THE MINECRAFT PROJECT: PREDICTORS FOR ACADEMIC SUCCESS AND 21st CENTURY SKILLS GAMERS ARE LEARNING THROUGH VIDEO GAME EXPERIENCES

A Dissertation

by

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This dissertation meets the standards for scope and quality of
Texas A&M University-Corpus Christi and is hereby approved.

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ABSTRACT

Video games are more than just entertainment. In fact, video games like *Minecraft* develop "Four Cs" skills in young gamers. These 21st century skills include critical thinking, creativity, communication, and collaboration (National Education Association, 2010) and are considered essential skills for future employment by workforce executives (Sardone & Delvin-Scherer, 2010). This study explores predictors of academic success and the 21st century skills gamers are learning through video game experiences.

This sequential mixed model study analyzed descriptive data to explore the video game experiences of 3D Modeling and Animation students enrolled at a South Texas area high school. The study analyzed data collected from 66 quantitative subjects and 4 qualitative participants. Three classes engaged in four weeks of gameplay to complete a modeling project in *Minecraft*. Data was collected during both phases of the project study through survey and case study methods.

The findings revealed that the Group Project Grades were heavily skewed indicating a significance that prior gaming experience affected the students' academic performance. The significance was supported by the unexpected high frequency of perfect scores (65%) and the high concentration of experienced gamers. Over half (54%) reported to have played video games for over 10 years. It was also noted that gender was statistically significant with Class Rank. Females had higher class ranks overall then the males. The qualitative data analysis led to the development of five major findings: 1.) The Strategist: Accomplishing the Mission, 2.) The Creator: The Art of Gameplay, 3.) The Communicator: Building Relationships and

Communities, 4.) The Hero: To Be the Hero of a Great Adventure, and 5.) I am an "Elite": A Digital Native. These major findings represent trends of the gaming phenomenon, gamer traits, and 21st century skills learned through playing video games.

The findings for this study have implications on teachers' perspectives and attitudes toward video game integration. Recommendations for future research include a longitudinal study with the four participants to provide a better understanding of applied 21st century skills over time, a content analysis of various video games, and a mixed model study exploring the reading habits, literacy skills, and genre interests of gamers.

DEDICATION

With my eternal love and respect, I dedicate this completed step in my pedagogical journey to the greatest teacher of my life. Thank you for teaching me to celebrate creativity and innovation.

For my Mama… Katherine Mansheim.

You are my sunshine.

I love you.

ACKNOWLEDGEMENTS

I am thankful and blessed that I have not been alone in this journey. I am grateful to the many mentors, teachers, family, and friends who have supported me through my life and especially these last five years. I cannot adequately express the love and thankfulness I feel for you all.

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To my brother, Thomas Hewett, I love you. Nothing more can be said but to say how grateful to God I am to have you as my big brother. You bless us with your goodness, your love of music, and gift for writing. I am forever looking up to you. To my father, Tom Hewett, thank you for your love and support. Your interest in architecture and design has had a lasting impact on me. To my niece, Genevieve Hewett, I hope this dissertation will inspire you in your future academic pursuits and be an example of the value of education. Keep writing and pursuing your dreams! I love you my sweet strong girl.

To my grandparents in Heaven, Howard Curtis Hewett, Helen Roebuck Hewett, Frank V. Mansheim, and Evelyn Brune Mansheim, thank you for teaching me the meaning of a grandparent's love and guidance. Thank you for reading books to me, for showing me how to fix and build things, for the breakfast mornings, and for all the adventures. I cherish and honor your memory.

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I wish to extend my sincere thanks to my dissertation committee: Dr. Dan Pearce, Dr. Bethanie Pletcher, Dr. Guang Zeng, and Dr. Ahmed Mahdy. Thank you for your guidance and support through this process. Your mentorship, knowledge, and expertise in your given fields of study have enriched my learning. I have reached this goal because of you all and I thank you. Dr. Pearce, you have been with me on this journey the longest. Thank you for believing in me and guiding me through both my master and doctoral programs.

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strong in you and I have been blessed to have you in my life. The path of a Jedi brings forth knowledge (Jedi Code, (n.d.)) much like this doctoral journey together. Love you, my Jedi sister, always…

Dr. Kakali Bhattacharya, your innovative use of *Second Life* to teach qualitative research methods changed my life as a technology teacher and sparked the start of this dissertation topic. The use of a virtual environment inspired me to explore the video game culture and gave me the courage to integrate *Minecraft* into my own courses. Thank you for challenging me to think "outside-the-box" in my teaching and my research.

To the countless educators and professors who I have met through my research and studies in *Second Life*, thank you for the professional development opportunities, the innovative teaching practices, and the sense of community in being a "virtual pioneer." Thank you to the International Society of Technology in Education (ISTE), the Texas Computer Education Association (TCEA), the Special Interest Group for Virtual Environments (SIGVE), the Virtual Pioneers, the Virginia Society for Technology in Education (VSTE), the Second Life Educators of Escambia County (SLEEC), and the Virtual Worlds Best Practices in Education (VWBPE) for providing a community for educators to explore this new research field.

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I would like to take a moment to thank the faculty and staff at my beloved Richard King High School. The level of professionalism exhibited daily has inspired me to have high

expectations in my teaching practice. I am blessed to be part of a community of thinkers and innovators. To my former principal, Minerva Abrego, thank you for seeing potential in me and for giving me a chance to teach technology applications in my own way. You were always supportive of my new ideas and encouraged me to be innovative. You changed my life!

To my Assistant Principal and esteemed colleague, Patrick Stark, thank you for your innovative mind and openness to new ideas and practices. When I first approached you about the integration of *Minecraft* in the classroom four years ago, you didn't even flinch. You immediately understood the potential and jumped in with me to make it happen for our students. The *Minecraft* Project could have never been a reality without your support. Thank you for building our first server and being an administrator that supports creativity and innovation in technology.

Finally, to my students, you are my source of inspiration and purpose in life. Thank you for being my fellow "virtual pioneers" on this journey. Thank you for putting your trust and faith in me. To my pilot study and four case study participants, Cayce, Nano, Wonder, Celeste, and Sterling, thank you for sharing your expertise and experiences through gaming. This dissertation would not have been possible without your stories. Keep creating and sharing your voice with the world!

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CHAPTER I: INTRODUCTION

Over a billion people around the world are engaged in online gaming (Spil Games, 2013). In America alone there are 183 million active gamers who play video games an average of thirteen hours a week (McGonigal, 2011). Millions of these gamers are children of all ages playing games on hand held devices, gaming consoles, and computers. Each day, millions of kids log into popular massively multiplayer online role-play games (known as MMORPGs) in which they socialize, play, compete, explore, and create content while embodied in the form of a virtual avatar. The games may be designed or moderated by adults but the children have become the experts in these 3D worlds (Meyers, 2009).

At the start of my doctoral studies, my qualitative research professor introduced me to the multi-user virtual environment (MUVE) of Second Life. I never considered myself an avid gamer and did not take the time to play video games as an adult. Yet I knew that many kids were spending a great deal of time playing video games. I had not truly experienced the advancement in game design that had occurred since I stopped playing my *Atari* and *Nintendo* games in the early 1990s. This is curious, considering that there is growing evidence that girls tend to give up video games by the end of their middle school years at about the time they decide that math and science are "unfeminine" (Gee, 2007). Gee notes that modifying video games during the teenage years appears to be a route toward future jobs in informational technology. It was my doctoral studies and my love for digital story-telling that drew me back into video games.

Conversations with my own students led me to realize that they were living an alternate reality after school. I was intrigued to find out about the "other lives" my students were living through these online fantasy role-play games. A role-playing game (RPG) is a fictional virtual space in which the player assumes the role of a character (Harrigan & Wardrip-Fruin, 2007)

within the narrative and problem solves their way through the game structures (Cover, 2010). I discussed these role-play experiences with my students and soon began to see that these video game "stories" were very much like interactive book series for them. One student even reported that the game *World of Warcraft (WoW)* taught him the vocabulary he needed to pass a Shakespeare reading assignment in his English class.

Children are engaging in collaborative efforts to create and complete complicated tasks within video game worlds. The phenomenon known as "Tipping the Iceberg" in the video game *Club Penguin* is well documented as evidence of children collaboratively problem solving to try to tip an iceberg within the game (Meyer, 2009). In a pilot study I conducted for one of my doctoral courses, my participant referenced the phenomenon in an interview about her learning experiences in video game environments. She described how she actively participated with others to problem solve ways to tip the iceberg (S. Smith, personal communication, September 7, 2012). This account supports the research concerning *Club Penguin*. The participant described many "iceberg tipping" scenarios that Meyer also observed. Even though the players never tipped an iceberg within the game, the many elaborate plans generated by the players is evidence of the highly collaborative nature of video game communities.

Through a pedagogical lens, I viewed these conversations as an epiphany in my teaching and future scholarly work. The concept of an entire parallel education taking place after school intrigued me (McGonigal, 2010). I wondered who was teaching our children in these video game worlds. If children are learning skills through video games, educators and researchers should seek to identify those skills and determine if they can predict academic success. Students should be encouraged by teachers to transfer these 21st century skills and strategies into the real world beyond the game.

Theoretical Framework

The theoretical framework for this sequential mixed model research study is based in connectivism, social constructivism, social constructionism, positivism, and interpretivism. Connectivism is the learning paradigm for the 21st century and a learning theory for the digital age (Siemens, 2005; Tucker, 2014). Siemens notes "connectivism presents a model of learning that acknowledges the tectonic shifts in society where learning is no longer an internal, individualistic activity" (p. 7). This collaborative learning theory relates to constructivist pedagogy in which students are encouraged to work together to problem solve, acquire knowledge, and share ideas (Tucker, 2014).

