 189–211. doi: 10.1016/j.asw.2011.03.001
- Block, J. H. (1983). Learning rates and mastery learning. *Outcomes*, 2(3), 18–23.

- Bloom, B. S. (1974). Time and learning. *American Psychologist*, 29, 682–688. doi:10.1037/h0037632
- Bloom, B. S. (1978). New views of the learner: Implications for instruction and curriculum. *Educational Leadership*, 35(7), 563–568, 570–576. Retrieved from <http://eric.ed.gov/?id=EJ179218>
- Bos, B., Wilder, L., Cook, M., & O'Donnell, R. (2014). iSTEM: Learning mathematics through Minecraft. *Teaching Children Mathematics*, 21(1), 56–59. Retrieved from <http://www.nctm.org/publications/article.aspx?id=42810>
- Bottino, R. M., Ott, M., & Tavella, M. (2014). Serious gaming at school: Reflections on students' performance, engagement and motivation. *International Journal of Game-Based Learning*, 4(1), 21. doi:10.4018/IJGBL.2014010102
- Bourgonjon, J., Valcke, M., Soetaert, R., de Wever, B., & Schellens, T. (2011). Parental acceptance of digital game-based learning. *Computers & Education*, 57, 1434–1444. doi: 10.1016/j.compedu.2010.12.012
- Bourgonjon, J., Valcke, M., Soetaert, R., & Schellens, T. (2010). Students' perceptions about the use of video games in the classroom. *Computers & Education*, 54, 1145–1156. doi: 10.1016/j.compedu.2009.10.022
- Bruner, J. (1996). *The culture of education*. Cambridge, MA: Harvard University Press.
- Carroll, J. (2013). Engaging and authentic technology use for literacy learning in the middle years. *Literacy Learning: The Middle Years*, 21(2), 7–17.
- Caruth, G. D., & Caruth, D. L. (2013). Distance education in the United States: From correspondence courses to the Internet. *Turkish Online Journal of Distance Education (TOJDE)*, 14(2), 141–149. Retrieved from <http://files.eric.ed.gov/fulltext/EJ1013772.pdf>
- Cavanaugh, C., Repetto, J., Wayer, N., & Spitler, C. (2013). Online learning for students with disabilities: A framework for success. *Journal of Special Education Technology*, 28(1), 1–8. doi:10.1177/016264341302800101
- Cheng, G., & Chau, J. (2016). Exploring the relationships between learning styles, online participation, learning achievement and course satisfaction: An empirical study of a blended learning course. *British Journal of Educational Technology*, 47(2), 257–278. doi:10.1111/bjet.12243
- Chiang, H. (2009). How accountability pressure on failing schools affects student achievement. *Journal of Public Economics*, 93(9) 1045–1057. doi:10.1016/j.jpubeco.2009.06.002

- Cipollone, M., Schifter, C. C., & Moffat, R. A. (2014). Minecraft as a creative tool: A case study. *International Journal of Game-Based Learning*, 4(2), 1–14. doi:10.4018/ijgbl.2014040101
- Conrad, R., & Donaldson, J. A. (2011). *Engaging the online learner: Activities and resources for creative instruction*. (2nd ed.). San Francisco, CA: Jossey-Bass.
- Davidson, E., Reback, R., Rockoff, J., & Schwartz, H. L. (2015). Fifty ways to leave a child behind: Idiosyncrasies and discrepancies in states' implementation of NCLB. *Educational Researcher*, 44(6), 347–358. doi:10.3102/0013189X15601426
- De-Marcos, L., Domínguez, A., Saenz-de-Navarrete, J., & Pagés, C. (2014). An empirical study comparing gamification and social networking on e-learning. *Computers & Education*, 75, 82–91. doi:10.1016/j.compedu.2014.01.012
- Delen, E., Liew, J., & Willson, V. (2014). Effects of interactivity and instructional scaffolding on learning: Self-regulation in online video-based environments. *Computers & Education*, 78, 312–320. doi:10.1016/j.compedu.2014.06.018
- Delost, M. E., & Nadder, T. S. (2014). Guidelines for initiating a research agenda: Research design and dissemination of results. *Clinical Laboratory Science*, 27(4), 237–244. Retrieved from <http://eds.b.ebscohost.com/>
- Dewey, J. (1913). *Interest and effort in education*. Boston, MA: Houghton Mifflin.
- Diegelman-Parente, A. (2011). The use of mastery learning with competency-based grading in an organic chemistry course. *Journal of College Science Teaching*, 40(5), 50–58.
- Driscoll, A., Jicha, K., Hunt, A. N., Tichavsky, L., & Thompson, G. (2012). Can online courses deliver in-class results? A comparison of student performance and satisfaction in an online versus a face-to-face introductory sociology course. *Teaching Sociology*, 40(4), 312–331. doi:10.1177/0092055X12446624
- Du Plessis, A., & Webb, P. (2011). An extended cyberhunts strategy: Learner centered learning-by-design. *Australasian Journal of Educational Technology*, 27(7), 1190–1207. Retrieved from <http://search.ebscohost.com/>
- Durak, G., & Ataizi, M. (2016). Learner views about a distance education course. *Contemporary Educational Technology*, 7(1), 85–105. Retrieved from <http://www.cedtech.net/articles/71/715.pdf>
- Dziuban, C., & Moskal, P. (2011). A course is a course is a course: Factor invariance in student evaluation of online, blended and face-to-face learning environments. *The Internet and Higher Education*, 14, 236–241. doi: 10.1016/j.iheduc.2011.05.003