The research field that studies gaming or virtual environments is rooted in social constructivism (Klopfer &Yoon, 2005). Constructivism assumes that reality is formed from the mind of the learner though his or her own construction (Dewey, 1938; Vygotsky, 1978). This social constructivism theory supports the learning of students to learn through collaboration, hypothesis testing, and experimenting (Klopfer &Yoon, 2005) while constructionism focuses on the constructed artifacts of a group that are created through social interactions. These social interactions allow humans to share, reify, and rationalize their experiences through model creation or artifacts of the social world and their language (Leedz-Hurwitz, 2009).

Rationale for the Study

James Paul Gee is one of the most quoted scholars in the field of video game study. Gee has devoted several books and a plethora of articles to the design of video games and their ability to challenge learning and maintain engagement. Gee feels that people learn best from a well-designed guided experience (Gee, 2010). He believes that game designers create digital environments with game levels to provide a structure for learning and problem solving (Gee,

2010). Gee utilizes an autoethnography approach to his research. His writings convey his experiences and observations with games and learning. He provides extensive examples of how games have taught him and he presents ideas on how educators might teach through these simulated environments. By immersing one's self in the game, players can experience the simulation and respond to the environment as they would in real life. As a linguist and literacy scholar, he provides insight into the "learning structures" of games. It should be noted that Gee's (Gee, 2003, 2010) research is based on games that are action-oriented and structured such as *Civilization, The Elder Scrolls III: Morrowind,* and *Rise of Nations* to name a few. In Gee's book, *What Video Games Have to Teach Us about Learning and Literacy* (2003), he lays out 36 principles of learning.

After reading his book, I decided to play a popular video game referenced in his research, World *of Warcraft (WoW).* The International Society for Technology in Education (ISTE) has a Massively Online Open Course (MOOC) group that gameplays in virtual worlds like *WoW, Minecraft,* and *Second Life* in order to study the potential of these new literacies and their learning structures. I separated myself from the content and played to observe the "learning structures" that Gee points out. What his research has shown is that video games are designed to teach the gamer how to play and advance through the game. This is what I experienced playing *World of Warcraft*. The learning structures of games are set up to provide instant feedback and steps to advance to the next level just when the gamer needs it most (Dickey, 2005; Gee, 2003). Gee raises the point that children will play games that are incredibly difficult for hours and yet not give up. The structures support and motivate the player to keep going.

As Jane McGonigal (2011) writes in her book *Reality is Broken: Why Games Make Us Better and How They Can Change the World*, a good game provides unnecessary obstacles that

we voluntarily accept in order to put our personal strengths to better use. These obstacles are learning structures designed to present challenges. Game creators design games this way to maintain gamer engagement. Both McGonigal and Gee explore how game design might be implemented to make school as engaging as a video game, thus challenging students through virtual simulations to learn, predict, and solve the future problems of the world.

Minecraft is a 16-bit sandbox video game that will run on most computers and mobile devices unlike other games that demand more hardware and substantial graphics cards. It was originally created by a Swedish programmer, Markus "Notch" Persson (known as "Notch" to *Minecraft* players) and published by the game developer *Mojang*. It is a natural technological fit for an average K-12 computer lab that is unable to handle and process high graphics demands. The content of the game is user-friendly. The avatars and the environments look very much like they are made of *Legos*. The enormously popular game boasts over 100 million registered players worldwide for the original PC version alone (Persson, 2014). This does not include players on mobile devices or newer releases of the game. *Minecraft* is a hybrid game with action-oriented learning structures and creative sandbox features. It gives players a choice to build in creative mode with unlimited resources or play in survival mode in which they have to gather their own resources, craft, and fight off attacks from monsters and other players. Other playing modes include hardcore, adventure, spectator, and multiplayer modes each with their own set of rules and player restrictions. In *Minecraft*, players are also able to build machines in the game and modify the game's programming. "Modding" is the modification of software and hardware to create a virtual function that the original creator unintended. *Minecraft* mods can change the mechanics of the game to create an entirely new playing experience. Modders are

independent developers or players that design content for games like *Minecraft*. Many of these modders are teenagers.

The Partnership for 21st Century Skills established by the National Education Association (NEA) has called for the teaching of the "Four Cs" in education. These four skills (Critical Thinking and Problem Solving; Communication; Collaboration; and Creativity and Innovation) are essential for student success in meeting the needs of the global economy. Workforce executives' report that students are not prepared to perform work related tasks that require the application of 21st century skills (NEA, 2010). The desire to explore if video games could effectively train students to work in a global society contributed to the rationale for this study. The researcher sought to collect data from digital natives that can help predict academic success, provide educators with a better understanding of the learning experiences of their students through video game environments, and explore virtual worlds as a tool for learning. It attempts to discover the 21st century skills that gamers acquire during after school hours that might help predict academic success.

Research Purpose and Questions

The purpose of this sequential mixed model research study was to explore the predictors of academic success and the 21st century skills gamers are learning through video game experiences. The study examined the predictors of academic success and what is learned through gaming experiences from the perspectives of South Texas area high school students enrolled in three 3D Modeling and Animation courses. These questions informed the research study:

1. What are the predictors of academic success in a 3D Modeling and Animation course?
2. What do participants learn from working in a video game environment? How might participants apply these real world skills?

3. How do participants apply strategies and collaborate in order to problem solve tasks while working in a video game environment? In what ways do participants apply strategies to help themselves in a video game environment?

Operational Definitions

The following operational definitions are used to describe specific experiences in this study.

Game-based Learning – Integration of a game utilized to teach or deliver content and curriculum to students.

Spatial Reasoning Skills – Ability to imagine and manipulate 2D and 3D objects.

Role-Playing Game – Game that incorporates a main story and calls upon a player to utilize a variety of literacy skills to complete missions by assuming the role of a fictional character.

Massively Multiplayer Online Role-Playing Game – Game that incorporates a main story and calls upon a large number of players to utilize a variety of literacy skills to complete missions by assuming the roles of various fictional characters online.

Virtual Environment – A virtual environment is an immersive 3D world in which the participant utilizes a variety of literacy skills to move and navigate in the space.

South Texas – A region in the state of Texas that is south of San Antonio and borders Mexico, also known as the Coastal Bend.

Subjectivity Statement

I have the spent the last five years immersing myself in the gamer youth culture and

exploring the learning structures of games. In addition, I have challenged myself as a teacher to move beyond being a consumer of games to a creator of virtual content and intellectual property. My intent was to better understand my students' learning styles and to acquire knowledge to teach. This study explores the predictors for academic success and the 21st century skills gamers are learning through video games. To understand my own subjectivity, I specifically offer some of my gaming experiences.

It was upon entering my doctoral program that I first delved into a virtual environment for educational purposes. My professor incorporated the use of *Second Life* into my qualitative research methods course and we utilized it for ethnographic purposes. *Second Life* is the most popular 3D multi-user virtual environment (MUVE) in the education domain (Minocha, 2010; Reeves & Shailey, 2010). My assignment was to study a subculture of *Second Life* and conduct research with the permission of the participants. My first encounter with other avatars in *Second Life* was on the education simulation (sim) owned by the International Society for Technology in Education (ISTE). The docents (volunteer guides) of ISTE Island were educators who volunteered their time helping new avatars acclimate to their new virtual surroundings. A virtual world like *Second Life* was the perfect place to collect stories. It provided me with opportunities to build and share experiences (Clark & Maher, 2001) with other educators from around the world.

Figure 1. First encounters with subculture, ISTE island (January, 2011) – *Second Life* -

Katherine Hewett©

Virtual reality grids proved to be a powerful medium for distance learning and professional development.

Figure 2. Virtual worlds conferences – *Second Life* and *Opensimulator* grid - Katherine Hewett©

I knew that in order to understand the culture I had to immerse myself deeper into these virtual communities. I decided to seek groups outside the educational areas of *Second Life*.

Figure 3. Texas Capitol and Presidio La Bahia (2013-2016) – *Second Life* - Katherine Hewett©

I also began to learn how to design in 3D worlds. I had to learn how to terraform using CAD tools built into the interface of the game engine to create and model an island.

Figure 4. Island of Dominica (2013-2016) – *Second Life* - Katherine Hewett©

I researched the history, botanicals, and marine life of Dominica and incorporated educational markers. Visitors were able to click and interact with markers and find information or videos.

The largest 3D modeling project I helped to create was a replica of Buckingham Palace. The build was replicated with two fellow creators and 3D modelers, Jacon Cortes and Crotian. Replication was based on research and the general style of the Regency era.

Figure 5. Buckingham Palace-3D model: Crotian, Twelfth Night, and Jacon Cortes (2012-2016) – *Second Life* - Katherine Hewett©

The entire palace from the furnishings to the actual structure was player-created. It is an example of how average sandbox gamers created artistic content in their free time.

James Paul Gee's research challenged me to delve deeper into the action-oriented games of the gaming youth culture. I played many of the popular MMORPG games like *World of*

Warcraft, *The Elders Scrolls Online*, *Guild Wars 2*, *Final Fantasy XIV: A Realm Reborn*, *Final Fantasy XIV: Heavensward*, *Star Wars: The Old Republic*, and *League of Legends*. These games were action oriented role-play games with learning structures designed to guide the player through the leveling process of the game's main story.

Figure 6. Healer – *World of Warcraft* - Katherine Hewett©

Missions were complex and required a good amount of strategy, reading, and failure to overcome. These experiences gave me a better understanding of my students' learning styles. The game provided learning structures to help me advance and "level-up" when needed. I could sense when I was improving and when I was being challenged by the difficulty of the quest, mental puzzle, or battle. It was very much the experience of stepping into a book or a film and becoming the character.

Figure 7. Veteran wood elf – *The Elders Scrolls Online* - Katherine Hewett©

To better understand the perspectives of my subjects and participants, I decided to play

some of the games I knew they played regularly. I leveled up a Bard in the game *Final Fantasy XIV: A Realm Reborn*.

Figure 8. Bard – *Final Fantasy XIV: A Realm Reborn* - Katherine Hewett©

I also explored the economy system of *Final Fantasy*, and like *ESO*, it was a complex system of supply and demand. Crafting clothing, furniture, and jewelry for the game's market economy gave me the opportunity to manage my game profits. To interact with a market board, the player simply clicks on the board to open a menu. Inside that menu are categories sorted by purpose. Players can compare prices with other players and determine which price is the best deal according to their needs, finances, or desires.

Figure 9. Market board – *Final Fantasy XIV: A Realm Reborn* - Katherine Hewett©

I spent time in the popular MMORPG known as *Guild Wars 2* upon the recommendation of another case study participant. Upon entering the game, the player is asked a series of

questions to set up the personal narrative for the character. Based on players' responses, the character's history and profile is written into the main story. As the player levels up through the game, it is revealed what the character's connection is to the narrative. Like *Final Fantasy* and *ESO*, *Guild Wars* features elaborate and lengthy narrative cutscenes for the player to watch and books for the player to read.

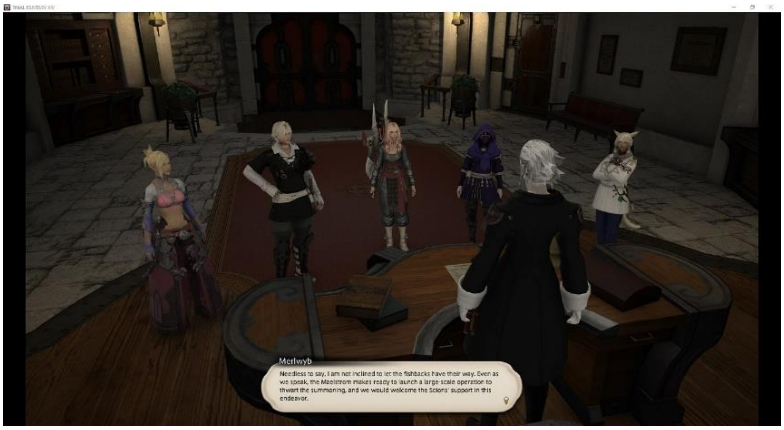

Figure 10. Main story cut-scene – *Final Fantasy: Realm Reborn* - Katherine Hewett©

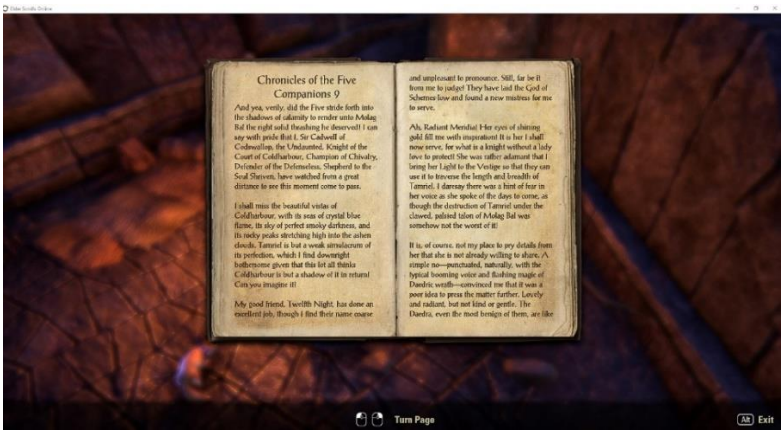

Figure 11. ESO lore book – *Elders Scrolls Online* - Katherine Hewett©

My niece, prompted me to a play the game, *Wizard101*. This children's MMORPG revolves around a main story about a school for witchcraft and wizardry. After I showed her how we could play together by logging into the same server, we spent hours lost in the story's narrative. It allowed me to reflect and connect to the feelings my participants expressed when

they described their stories of playing video games with their parents and families.

Figure 12. Battle – *Wizard101* - Katherine Hewett©

My niece and I also spent some time playing *Pirates101*. The game features a turn-based combat system like its sister game *Wizard101*. It differs in its board game style of play. The game features a main story that guides the player through the game. Step by step instructions and tips are also programmed into key areas to help players learn the game. It has many of the action oriented features similar to *WoW*, *Final Fantasy*, *ESO*, *Star Wars: The Old Republic*, and *Guild Wars 2*.

Figure 13. Buccaneer pirate – *Pirate101* - Katherine Hewett©

The game is divided into books and each book of quests features its own chapters. Players complete each chapter of the books as they level up. The story is rich and struggling readers can follow along with the characters' audio dialogue.

Figure 14. Buccaneer pirate – *Pirate101* - Katherine Hewett©

Each passage appears at the bottom of the screen in a text bubble with the character providing the voice over. Readers or players can progress through the reading at their own pace.

In 2013, I implemented a new technology applications course known as 3D Modeling and Animation. The course's standards included virtual environments and virtual design skills in its curriculum. I implemented the video game *Minecraft* and the virtual grid of *OpenSimulator* into the classroom. These proved to be safe environments for my students and both could be run off a private server. This was the first time they had played a mainstream multiplayer video game in a classroom with their peers for educational purposes. It was my first experience teaching students in avatar form. Together we modeled and created historical landmarks like the Cathedral of Notre Dame.

Figure 15. Game-based learning integration – *Minecraft* - Katherine Hewett©

My pilgrimage to PAX (Penny Arcade Expo) was the culminating moment of my

doctoral studies in this area of game study. PAX is one the largest gaming conventions in the world and hosts expos around the world by regions (PAX East, PAX South, PAX Aus, PAX Prime, and PAX Dev). This was a unique opportunity to experience the phenomenon of video games and their culture on a grand scale.

Figure 16. Trade show and console freeplay area, PAX South - Katherine Hewett©

PAX South featured a massive trade show with video game companies demonstrating the latest technologies and game content. It also featured areas for gamers to meet up as a community, play games of all kinds, and attend sessions with independent game developers.

In conclusion, my own subjectivity guided me in how I designed my questions for the subjects and participants of the study. I felt a strong sense of obligation to play and experience the games for myself as the researcher. For case study reasons, I offer this statement as proof of my commitment to immerse myself into the culture of video games and my desire to saturate myself in this field of study. The qualitative paradigm allows for researchers to have subjectivities that stem from their relationship with the topic (Peshkin, 1988). I offer this account as evidence of my commitment, trustworthiness, and rigor.

Significance of the Study

While scholars in the field understand that games can be valuable simulation tools, there has been limited research on the effectiveness of gaming and virtual environments in schools

(Chen, Siau, Nah, 2012) or how the implementation of video games or virtual worlds in actual classrooms translates into student success. Bellotti, Bottino, Fernández-Manjón, & Nadolski, (2014) state that there is a growing need for educational technology research in the field of digital games. While universities have begun to gather data on their programs, evidence and articles related to the successful implementation of virtual environments in K-12 schools are needed. Scholars know that students are learning skills in these environments, yet most of the research has been conducted with college students. "There are few case studies examining the learning potential of secondary students through the act of creating a video game" (Alexander, & Ho, 2015, p.28). In the 2010 National Education Technology Plan, the Secretary of Education discusses the need for research and how "assessment technologies, such as simulations, collaborative environments, virtual worlds, games, and cognitive tutors, can be used to engage and motivate learners while assessing complex skills" (United States Department of Education, 2010, p. 15; McClarty, Orr, Frey, Dolan, Vassileva, & McVay, 2012). While studies are limited, some are finding that video games support literacy learning and have a beneficial impact on learners (Clarke & Treagust, 2010).

The cost of implementing emerging technologies has prevented K-12 schools from utilizing virtual environments for learning in the classroom (Morgan, Kriz, Howard, Neves, & Kelso, 2001). Teachers are just beginning to implement these spaces in their courses and are facing technology hurdles. A 3D virtual environment software or video game requires certain technology hardware and graphics cards. The expense of setting up a server and the logistics of imaging and setting up a classroom lab of computers is costly. In the past, this has limited schools from implementing virtual spaces. K-12 teachers have faced more restrictions than educators at the university level. Researchers also face tougher Institutional Review Board

approval when researching K-12 populations. For this sequential mixed model study, the researcher implemented the use of a mainstream video game, *Minecraft*, in a public school classroom. It was a new experience to record and a chance to contribute data to this new field of research targeting a secondary (9-12) population. Before the study, the researcher found many articles written on promoting the implementation of *Minecraft* as an education tool. However, research studies on the integration of *Minecraft* in the classroom were more limited than research on video games in general. The significance of the study is to contribute to the growing body of research within the field of game-based learning, virtual worlds, and video games.

CHAPTER II: REVIEW OF THE LITERATURE

A systematic review of the literature into game-based learning, literacy, digital literacy, and video game research informed and guided this study. This chapter outlines a review of these topics to support the research questions. The following themes emerged from the review of the literature: (1) The Evolution of Digital Literacies; (2) 21st Century Skills: The "Four Cs"; (3) Video Games for the Development of 21st Century Skills: Gameplay and Game Design; (4) Virtual Identity and the Rise of the Avatar; (5) The Cultural Evolution of Bicultural Virtual Identity; and (6) The Digital Divide in Education.