- Edwards, C. M., Rule, A. C., & Boody, R. M. (2013). Comparison of face-to-face and online mathematics learning of sixth graders. *Journal of Computers in Mathematics & Science Teaching*, 32(1), 25–47. Retrieved from <http://www.editlib.org/p/39231/>
- Elliott, D. (2014). Leveling the playing field: Engaging disadvantaged students through game-based pedagogy. *Literacy Learning: The Middle Years*, 22(2), 34–40. Retrieved from <http://search.ebscohost.com/>
- Ertmer, P. A., & Newby, T. J. (2013). Behaviorism, cognitivism, and constructivism: Comparing critical features from an instructional design perspective. *Performance Improvement Quarterly*, 26(2), 43–71. doi:10.1002/piq.21143
- Eseryel, D., Law, V., Ifenthaler, D., Ge, X., & Miller, R. (2014). An investigation of the interrelationships between motivation, engagement, and complex problem solving in game-based learning. *Journal of Educational Technology & Society*, 17(1), 42–53. Retrieved from [http://www.ifets.info/others/abstract.php?art\\_id=1432](http://www.ifets.info/others/abstract.php?art_id=1432)
- Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G\*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, 39, 175–191. doi:10.3758/BF03193146
- Forte, E. (2010). Examining the assumptions underlying the NCLB federal accountability policy on school improvement. *Educational Psychologist*, 45(2), 76–88. doi:10.1080/00461521003704738
- GamED Academy. (2016, January). Academic courses. Retrieved from <http://gamedacademy.com/classes/>
- Gay, L. R. (2011). *Educational research: competencies for analysis and applications*. Pearson.
- Gikandi, J., Morrow, D., & Davis, N. (2011). Online formative assessment in higher education: A review of the literature. *Computers & Education*, 57(4), 2333–2351. doi: 10.1016/j.compedu.2011.06.004
- Greitzer, F. L., Kuchar, O. A., & Huston, K. (2007). Cognitive science implications for enhancing training effectiveness in a serious gaming context. *Journal on Educational Resources in Computing*, 7(3). doi:10.1145/1281320.1281322
- Grosso, S. S., Smith, T. L., & Grosso, J. E. (2012). Interactive questions concerning online classes: Engaging students to promote active learning. *International Journal of Education Research*, 7(1), 49–59. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.587.7172&rep=rep1&type=pdf>
- Hamlen, K. R. (2013). Understanding children's choices and cognition in video game play: A synthesis of three studies. *Zeitschrift Für Psychologie*, 221(2), 107–114. doi:10.1027/2151-2604/a000136