The Evolution of Digital Literacies

Reading, reading instruction, and a broad notion of literacy has changed as technologies explore new literacies and exploit their potential (Coiro, 2003; Kinzer & Leander, 2003; Lankshear & Knobel, 2003; Leu, 2000a; Smolin & Lawless, 2003). Students redefine literacy practices daily through their discourse practices in chat rooms, talking with friends on Skype, and through their social interactions within MUVEs, MMOs, and MMORPGs video games (Cammack, 2002; King & O'Brien, 2002; Kinzer, 2003; Lewis & Fabos, 1999). Their ability to alter their identities online and how they communicate utilizing these new immersive technologies has linguistic implications for the development of language, literacy skills, and technology (Crystal, 2001).

In 2007, the Immersed in Learning project sought to evaluate the use of 3D worlds as a literacy tool to teach digital media and promote creativity. The study was conducted by the School of Art & Design at the University of Wolverhampton in the United Kingdom. Doyle (2010) examined the benefits of integrating 3D immersive learning with face-to-face learning for students who were already comfortable inhabiting the digital realm (p. 99). The study followed

the development of Kriti Island in *Second life* and it how it quickly became a virtual world that provided a space for real collaboration on a national and international level. The success of the island led to ongoing research questions. Doyle found that the *Second Life* platform not only provided a virtual space for creative practice but also a space for students to explore concepts that would be impossible to explore in real life. In their book, *Learning and Research in Virtual Worlds,* Hunsinger and Krotoski (2010) write about the success of the research program and promote a deeper focus on the use of virtual worlds for creative practice. They report that virtual worlds provided the ideal environment for group projects, mutual exploration, shared acquisition of knowledge, and building skills for the study participants. They believed virtual worlds offered students an interactive learning environment where they could collaborate in real time with one another. They reasoned this interactivity could have been more difficult to achieve in other course management systems or in every day traditional classrooms. The Immersed in Learning project demonstrated that a virtual world or video game offered students boundless creative and innovative opportunities that go beyond the physical limits of the researchers and learners. In order to create meaningful literacy experiences in virtual worlds for children, Hunsinger and Krotoski suggest we need to understand the culture of the society within virtual worlds as well as the context. They have found that these spaces offer unique and customized social learning environments that are tailored to rich situated learning. This type of creative combination is difficult to reproduce in textual environments. Therefore, in this study, virtual worlds provided better visual engagement and interactivity to help students develop a wide range of literacy skills and technology practices reshaping the definition of reading and literacy in the process.

These new virtual technologies and their social networks represent a wide range of literacy practices involving not only print, but also images, sounds, performance, and language

(McLean, 2010). How students use these media literacies to communicate is directly related to the acquirement of skills, culture, and information through practice. McLean reports that students learn technical, creativity, and communication skills while developing an appreciation for diversity through virtual spaces or games. In an ethnographic research study on transnational Internet literacy practices conducted by Miller and Slater (2000), researchers found that the "internet provided young people with a natural platform on a global stage for enacting core values and national pride" through social networking (McLean, 2010, p. 3). Students found themselves exposed to diverse cultural affinity spaces online. At the same time, these students exhibited a strong sense of their own identity. The study found that the Internet provided students with a platform to share their voices and culture with the world utilizing various forms of literacy practices. McLean further describes Lam's (2006) research which found that students used digital media networks to develop relationships. These studies showed that the "invocation, construction, and performance of the literacy and identity-making practices" were not limited to the real world. These are examples of how McLean, like Hunsinger and Krotoski, believe that digital technologies and virtual social networks represent a range of literacy practices.

In 2013, the Pew Research Center published a study on the "Impact of Digital Tools on Student Writing and How Writing is Taught in Schools." Purcell, Buchanan, and Friedrich (2013) found that digital technologies do shape reading, reading instruction, and the definition of literacy. Specifically, the study noted that digital tools or worlds impacted student writing in various ways. They reported that 96% of teachers in their study saw these digital worlds as a means to encourage their middle and high school students to write in different formats for specific audiences via various media. Purcell, Buchanan, and Friedrich also noted that 79% of the teachers surveyed agreed that digital tools encourage collaboration and 78% felt that these

technologies encourage creativity and personal expression.

In 2006, Meyers (2009) reported a case study example of this literary and discourse phenomenon via a popular children's online video game known as *Club Penguin*. According to Meyers, a meme began to circulate among the *Club Penguin* community about whether or not tipping one of the game's icebergs was possible. Penguins began to gather and problem solve ways to tip the iceberg. Meyers noted the "activity became the focus of considerable information seeking, writing, video, and image creating" (2009, p. 233). Meyers uses this case example to make the point that the technical and social logistics to log in to chat with a created identity (avatar) for the purposes of sharing with others is a way to practice literacies and skills. These skills are "transferable" to other applications and demonstrate how virtual worlds can impact education. In order to fully understand the potential and the effective power for learning that virtual spaces or games can possess, Meyers suggests that the teacher must adopt a sociocultural view of literacy. In school, the perspective is connected to the culture, history, and social contexts that condition the literary practices of the virtual environment. Anderson (1991) agrees and adds that virtual spaces provide teachers and students both with opportunities to express their identities through interactive literacy practices unique to virtual spaces. These interactive spaces are created either by the teacher's or student's imagination and are only limited to the resources of the environment (Anderson, 1991, p. 6). It is this same imagination and interactivity that Crowe & Bradford (2006) believe lies at the very essence of virtual reality. Therefore, Meyer believes that virtual worlds offer tremendous potential for learning, creativity, collaboration, and problem solving to develop a wide variety of literacy skills through social networking and information sharing. These skills are encouraged for innovative project learning and give students an array of communication and technology skills to utilize (Stuht & Colcord, 2011).

21st Century Skills: The "Four Cs"

The National Education Association (NEA) is an organization promoting 21st century readiness through the establishment of the Partnership for 21st Century Skills (National Education Association, 2015). They provide resources and tools to educators to help prepare students for a global economy and have created a framework of skills that are designed to meet the demand for future innovation (Tucker, 2014). The framework for 21st Century learning can be divided into two categories: support skills and student outcome skills. Under the learning and innovation student outcomes, there are four specific skills identified as important to learning and are commonly referred to as the "Four Cs" (Claymier, 2014; Hunt, 2013). These "Four Cs" skills include Critical Thinking and Problem Solving; Communication; Collaboration; and Creativity and Innovation. 21st century learning is considered the acquirement of work or life skills that include technology fluency and literacy along with the "Four Cs" and societal awareness. These "Four Cs" are considered essential skills for future employment by workforce executives looking for competent employees (Sardone & Delvin-Scherer, 2010).

Workforce development literature supports these 21st century skills as a means for success in both college and careers in a globalized high tech world (Friedman, 2005; Schuman, Besterfield-Sacre, & McGourty, 2005; Jacobsen-Lundeberg, 2013; Trilling & Fadel, 2009). According to Tucker (2014) these skills are essential to global competition, accelerated changes in technology, and rising workforce competencies. In a 2010 study, conducted by the American Management Association, known as the AMA 2010 Critical Skills Survey, the association measured the importance of the "Four Cs" and their impact on the future (NEA, 2010). Executives (75.7%) agreed with the need for these skills and competencies as well as their importance to their own organizations in the next three to five years as they look to grow in

today's global economy. These executives (80%) also believed that teaching these skills to students would help prepare them for the future. Workforce managers in the study also stressed the importance for students to develop these skills because they surpass the basics of reading, writing, and arithmetic. These skills enable employees to think critically, problem solve, collaborate, and communicate effectively. The NEA notes that only employees "who have the knowledge and skills to negotiate constant change and reinvent themselves for new situations will succeed" (p. 6). Ledward and Hirata (2011) agree with the need for proficiency in critical thinking, problem solving, communication, and teamwork. Fandiño (2013) also suggests that these skills will help students thrive in a new global economy that demands they access, synthesize, and communicate information effectively. They must be able to work to solve complex problems collaboratively and discover new knowledge via 21st century technologies.

Sardone & Delvin-Scherer (2010) outline a case for these essential skills based on a mixed-methods study that measured students' abilities to recognize their own motivational factors and learned 21st century skills associated with digital games. The study looked at undergraduate education majors working on a game-based learning project with middle school students. Sardone & Delvin-Scherer recorded impressions of participants regarding their motivation, and the playability and manageability of video games. They recorded qualities in regards to learning and innovation as they related to 21st century skills. They interviewed focus groups and recorded participants' experiences and reactions to the game-based learning environment. They discovered that students were indeed "able to detect the learning skills embedded in video games" (p. 409). They also noted that "peer modeling and positive responses" with the middle school students appeared to impact the participants' decision to use video games for instructional purposes. The results showed that the participants' content

knowledge and pre-service teacher reactions to video games were important factors. Sardone and Delvin-Scherer found that games do indeed offer ways to teach and develop 21st century skills with students. These skills are similar to the ISTE Standards that include Creativity and Innovation; Communication and Collaboration; Research and Information Fluency; Critical Thinking, Problem Solving, and Decision Making; Digital Citizenship; and Technology Operations and Concepts, as developed by the International Society for Technology in Education (ISTE) (Higgins, 2014). The American Association of School Librarians (2007) also has developed a similar set of standards and frameworks for learning 21st century skills.

Technological advancements have created a need for these skills and educators are being called upon to develop them with students in the classroom so that students are college-ready and ultimately career-ready (Li, Lemieux, Vandermeiden, & Nathoo, 2013). While younger workers are viewed as "tech junkies" they are lacking in the talent qualifications or career interests to design 21st century technologies because students are making college and career decisions based on an outdated 20th century career culture (Gordon, 2009). Gordon notes a study by the U.S. Department of Labor which found that "62% of all U.S. jobs now require two-year or four-year degrees and higher, or special postsecondary occupation certificates or apprenticeships" and these requirements will increase to include 75% of U.S. jobs (p. 28). This is problematic for the U.S. when considering that one in four high school seniors are deemed college-ready (ACT, 2010; NEA, 2010). This number is based on four national retention studies known as, "What Works in Student Retention" (1980, 1987, 2004, and 2010) conducted by ACT and supports Gordon's point that students are not graduating college-ready which ultimately impacts career-readiness. ACT conducts research and collects data from colleges and universities to help identify practices on college student retention and persistence to degree-completion. It should

also be noted that one-third of college students begin their college careers by taking at least one remedial course (NEA, 2010; Wirt, 2004). According to the NEA, most schools have neither the learning environments nor the instructional programs in place to model these college-ready and career-ready expectations or the measures to equip students with the skills and knowledge to be successful in a global economy. In an attempt to meet this need, many school districts are looking toward technology integration and have moved to adopt one-to-one laptop initiatives or simply allow students to bring their own devices to school (BYOD policies) (Donovan, Green, & Mason, 2014; Lowther, Inan, Ross, & Strahl, 2012).

Critical thinking and problem solving. The NEA states that America's education system was built on an economy and society that no longer exists. Scholars believe we have moved from an economy built on the need for manual labor to a global economy structured on the process of assimilating data in people's right brains (Jones, 2014; Pink, 2006). Gordon, Jones, and Pink agree that there is a shift in society toward jobs that require higher levels of education, technology proficiencies, and critical thinking and problem solving skills. Skilled workers who can design, create, and manage 21st century technologies are highly sought in today's workforce. However, managers feel many employees do not have these 21st century skills they need and that they should have learned them in school. Jonassen (2007) writes that 21st century problem solving can be cognitively demanding on poorly prepared employees and students. Often students find it difficult to discuss ill-defined and ill-structured real world challenges (Antonenko, Jahanzad, & Greenwood, 2014).

Thomas, Ge, and Greene (2011) conducted a technology-rich ethnography (TRE) study to explore the use of game design with programming students to develop 21st century skills. They examined how students engaged in problem solving within the classroom utilizing game

design. The researchers asked the participants for the study to create video games for elementary school children by utilizing a popular 3D multi-user learning environment knows as *Quest Atlantis* (QA). Six games were created and incorporated into the game for the elementary audience to play. The games included common features like feedback systems, backstory, levels, rules, cheats, and compelling graphics to interest the children in gameplay and engage the student designers in learning. The children provided feedback to the student game designers. Thomas, Ge, and Greene found that designing gave students an opportunity to learn how to code or program while using their critical thinking and creativity skills. They discovered that using video games and game culture allowed students to approach problem solving scenarios in a fun way and provided them with a space that was safe and familiar to them. The student designers used instructional scaffolding to problem solve, communicate, and brainstorm their ideas based on the feedback of the elementary audience. Overall, the quality of the games demonstrated more complexity and creativity than a similar study (Ge, Thomas, & Greene, 2006) they had previously conducted. Their studies are an example of how scholars are now researching the benefits of gameplay and game design to teach problem solving, creativity, and critical thinking. Thomas, Ge, and Greene believe game worlds provide an affinity space to practice and develop skilled problem solvers. Scholars find that repeated exposure to video games enhances these critical thinking and problem solving skills (Day, Arthur, & Gettman, 2001; Delisi & Wolford, 2002; Gee, 2007; Ravencroft & Matheson, 2002; Sardone & Delvin-Scherer, 2010).

The National Reading Council (2010) reports that the need for these skilled problems solvers will only continue to grow over the next five to ten years. However, the current education system that is supposed to prepare students for a global workforce still remains slow to change. To best prepare students for these jobs of the future we must have a clear understanding

of what skills workforce managers are requiring of their employees. Therefore, a defined meaning of critical thinking and problem solving is needed to better understand the need that these scholars are describing.

The Partnership for 21st Century Learning Skills (NEA, 2010, p. 8-9) defines critical thinking and problem-solving as described in Table 1:

Table 1

NEA Definition of Critical Thinking and Problem Solving - 21st Century Skills

Critical Thinking and Problem Solving
Reason Effectively ➢ Use various types of reasoning (inductive, deductive, etc.) as appropriate to the situation **Use Systems Thinking** ➢ Analyze how parts of a whole interact with each other to produce overall outcomes in complex systems **Make Judgments and Decisions** ➢ Effectively analyze and evaluate evidence, arguments, claims, and beliefs ➢ Analyze and evaluate major alternative points of view ➢ Synthesize and make connections between information and arguments ➢ Interpret information and draw conclusions based on the best analysis ➢ Reflect critically on learning experiences and processes **Solve Problems** ➢ Solve different kinds of unfamiliar problems in both conventional and innovative ways ➢ Identify and ask significant questions that clarify various points of view and lead to better solutions

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According to the Partnership for 21st Century, in order for students to reason effectively they must apply "systems thinking" in order to comprehend how the parts of a whole interact and

link together. This means that students must be able to judge, decide, and solve problems in both conventional and innovative ways. Mayer (2011) agrees and adds that quality games provide student gamers with opportunities to explore meaningful questions while strengthening inquiry-based skills through gameplay.

Communication and collaboration. Students should be able to effectively articulate their ideas and thoughts through various communication tools (Donovan et al., 2014). The Partnership for 21st Century reports that not only is it important to make sure students possess the ability to articulate ideas through oral, written, and nonverbal communication but they must also able to listen to decipher meaning. Video games can help develop these communication and collaboration skills through the use of video game chats, voice streaming websites, playing with friends, and various digital tools. The ability to listen and communicate effectively impacts the outcome of teamwork in a video game. These environments offer rich immersive learning spaces to apply a variety of 21st century literacies (visual, technological, and textual) through collaborative gameplay.

A content analysis study conducted by the New Mexico State University Learning Games Lab (NMSU's Learning Games Lab, 2003) reported middle school students' preferences for playing video games and the implications video games have related to collaborative learning environments (Trespalacios, Chamberlin, & Gallagher, 2011). The study addressed the acquirement of 21st century skills relating to communication and collaboration. The researchers invited children to play video games in a summer research lab. After each research session the students were asked preference questions through various settings. Results showed that the students preferred to work in groups and were motivated by companionship, collaboration, competition, and challenge. In addition, the data showed that 72% out of 72 students preferred

playing multiplayer games rather than single player games. Trespalacios, Chamberlin, and Gallagher discovered that 30% of the students collaborated with others players to meet goals and 34% preferred multiplayer games because it allowed them to play with friends. The content analysis phase lead to the development of three major themes: company, collaboration, and competition. These themes had a direct impact on the preferences of the students in the study. These outcomes show that the students enjoyed working as a team and building their social and collaboration skills. Different skill levels or levels of expertise among players enhanced these collaborative experiences. Their expertise or skills were learned and shared among the community as roles were defined through gameplay and as each player exhibited certain talents or skills. Listening effectively to acquire knowledge, values, attitudes, and intentions is a key factor to communicating successfully with diverse groups and environments (Partnership for 21st Century, 2011) and video games with their diverse cultural spaces are one type of digital tool that can give students a platform to practice these skills. Today's economy and society require skills related to interacting with people of varied linguistic and cultural backgrounds (NEA, 2010).

The Partnership for 21st Century Learning Skills (NEA, 2010, p. 14, and 20) defines communication and collaboration as described in Table 2:

Table 2

NEA Definition of Communication and Collaboration- 21st Century Skills

Communication
Communicate Clearly ➢ Articulate thoughts and ideas effectively using oral, written, and nonverbal communication skills in a variety of forms and contexts

	➢ Listen effectively to decipher meaning, including knowledge, values, attitudes, and intentions ➢ Use communication for a range of purposes (e.g. to inform, instruct, motivate, and persuade) ➢ Use multiple media and technologies, and know how to assess impact and their effectiveness a priority ➢ Communicate effectively in diverse environments (including multilingual and multicultural)
Collaboration	
	Collaborate with Others ➢ Demonstrate ability to work effectively and respectfully with diverse teams ➢ Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal ➢ Assume shared responsibility for collaborative work, and value the individual contributions made by each team member

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Collaborative problem solving is an essential 21st century skill that students need to develop in order to collectively solve dynamic real world problems (Antonenko et al., 2014). Jones agrees and adds that in order for students to effectively apply these collaboration skills in educational and life situations they must be taught these skills in school. The Global Digital Citizen Foundation refers to this skill as collaboration fluency (Crockett, 2015).

Creativity and innovation. Creativity and innovation is just as important as literacy (Aronica, & Robinson, (n.d.); Robinson, 2006). According to the Partnership for 21st Century Skills, creativity and innovation help develop student's abilities to think creatively, engage in creative collaboration, and implement new innovations (Donovan et al., 2014; NEA, 2010). Creativity is the crucial 21st century skill needed to solve pressing contemporary global issues (Robinson & National Advisory Committee on Creative and Cultural Education, 1999; Newton & Newton,

2014). It is a set of abilities, skills, motivations and states that are important for students to learn in order to deal with these real world problems (Hsiao, Chang, Lin, & Hu, 2014; Williams, 1972; Wilson, 2003; Torrance, 1972).