- Hamlen, K. R. (2014). Video game strategies as predictors of academic achievement. *Journal of Educational Computing Research*, 50(2), 271–284. doi:10.2190/EC.50.2. g.
- Harris-Packer, J. D., & Ségol, G. (2015). An empirical evaluation of distance learning's effectiveness in the K–12 setting. *American Journal of Distance Education*, 29(1), 4–17. doi:10.1080/08923647.2015.990768
- Harsh, S., & Young, J. (2015). Using varied learning environments for deeper learning and student mastery of complex content. *Delta Kappa Gamma Bulletin*, 81(3), 7–16. Retrieved from [www.questia.com/](http://www.questia.com/)
- Hassel, H., & Lourey, J. (2005). The dearth of student responsibility. *College Teaching*, 53(1), 2. doi:10.3200/CTCH.53.1.2-13
- Hersman, B. L. (2014). Increasing student engagement in online classes. *Chronicle of Kinesiology & Physical Education in Higher Education*, 25(2), 23–25. Retrieved from <http://search.ebscohost.com/>
- Hess, T., & Gunter, G. (2013). Serious game-based and nongame-based online courses: Learning experiences and outcomes. *British Journal of Educational Technology*, 44(3), 372–385. doi:10.1111/bjet.12024
- Hetzner S., & Leen, E. (2013). Personalization and tutoring in e-learning—The key for success in learning in later life. *European Journal of Open, Distance and E-Learning*, 17(1). Retrieved from <http://www.eurodl.org/?p=special&sp=articles&inum=5&article=626>
- Heubert, J. P., & Hauser, R. M. (Eds.). (1999). *High stakes: Testing for tracking, promotion and retention*. Washington, DC: National Academies Press. Retrieved from <http://www.nap.edu/books/0309062802/html/index.html>
- Hidi, S., & Renninger, K. A. (2006). The four-phase model of interest development. *Educational Psychologist*, 41(2), 111–127. doi:10.1207/s15326985ep4102\_4
- Hill, V. (2015). Digital citizenship through game design in Minecraft. *New Library World*, 116(7/8), 369–382. doi:10.1108/NLW-09-2014-0112
- Huang, W. (2011). Evaluating learners' motivational and cognitive processing in an online game-based learning environment. *Computers in Human Behavior*, 27, 694–704. doi: 10.1016/j.chb.2010.07.021
- Iskander, G. M. (2014). Developing scale for assimilate the integration between learning theories and e-learning. *International Journal of Emerging Technologies in Learning*, 9(2), 4–8. doi:10.3991/ijet. v9i2.3206

- Jaggars, S. S., & Xu, D. (2016). How do online course design features influence student performance? *Computers & Education*, 9(5), 270–284. doi:10.1016/j.compedu.2016.01.014
- Jonassen, D. H. (1999). Designing constructivist learning environments. In C. M. Reigeluth (Ed.), *Instructional design theories and models: A new paradigm of instructional theory* (Vol. 2, pp. 215–239). Mahwah, NJ: Lawrence Erlbaum.
- Ke, F., & Abras, T. (2013). Games for engaged learning of middle school children with special learning needs. *British Journal of Educational Technology*, 44(2), 225–242. doi:10.1111/j.1467-8535.201201326.x
- Kim, J. S., & Sunderman, G. L. (2005). Measuring academic proficiency under the No Child Left Behind Act: Implications for educational equity. *Educational Researcher* 34(8), 3–13. doi:10.3102/0013189X034008003
- Koohang, A. (2009). A learner-centered model for blended learning design. *International Journal of Innovation and Learning*, 6(1), 76–91. doi:http://dx.doi.org/10.1504/IJIL.2009.021685
- Koohang, A., Riley, L., Smith, T., & Schreurs, J. (2009). E-learning and constructivism: From theory to application. *Interdisciplinary Journal of E-Learning & Learning Objects*, 591–109. Retrieved from <http://www.learntechlib.org/p/44824>
- Korte, G. (2015, December 11). The Every Student Succeeds Act vs. No Child Left Behind: What's changed? *USA Today*. Retrieved from <http://www.usatoday.com/story/news/politics/2015/12/10/every-student-succeeds-act-vs-no-child-left-behind-whats-changed/77088780/>
- Kovačević, I., Minović, M., Milovanović, M., de Pablos, P. O., & Starčević, D. (2013). Motivational aspects of different learning contexts: “My mom won’t let me play this game . . .” *Computers in Human Behavior*, 29, 354–363. doi:10.1016/j.chb.2012.01.023
- Lemanski, C. (2011). Access and assessment? Incentives for independent study. *Assessment & Evaluation in Higher Education*, 36(5), 565–581. doi:10.1080/02602930903541031
- Larsen, L. J. (2012). A new design approach to game-based learning. *Journal of Interactive Learning Research*, 23(4), 313–323. Retrieved from <https://www.learntechlib.org/p/39296/>
- Majgaard, G. (2014). The Playful and Reflective Game Designer. *Electronic Journal of E-Learning*, 12(3), 271–280. doi: <http://doi.org/10.16993/dfl.68>
- Maleyko, G., & Gawlik, M. (2011). No Child Left Behind: What we know and what we need to know. *Education*, 131(3), 600–624. Retrieved from <https://krboernke.files.wordpress.com/2011/05/nclb.pdf>