In a study conducted by the Department of Technology Application and Human Resource Development at the National Taiwan Normal University in Taiwan, four researchers developed a game-based learning system to foster student creativity. Hsiao, Chang, Lin, and Hu (2014) measured data gathered on two classes of fifth grade students. One class served as the experimental group and the other as the control group. The students were engaged in a classroom unit on "Electrical Science." The objective of the study was to determine the instructional strategies of the two classes. The researchers designed a digital game called ToES. One class received the game-based learning system while the other received traditional classroom instruction. The data results showed that the experimental group's creativity and performance on manual skills had a positive growth when involved in a game-based learning environment. Hsaio, Chang, Lin, and Hu found that not only was the digital game an effective learning tool but that there was also a positive effect on creativity and student performance. They also discovered that the game environment accelerated the "improvement of practical behaviors regarding manual skills" (p. 377). This study demonstrates how the use of a video game fostered creativity in students and provided them with an opportunity to practice their 21st century skills. The Partnership for 21st Century (NEA, 2010) agrees with Hsaio, Chang, Lin, and Hu and promotes game-based learning strategies utilizing video games as a means to practice skills. They believe that students must be able to utilize a variety of techniques to create new ideas. In addition, students must be able to then elaborate, refine, analyze, and evaluate to maximize their creative efforts while showing originality and inventiveness as an individual and

within a group. Based on their research, Hsaio, Chang, Lin, and Hu state that creativity is not an innate phenomenon but that it can be fostered and nurtured in students through 21st century learning. This study indicates thinking creatively and innovatively can be taught.

The Partnership for 21st Century Learning Skills (National Education Association, 2010, p. 25) defines creativity and innovation as described in Table 3:

Table 3

NEA Definition of Creativity and Innovation - 21st Century Skills

Creativity and Innovation
Think Creatively ➢ Use a wide range of idea creation techniques (such as brainstorming) ➢ Create new and worthwhile ideas (both incremental and radical concepts) ➢ Elaborate, refine, analyze, and evaluate original ideas to improve and maximize creative efforts **Work Creatively with Others** ➢ Develop, implement, and communicate new ideas to others effectively ➢ Be open and responsive to new and diverse perspectives; incorporate group input and feedback into the work ➢ Demonstrate originality and inventiveness in work and understand the real world limits to adopting new ideas ➢ View failure as an opportunity to learn; understand that creativity and innovation are part of a long-term, cyclical process of small successes and frequent mistakes **Implement Innovation** ➢ Act on creative ideas to make a tangible and useful contribution to the field in which the innovation will occur

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Advancements in technology have created a surge in a wide variety of creation tools and techniques that can be used by educators to teach creative thinking skills (Donovan et al., 2014).

Jones (2011) believes these advancements provide teachers with an opportunity to shift the emphasis of learning from "passive" to "active" through the design and creation of student products. Newton & Newton (2014) agree with Jones that this mind shift challenges teachers to foster students' creative thinking by constructing engaging lessons situated around their interests and allowing outcomes to happen naturally. Video games do indeed maximize creative boundaries of interactivity, virtual immersion, community design, and digital storytelling (Squire, (in press)) while delivering authentic learning opportunities that consider student interests and experiences (Alexander & Ho, 2015).

Video Games for the Development of 21st Century Skills: Gameplay and Game Design

According to Gee (2008), video games are a part of these new 21st century skills and literacies. "Paying attention to gaming and the "gaming lives" of students powerfully invites students to speak with us about how "literacy" itself is changing" (Alexander, 2009, p. 37). These new changes in literacy are being directly shaped by the "video game generation": the current generation of 21st century youths who have grown up in the era of video games (Bogost, 2007; Leonard, 2003; Martinovic, Burgess, Pomerleau, & Marin, 2015). Cognitive science research indicates that this video game generation experiences the world entirely differently than previous generations (Jones, 2014). Jones describes a new media rich world where the frontal lobes of youths' brains are stimulated daily by various forms of technologies. Qing, Lemieux, Vandermeiden, and Nahoo (2013) note that educators can tap into these engaging technologies for educational use by stimulating students' interests, creating opportunities for learning, and exercising 21st century skills by having students engage in rules-based video gameplay and become content and game designers. Project Tomorrow (2008) also promotes game design and gameplay as engaging ways to practice 21st century skills with students.

Gameplay for learning 21st century skills. It is obvious that children are interested in video games (Alexander, & Ho, 2015). In 2008, the PEW Research Center reported a study that looked at teenage video game usage and preferences. They found that 97% of teens aged 12–17 played computer, Web, portable, or console video games (Lenhart et al., 2008). This does not seem to be a surprise, as playing video games is a common activity for teenagers. Sardone & Delvin-Scherer (2010) reason that the popularity of video games naturally makes the subject matter more engaging and gamers like to be challenged to problem solve and understand difficult concepts. Hoffman and Nadelson (2009) observe that gamers by nature "typically exemplify behavior that is intense, purposive, and goal directed" (p. 245). They develop a "gamer disposition" that encourages them to adapt and creatively solve new ways to overcome obstacles (Brown & Thomas, 2008; Romero, Usart, & Ott, 2015).

Researchers are increasingly interested in the potential of video games because of their ability to enhance cognitive skills and learning through gameplay (Martinovic et al., 2015). A recent study from the University of California suggests that video games are beneficial to the human brain and researchers are eager to find out how the use of video games can benefit cognitive brain development (Jenkins, 2014). Anguera, Boccanfuso, Rintoul et al. (2013) looked at the game NeuroRacer to explore whether it could improve multitasking skills in older adults. The game is a designed to have the player steer a car while watching for key signs to appear along the road. The player must then determine whether that sign is a certain color or shape and if so must target and shoot down specific ones. The game challenges players to focus, task switch, and utilize working memory to hold on to information. The researchers, led by neuroscientist Gazzaley (Abbott, 2013), found that not only did the game improve multitasking, but the effects carried over into daily life and could last up to six months (Anguera et al., 2013).

It was also noted that the brain patterns altered as the cognitive skills improved with gameplay. They also reported that "this study offers neural and behavioral evidence of generalized positive effects from video game training on cognitive control abilities of older adults, with enhancements comparable to those observed in younger adults who are habitual action video-game players: interference resolution, working memory, and sustained attention" (p. 100). The researchers concluded that a "custom-designed video game targeting impaired neural processes in a population can be used to diagnose deficits, assess underlying neural mechanisms, and enhance cognitive abilities" (p. 100). This indicates that playing video games can have positive effects on the brain.

Dewey (1916, 1938) believed that students should be allowed to take an "active role" in their education and learn through a social and interactive process. Playing video games allows students do just this. Buchanan and Vanden Elzen (2012) describe this type of active gameplay as the "nature of the interactivity: the kinds of choices, the consequences of choices, and the feedback that teaches the player the relationship between a choice and consequence" (p. 21). Squire (2011) also describes a similar viewpoint in his research of how consequences can teach players about their choices. Squire notes that video gameplay offers players "a functional, or pragmatic, way of knowing, because we make meaning through interacting directly with the world and observing our actions' consequences" (p. 143). Students can evaluate choices, consequences, and the game's system in a well-designed game (Boltz, Henriksen, Mishra, & the Deep-Play Research Group, 2015). Bebbington and Vellino (2015) agree and add that these games provide students with spaces to create and share their expertise, information, and new ideas while developing information literacy skills through their social interactions and gameplay. Researchers continue to be interested in these gaming environments because they allow gamers

to “play” with complex literacy skills, multiple writing modes, and “develop a sense of how texts and visuals interact” (Alexander, 2009, p. 36).

Literacy scholars are engaged in pioneering work to call attention to “gameplay” and how gaming platforms can be used for educational purposes to promote 21st century literacy (Alexander, 2009; Gee, 2003; Gee, Hawisher, & Seife, 2007). In fact, the NEA reports that educators around the world have begun to use video games to teach reading and language skills. A study conducted by King Saud University in Riyadh, Saudi Arabia, AlShaiji (2015) investigated kindergarten students’ learning of English through the means of video games. The goal was to determine whether or not video games had a significant impact on the students’ learning outcomes when it came to reading and learning English. An experimental group and a control group were each measured to determine if there were any outcome differences between the two groups. The subjects for the study were 60 kindergarten females with no prior knowledge of English. They were divided between the two groups. The children took pre- and post-vocabulary exams that were age appropriate before and after gameplay (experimental group) and traditional instruction methods (control group). An ANCOVA analysis was performed to analyze the quantitative data. The results indicated that the group that received the instruction via a video game had a mean score that was significantly higher ($a=0.05$) than those in the group that received traditional instruction. The results indicated that video games had a positive result on the students’ English learning as well as their retention. AlShaiji found that the video games helped students learn new English words more successfully and proved to be a more effective teaching method for the children. AlSaiji cited another study that investigated the influence of video games on children’s subsequent performance on instructional tasks (Agudo, 2007). Agudo found that “video games enhanced children’s fine motor skills, alphabet recognition, concept

learning, numerical recognition, counting skills and pre-language knowledge, cognitive development, and self-esteem or self-concept" (AlSaiji, 2015, p. 124). AlSaiji concluded that using a video game in the classroom improved vocabulary learning processes and the student's retention because the experience of playing a game was more enjoyable for learning. Adams (2009) would agree with AlSaiji and Agudo by adding that struggling readers also improve their collaborative reading skills while reading aloud and interacting with video games. Readers respond well to video games because games provide them with affinity spaces that are "textually rich and require quite a bit of reading, writing, and critical thinking" (Alexander, 2009, p. 36). Preliminary research with disabled students have also shown that video games "(a) can be more effective than traditional instruction (Twyman & Tindal, 2006); (b) increase motivation (Charlton, Williams, & McLaughlin, 2005); (c) promote self-esteem (Harris & Rea, 2009); (d) provide access to experiences beyond the classroom (Markey, Power, & Booker, 2003); (e) improve skills for extended periods after the game ends (Beaumont & Sofronoff, 2008); and (f) accelerate learning (Charlton et al., 2005)" (Marino & Beecher, 2010, p. 302). These studies demonstrate how video games engage all kinds of readers. These "affinity spaces" are informal online learning environments for people who share a strong interest in a common activity (Gee, 2007). They set the stage for character creation in which student avatars can then write fanfiction, create machinima films, and produce video guides (paratext) on social media sites to assist and teach other gamers how to improve their skills (Gerber & Price, 2011) while "developing literate identities through their gameplay" (Gerber & Price, 2013, p. 54). Students are clearly benefiting from the literacies of video games (Adams, 2009) and students want more. A national survey conducted by Project Tomorrow (2009), collected data from over 280,000 students and found that 51% of students felt educators should use more video games and

simulations to teach concepts in the 21st century classroom (Trespalacios, Chamberlin, & Gallagher, 2011). Educators can take advantage of student interests and use games as educational tools to facilitate literacy opportunities for readers to communicate, create, and collaborate. Workplace research demands 21st century skills to drive its modern workforce and affinity spaces like MUVEs, MMOs, and MMORPGs give students opportunities to practice real world skills through gameplay (King, 2015).

Literacy scholars acknowledge that formal (structured) and informal (non-structured) literacies are associated with single-player role-play (RPG) and massively multiplayer online role-play (MMORPG) video games (Gee 2003; Sefton-Green, 2006; Steinkuehler, 2008; Walton & Pallit, 2012, p. 347). In 2011, the United States Supreme Court ruled that video games are "like protected books, plays, and movies, and they communicate ideas through familiar literary devices and features that are distinctive to the medium" (Brown v. EMA, 2011, p. 1; Buchanan & Vanden Elzen, 2012, p. 15). Buchanan & Vanden Elzen (2012) note that "the story in a modern video game can even rival a novel in its' depth and length" (p. 19). For example, games with elaborate main story narratives like *Final Fantasy: Realm Reborn* and *World of Warcraft* both enjoy a massive subscription base of players (Final Fantasy XIV, 2015; World of Warcraft, 2015). In fact, five million players engage in the narrative literacy of *Final Fantasy* while 5.6 million players enjoy the *World of Warcraft* story worldwide. These figures demonstrate the number of readers that value the depth and length of these popular games and their narratives. MMORPGs not only support 21st century learning strategies and pedagogies like other forms of literacy but they also allow gamers a chance to collaborate and communicate to problem solve situations in pursuit of a shared goal (Gee, 2003; McCreery, Scharader, & Krach, 2011; Schrader, Lawless, & McCreery, 2009; Squire, 2006). Findings from a five-year study from the

NMSU's Learning Games Lab include that video games like RPGs and MMORPGs lead to student "improvement in written and oral communication as well as enhanced critical thinking skills" (Trespalacios et al., 2011, p. 50). These improvements have also been recognized by researchers studying RPGs and MMORPGs and their effects on gamers' IQ scores and spatial reasoning skills. Scholars also report an increase in IQ scores worldwide and some believe this phenomenon is linked to the "immersive cognitive complexity of video games in which reading visual representations of three-dimensional space develops multidimensional visual-spatial skills" (McGrath, 2003; Tüzün, et al., 2009). Borja (2007), Sardone, and Delvin-Scherer (2010) agree with Trespalacios, Chamberlin, and Gallagher adding that video games are known to "hone mathematical, problem solving, and reading comprehension abilities" which could also explain why video games are linked to an increase in IQ scores (p. 410). These scholars' findings support Gee (2003) and Prensky (2006), who have argued that players acquire problem solving skills, language and cognitive skills, strategic thinking skills, and multitasking and parallel processing skills via video games (Bayeck, 2016).

In 2011, the *Nature Structural & Molecular Biology* journal published a study that reported that the players of the collaborative online game, *Foldit* (Solve Puzzles for Science), had problem solved the structure of a protein-sniping enzyme critical for reproduction of the AIDS virus within three weeks (Coren, 2011). *Foldit* is an MMO game developed by the University of Washington's Center for Game Science and is designed to engage players in problem solving puzzles that evolve around actual protein structures that players can manipulate (Kelly & Maddalena, 2015). Boyle (2015) describes *Foldit* as a perfect example of how average gamers collaborated, communicated, and problem solved a real world need that had stumped researchers from the scientific community for a decade. This is why scholars in the field of

game research and game-based learning have called for the need to treat video games as a "game literacy" that encompasses a variety of dimensions (Gee, 2007; Squire, 2008). Scholars who research game literacy describe it as a "critique and design of a game, its multimodality, its virtuosity in play, and its systemic thinking" (Buckingham & Burn 2007; Burn 2008, 2009; Squire, 2008; Walton & Pallit, 2012, p. 347; Zimmerman, 2009). Fraser, Katchabaw, and Mercer (2014) agree and believe that video games will continue to grow in popularity in other research areas. They add that a desire for demographically customized learning will be critical for game literacy and the application of video games in the 21st century classroom.

Game design for learning 21st century skills. Playing in online affinity spaces fosters a desire in students to create and analyze media design (Elkins, 2015; Hobbs & Rowe, 2011). Buchanan and Vanden Elzen (2012) suggest this creativity and design phenomenon is evidence that the artistry of video games is evolving with the technology. A key 21st century skill is to be able to "think systematically" and game design is a way to promote "meta-level reflection on skills and processes that designer-players use in building such systems" (Salen, 2007, p. 301). Akcaoglu (2016) states the "processes" of game design have a natural appeal for children because of the meaningful and fun outcomes they create. Miller (2014) agrees and adds that video game design is a mix of artistic and technical expertise that challenges students to become creators. Learning to design video games and to share them with peers is highly motivating for students (Myers, 2009) and it is a "professional practice that is richly grounded in 21st century knowledge and skills" (Salen, 2007).

In 2012, Alexander and Ho (2015) at the University of Texas at Arlington (UTA) researched the development of a video game with secondary students. In this case study the students were "engaged in experiential learning through an action-oriented education where

instructors provided a hands-on project" (p.29). The summer program was called "Gaming Worlds" and focused on game design with a 3D software program. As part of their game design, students were allowed to narrate a story and create a game based on that story. There were six phases included in the summer game design program. These phases included various aspects of game design such as pre-assessments to provide a baseline, educators to provide guidelines, having groups share ideas, game creation, animation and modeling, and programming and rigging. The learning outcomes were examined and Alexander and Ho state that game design is a complex process in regards to art, design, and engineering. The summer program provided the students with opportunities to develop concept ideas, characters, and narrative. Storytelling became a powerful tool as students translated their narratives into 2D and 3D artwork with interactive elements while developing professional design standards unique to the commercial video game market. The researchers found that students were able to communicate, collaborate, and problem solve as a team while applying game theory and the use of hardware and software. Alexander and Ho found that "game development is an art form that borrows and transforms previous experiences of art making into a new type of participation and collaboration" (p. 35). Salen would agree that the creativity of game design takes many art forms such as creative problem solving algorithms or creating the look of the game with drawing and 3D modeling programs. Game creation through design and programming empowers student learning and provides an authentic 21st century learning experience (Navarrette, 2013). "Knowing how to put together a successful game involves system-based thinking, iterative critical problem solving, art and aesthetics, writing and storytelling, interactive design, game logic and rules, and programming skills" (Salen, 2007, p. 305).

Computer software known as "game engines" are also part of a new generation of 3D

modeling and graphic arts tools that have emerged from the entertainment industry and are now being used for industry, science, and educational purposes (Hjelseth, Morrison, & Nordby, 2015). Akacaoglu (2016) describes these game engines as more "intuitive" and children find them easy to use which makes game design a fun and authentic learning experience for them. The use of programming and game creation through game engines is quickly becoming a popular way for educators to teach core content areas (mathematics, English, and science) and develop students' higher order thinking skills (Akpinar & Alan, 2015). STEAM fields promote science, technology, engineering, arts, and mathematics through computing concepts and game design (Myers, 2009).

The use of game engines like *Scratch* developed by MIT (Massachusetts Institute of Technology), *OpenSimulator* (OS), and *Unity*, gives students an opportunity to develop 21st century creativity, media literacy, thinking aptitude, and problem solving (Pinto & Escudeiro, 2014) while learning core content and curriculum. In a qualitative study published by Pinto and Escudeiro in 2014, the researchers examined the game engine *Scratch* and the practical application of its use as an educational tool in a 5th and 6th grade information technology class. The researchers explored whether the game engine would develop creativity, problem solving, media literacy, and critical thinking skills. The study involved three phases with the students. First, they evaluated the methodologies for introducing *Scratch*. In the second phase they focused on how the game engine promoted learning within small groups by focusing on the creation of mini games. In the final phase, the focus was on game creation and sharing these games with others on the Internet. Thirty-nine students were divided among four classes. There were 17 girls and 22 boys, all sixth-graders involved in the study. Pinto and Escudeiro found that the students were able to adapt to the *Scratch* game engine and concluded that the tool did

indeed motivate students and improve their learning. They state that Scratch contributed to a noticeable higher level of concentration while promoting a sense of collaborative learning that facilitated creativity and relationships among group members. Myers (2009) agrees with Pinto and Escudeiro, addings that game engines like *Scratch* can help student designers develop "math concepts that range from addition and subtraction, angles, geometric coordinates, and variables to higher-level geometric and algebraic concepts needed to control the dynamics of motion (character movement, gravity, background scrolling) within 2D or 3D grids" (p. 9). Game design not only fulfills requirements for 21st century learning, but also meets Common Core Standards for reading and writing informational and technical texts (Farber, 2016).