- Marino, M. T., Gotch, C. M., Israel, M., Vasquez, E., Basham, J. D., & Becht, K. (2014). UDL in the middle school science classroom: Can video games and alternative text heighten engagement and learning for students with learning disabilities? *Learning Disability Quarterly*, 37(2), 87–99. doi:10.1177/0731948713503963
- Marino, M., Israel, M., Beecher, C., & Basham, J. (2013). Students' and teachers' perceptions of using video games to enhance science instruction. *Journal of Science Education & Technology*, 22(5), 667–680. doi:10.1007/s10956-012-9421-9
- Marra, R. M., Jonassen, D. H., Palmer, B., & Luft, S. (2014). Why problem-based learning works: Theoretical foundations. *Journal on Excellence in College Teaching*, 25(3/4), 221–238. Retrieved from <http://search.ebscohost.com/>
- Means, B., Toyama, Y., Murphy, R. F., & Baki, M. (2013). The effectiveness of online and blended learning: A meta-analysis of the empirical literature. *Teachers College Record*, 115(3), 1–47. Retrieved from <https://www.tcrecord.org.proxy1.ncu.edu/library/Abstract.asp?ContentId=16882>
- Monteiro, E., & Morrison, K. (2014). Challenges for collaborative blended learning in undergraduate students. *Educational Research & Evaluation*, 20(7/8), 564–591. doi:10.1080/13803611.2014.997126
- Moore, J. (2013). Three views of behaviorism. *Psychological Record*, 63(3), 681–691. doi: 10.11133/j.tpr.2013.63.3.020
- Moshirnia, A., & Israel, M. (2010). The educational efficacy of distinct information delivery systems in modified video games. *Journal of Interactive Learning Research*, 21(3), 383–405. Retrieved from <http://www.editlib.org/p/29487>
- Omar, N., Hassan, H., & Atan, H. (2012). Student engagement in online learning: Learners attitude toward e-mentoring. *Procedia - Social and Behavioral Sciences*, 67, 464–475. doi: 10.1016/j.sbspro.2012.11.351
- Orthner, D. K., Jones-Sanpei, H., Akos, P., & Rose, R. A. (2013). Improving middle school student engagement through career-relevant instruction in the core curriculum. *Journal of Educational Research*, 106(1), 27–38. doi:10.1080/00220671.2012.658454
- Overby, A., & Jones, B. L. (2015). Virtual LEGOs: Incorporating Minecraft into the art education curriculum. *Art Education*, 68(1), 21–27. doi:10.1080/00043125.2015.11519302
- Piaget, J., & Inhelder, B. (1969). *The psychology of the child*. New York, NY: Basic Books.
- Plass, J. L., O'Keefe, P. A., Homer, B. D., Case, J., Hayward, E. O., Stein, M., & Perlin, K. (2013). The impact of individual, competitive, and collaborative mathematics

- game play on learning, performance, and motivation. *Journal of Educational Psychology*, 105(4), 1050–1066. doi:10.1037/a0032688
- Poncy, B. C., McCallum, E., & Schmitt, A. J. (2010). A comparison of behavioral and constructivist interventions for increasing math-fact fluency in a second-grade classroom. *Psychology in Schools*, 47(9), 917–930. doi:10.1002/pits.20514
- Pyari, D. (2011). *Theory and distance education: At a glance*. Vol. 12. Singapore: IACSIT Press.
- Przybylski, A. K., Rigby, C. S., & Ryan, R. M. (2010). A motivational model of video game engagement. *Review of General Psychology*, 14(2), 154–166. doi:10.1037/a0019440
- Reeves, T. C. (2015). Educational design research: Signs of progress. *Australian Journal of Educational Technology*, 31(5), 613–620. doi:http://dx.doi.org/10.14742/ajet.2902
- Roseth, C., Saltarelli, A. J., & Glass, C. R. (2011). Effects of face-to-face and computer mediated constructive controversy on social interdependence, motivation, and achievement. *Journal of Educational Psychology*, 103(4), 804–820. doi:10.1037/a0036898
- Rotgans, J. I., & Schmidt, H. G. (2014). Situational interest and learning: Thirst for knowledge. *Learning and Instruction*, 32, 37–50. doi: 10.1016/j.learninstruc.2014.01.002
- Rowe, F. A., & Rafferty, J. A. (2013). Instructional design interventions for supporting self-regulated learning: Enhancing academic outcomes in postsecondary e-learning environments. *Journal of Online Learning & Teaching*, 9(4), 590–601. Retrieved from [http://jolt.merlot.org/vol9no4/rowe\\_1213.pdf](http://jolt.merlot.org/vol9no4/rowe_1213.pdf)
- Ruggiero, D., de Hurtado, B. G., & Watson, W. R. (2013). Juvenile offenders: Developing motivation, engagement, and meaning-making through video game creation. *International Journal of Game-Based Learning*, 3(2), 112–129. doi:10.4018/ijgbl.2013040107
- Sadi, O., & Uyar, M. (2013). The relationship between cognitive self-efficacy, self-regulated learning strategies and biology achievement: A path model. *Journal of Baltic Science Education*, 12(1), 21–33. doi: 10.1016/j.sbspro.2013.09.291
- Sáez-López, J. M., Miller, J., Vázquez-Cano, E., & Domínguez-Garrido, M. C. (2015). Exploring application, attitudes and integration of video games: MinecraftEdu in middle school. *Educational Technology & Society*, 18(3), 114–128.
- Schifter, C. C., & Cipollone, M. (2015). Constructivism vs constructionism: Implications for Minecraft and classroom implementation. In P. Isaias, J. M. Spector, D.

- Ifenthaler, & D. G. Sampson (Eds.), *E-Learning systems, environments & approaches* (pp. 213–227). doi:10.1007/978-3-319-05825-2\_15
- Sicilia, M., Lytras, M. D., Sánchez-Alonso, S., García-Barriocanal, E., & Zapata-Ros, M. (2011). Modeling instructional-design theories with ontologies: Using methods to check, generate and search learning designs. *Computers in Human Behavior*, 27, 1389–1398. doi: 10.1016/j.chb.2010.07.040
- Simoncelli, A., & Hinson, J. (2010). Designing online instruction for postsecondary students with learning disabilities. *Journal of Educational Multimedia and Hypermedia*, 19(2), 211–220. Retrieved from <http://www.editlib.org/p/33205>
- Simonson, M., Smaldino, S., Albright, M., & Zvacek, S. (2012). *Teaching and learning at a distance: Foundations of distance education* (5th ed.). Boston, MA: Pearson.
- Smolčec, M., & Smolčec, F. (2014). Using Minecraft for learning English. *TESL-EJ*, 18(2), 1–15. Retrieved from <http://www.tesl-ej.org/wordpress/issues/volume18/ej70/ej70int/>
- Siu Cheung, K., Tak-Wai, C., Griffin, P., Ulrich, H., Ronghuai, H., Kinshuk, & Shengquan, Y. (2014). E-learning in school education in the coming 10 years for developing 21st century skills: Critical research issues and policy implications. *Journal of Educational Technology & Society*, 17(1), 70–78. Retrieved from [http://www.ifets.info/journals/17\\_1/ets\\_17\\_1.pdf](http://www.ifets.info/journals/17_1/ets_17_1.pdf)
- Szilas, N., & Acosta, M. (2011). *A theoretical background for educational video games: Games, signs, knowledge*. IGI Global, 215–238. doi:10.4018/978-1-60960-495-0.ch011
- Tao, J., Fore, C., & Forbes, W. (2011). Seven best face-to-face teaching practices in a blended learning environment. *Journal of Applied Learning Technology*, 1(3), 20–29.
- Teach for America. (2011). Instructional planning and delivery. [http://www.teachingasleadership.org/sites/default/files/Related-Readings/IPD\\_2011.pdf](http://www.teachingasleadership.org/sites/default/files/Related-Readings/IPD_2011.pdf)
- Trespalacios, J., Chamberlin, B., & Gallagher, R. (2011). Collaboration, engagement & fun: How youth preferences in video gaming can inform 21st century education. *TechTrends: Linking Research & Practice to Improve Learning*, 55(6), 49–54. doi:10.1007/s11528-011-0541-5
- Tromba, P. (2013). Build engagement and knowledge one block at a time with Minecraft. *Learning & Leading with Technology*, 40(8), 20–23. Retrieved from <http://files.eric.ed.gov/fulltext/EJ1015174.pdf>

- Tsai, A. (2011). A hybrid e-learning model incorporating some of the principal learning theories. *Social Behavior & Personality: An International Journal*, 39(2), 145–152. doi:10.2224/sbp.2011.39.2.145
- Tsang, S., Katz, A., & Stack, J. (2008). Achieving testing for English language learners, ready or not? Education Policy Analysis Archives, 16, 1–26. doi:10.14507/epaa.v16n1.2008
- Verpoorten, D., Westera, W., & Specht, M. (2011). Using reflection triggers while learning in an online course. *British Journal of Educational Technology*, 43(6), 1030–1040. doi:10.1111/j.1467-8535.2011.01257.x
- Voskoglou, M. G. (2010). Problem-solving as a component of the constructivist view of learning. *Journal of Education Research*, 4(2), 93–112.
- Vygotsky, L. (1978). *Mind in society*. Cambridge, MA: Harvard University Press.
- Wan, Z., Compeau, D., & Haggerty, N. (2012). The effects of self-regulated learning processes on e-learning outcomes in organizational settings. *Journal of Management Information Systems*, 29(1), 307–340.
- Watson, W. R., Mong, C. J., & Harris, C. A. (2011). A case study of the in-class uses of a video game for teaching high school history. *Computers & Education*, 56, 466–474. doi: 10.1016/j.compedu.2010.09.007
- Whitton, N. (2012). The place of game-based learning in an age of austerity. *Electronic Journal of e-Learning*, 10(2), 249–256. Retrieved from <http://files.eric.ed.gov/fulltext/EJ985426.pdf>
- Wichadee, S. (2014). Students' learning behavior, motivation and critical thinking in learning management systems. *Journal of Educators Online*, 11(3), 1–21.
- Wilson, K., Boyd, C., Chen, L., & Jamal, S. (2011). Improving student performance in a first-year geography course: Examining the importance of computer-assisted formative assessment. *Computers & Education*, 57, 1493–1500. doi:10.1016/j.compedu.2011.02.011
- Wouters, P., van der Nimwegen, C., van Oostendorp, H., & van der Speck, E. D. (2013). A meta-analysis of the cognitive and motivational effects of serious games. *Journal of Educational Psychology*, 105(2), 249–265. doi:10.1037/a0031311
- Yildiz, S., & Yildiz, E. (2011). A study on pc—video games in terms of the space awareness from childhood to youth. *Procedia – Social and Behavioral Sciences*, 28, 796–800. doi: 10.1016/j.sbspro.2011.11.145
- Young, M. F., Slota, S., Cutter, A. B., Jalette, G., Mullin, G., Lai, B., Yukhymenko, M. (2012). Our princess is in another castle: A review of trends in serious gaming for

education. *Review of Educational Research*, 82, 61–89. doi:10.3102/0034654312436980

Yudkowsky, R., Park, Y. S., Lineberry, M., Knox, A., & Ritter, E. M. (2015). Setting mastery learning standards. *Academic Medicine*, 90(11), 1495–1500. doi:10.1097/ACM.0000000000000887

Zimmerman, B. J., & Dibenedetto, M. K. (2008). Mastery learning and assessment: Implications for students and teachers in an era of high-stakes testing. *Psychology in the Schools*, 45(3), 206–216. Retrieved from <http://eric.ed.gov/?id=EJ787062>



## Appendix

## Appendix A: Letter of Permission

May 3, 2016

Applied Research Center Nova  
Southeastern University 1750 NE  
167th Street North Miami Beach, FL 33162

University IRB Office:

As Principal, I have given Ms. Mary Kruger permission to review and use archival data on previous course outcomes stored by our school. I have spoken with Ms. Kruger and understand the scope of her research, and how she will be using our data. All information to be gathered will be done in a confidential and appropriate manner.

Should you have any questions, please feel free to contact me.

Sincerely,

A handwritten signature in cursive script that reads "Jody Novakoski". The signature is written in dark ink on a light background.

Jody Novakoski, Principal of GamED Academy's Minecraft School

Appendix B: Independent  $t$  test Results Table

*Independent t test Results for Differences Between Course Average Scores of Graded and Ungraded Students*

<b>Student</b>	<b><math>n</math></b>	<b><math>M</math></b>	<b><math>SD</math></b>	<b><math>t</math></b>	<b><math>p</math></b>
Graded	83	94.26%	3.5%		
Ungraded	126	94.26%	3.3%	.013	.990