Sandbox video games like the 3D grid of *Minecraft* fall within the art education paradigm of game design because of the "aesthetic choices" students make to build and design limitless creations (Overby & Jones, 2015). In addition, Bergstrom and Lotto (2015) note that is extensive research into "aesthetic computing" which widens the scope and emphasizes how art can inform computing through creative coding or code bending. In a case study conducted by Overby and Jones, the researchers examined the phenomenon of *Minecraft* through participant observations and interviews. They observed children playing the game and interacting with one another on building projects. Overby and Jones wanted to study how *Minecraft* might support art education and instruction. They interviewed eight children ranging in age from 5 to 18. All participants but one were family members and acquaintances of the authors of this study. Many of the children were girls and this was noted by the researchers as they began to consider how video games like *Minecraft* might empower girls to consider technology careers. Overby and Jones agree with Hayes (2008) that males are overrepresented in the technology fields and there is a need to draw more girls into these professions. They detail that the reason they chose to

utilize *Minecraft* is because it is a "classroom-friendly program" that taps into the learning potential of virtual spaces that support art education. Overby and Jones found that players often acquired their knowledge and skills in *Minecraft* through other players by fostering a culture of "peer teaching." They found that *Minecraft* provided the children with spaces to create, collaborate, and reflect on their learning and artwork. They also found that it was equally engaging to both male and female participants and that gaming and computing might be a way to encourage more female students to consider technology professions. The researchers suggest that the use of *Minecraft* in the classroom is a gateway into architecture concepts, 3D software, and collaborative art. Overby and Jones conclude that "learning to program in *Minecraft* may lead students into more complicated coding activities or pique their interest in learning *Photoshop, Maya,* or similar image and 3D modeling programs that can help them create new skins and objects for their *Minecraft* world" (p. 24). This is why STEAM educators have embraced *Minecraft* to teach lessons in engineering, physics, art, and mathematics (Jenkins, 2014). Student collaborations extend outside of *Minecraft* and often lead to the creation of modifications ("mods") for the game's programming to enhance content and gameplay (Elkins, 2015; Gee, 2003, 2005, 2012; Gee & Hayes, 2010). Myers (2008) also says that through digital design activities students can learn a combination of critical 21st century skills through one project. *Minecraft* is unique because it motivates students to learn core content, programming, 3D modeling, and game design concepts through gameplay (Hewett, 2014).

Virtual Identity and the Rise of the Avatar

The process of creating and constructing an online identity or avatar for young people is complex and is tied to their personalities (Yerbury, 2010, 2011). These customization choices are further complicated by the aspects of their lives, their sense of self, self-esteem, and other

characteristics they wish to express as part of their identity. In an ethnographic study conducted by Yerbury for the University of Technology Sydney (UTS) published in 2010, the researchers examined members of generations X and Y to explore their perspectives on identity creation through online spaces. Specifically, they wanted to "understand how young people answer the question of who to be through their activities in civil society online" (p. 26). The sixteen participants were interviewed and public online forums and virtual spaces were observed and data was collected for these interactions. Yerbury found that young people do indeed exhibit a strong sense of self in virtual spaces and recognize the possibilities for creating multiple identities. The young people saw information and communication technologies as both a threat and a support to their sense of self in virtual spaces. The question, "who to be" revealed "tensions between the freedom to create one's own identity and the desire for authenticity, and between the need for a sense of security and recognition of the possibility of experimenting with something challenging or different" (p. 25). What Yerbury found is that young people often base their online identities on psychological preferences, characteristics, and in many cases social purposes.

This concept of identity in online spaces has filtered into the virtual worlds of video games. Graber and Graber (2010) argue that most students already have a digital identity in one form or another with the use of a Facebook profile, YouTube, Twitter, Snapchat, Instagram, or Pinterest. They discuss how these digital identities contain personal information the students have chosen to share. They argue that students' digital selves have become an extension of their real world lives as they communicate, network, blog, buy and sell, and play online video games. Merchant (2009) adds that teachers and students often import their own value systems into their avatars and as they explore these virtual spaces they interpret the artifacts and expected norms

that exist and adapt their identity to fit in. The ability to experience relationships strictly in the form of an avatar requires an examination of the paradigm of what it means to be "self," and calls into question what constitutes personal identity. It has long been argued in the literature that massively multiplayer online games and worlds disrupt traditional ideas and experiences of personal identity (Turkle, 1995). Turkle has spent over a decade, engaged in the "ethnographic and clinical study of how people negotiate the virtual and the "real" as they represent themselves on computer screens linked through the Internet" (p. 643). She argues that the computer and online video games have changed the notion of identity. Turkles finds that virtual worlds encourage us to think of identity in terms of multiplicity and flexibility. Edgar (2016) agrees that avatars in game worlds like *Second Life* and *World of Warcraft* are examples of how multiplicity and flexibility impact the meaning of personal identity in game worlds. Players customize their avatars based on their personal values, affinity culture, role-play needs, and how they view themselves through the game's narrative. Edgar states that virtual worlds confront the player to construct a coherent narrative of online life. In online gaming environments the digital identity takes the form of a "virtual mask" allow young people, through their avatars, opportunities to experiment with their own personal identity in creative ways (Crowe & Bradford, 2006). In a study at the Virtual Human Interaction Lab (VHIL) located at Stanford University, Bailenson, Yee, Merget, and Schroeder examined the realism of avatars in terms of behavior and form and how these qualities are critical to the development of collaborative virtual environments. The participants for the study included thirty undergraduate students. The researchers had three conditions for the study that included voice only, video conference, and emotibox. The participants were observed and recorded in front of a computer with a Logitech QuickCam. The researchers varied facial resemblance and gestures of the avatars to their users faces. The

participants' faces were tracked in real time via a face-tracking system that captured the position and orientation of their faces. The paired participants reacted to each other's avatars and the researchers explored what those behaviors revealed about their identities when the avatars were less realistic in form. Bailenson, Yee, Merget, and Schroeder found that "understanding the relationship between form and behavioral realism is critical to begin examining the use of these new forms of media" (p. 370). Researchers have found that altering the physical appearance of an avatar such as increasing height changed the person's self-esteem and social perception (Lanier, 2010).

This phenomenon shows that our perceptions of self-worth are triggered by how we feel we are publicly perceived (Suh, Kim, & Suh, 2011). Yard (2010) says this bonding relationship between user and avatar seems to trigger the neurons in the brain as it responds to the avatar while developing a sense of self and valuation. This close feeling of connection causes students to choose avatars that express their own values in real life and accessorize them accordingly (Kang & Yan 2006; O'Brien & Murnane, 2009). Because of this bond we expect the avatar to resemble the student's tastes and that this will influence the usage of the avatar in relation to the cognitive connection (Suh et al., 2011). Crowe and Bradford (2006) mention that the value of the avatar will be unique and dependent on the needs of the student in relation to the type of clothing, language, and character skills as they choose among their various avatar forms and move among worlds. Considering there are broad choices in how students can create their avatars, it is known that how they respond and conceptualize their avatars will relate to their digital and real life selves (Kafai, Fields, & Cook, 2007).

The Cultural Evolution of Bicultural Virtual Identity

As students become aware of the world outside their immediate circles through virtual

environments or video games, they begin to develop a bicultural sense of identity which is rooted in the global online virtual culture as well as their home and local culture (Doku & Asante, 2011). Uzelac (2008, 2010) suggests that culture and the arts are increasingly intersecting with digital trends in technology. They involve various forms of communication, cultures, media, video games, and other information technologies. Uzelac has studied scientific and popular literature circles and has found widely used terms for digital culture, virtual culture, cyber-culture, e-culture, and convergence culture within their fields. Uzelac reports that today's technologies often exist without detection and that these digital environments envelope our everyday lives. These technologies exist in business, finance, and within the distribution of media. It is clear that digital technologies like virtual spaces have transformed culture. Virtual spaces are a shifting bicultural landscape in which teachers need to have a clear understanding. The virtual spaces are able to transcend barriers in relationship to learning and research (Hunsinger & Krotoski, 2010). These virtual environments or games reflect the lives and work of participants' bicultural worlds. The more virtual spaces or games become culturally integrated into the education and classrooms, the more important it is to utilize them as tools for engagement in everyday life.

Transcending locality and nationality, students can develop an understanding for various cultures around the world and adapt to a global culture. In a study conducted by Cucoš & Ceobanu (2009), the researchers "focused on the intercultural predispositions that accompanied the new cultural formulas that are created or transmitted virtually through cyberspace" (p. 1). They analyzed the literature in an attempt to identify the cultural realities of cyberspace and their relationships. They found that language, iconography, and symbolistic technicality fosters a unification or differentiation of culture beyond cultural polymorphism. This phenomenon of

globalization with a shared set of knowledge and values impacts the psychological and moral views of a student's local culture. This makes it very hard to delimitate the question of what culture is today. Cucoš & Ceobanu found that there are two dimensions of a cultural environment: the objects of the culture itself (artistic productions, philosophies, ideologies, and scientific theories) and their disposal modalities (radio, television, internet, virtual worlds, and video games). They conclude that the world of cyberspace is where many learn about themselves and the global hypertext of cultures. Cyberspace is where students can learn a collective intelligence that is no longer genetic in relation to local traditions and nations but globally.

How a culture communicates varies around the world, as evident by their use of electronic genres and communication styles (Reeder, Macfadyen, Roche, & Chase, 2004). Giddens (1993) and Robson (2002) note that the diversity phenomena and students' desires to learn about other cultures has led to the growing trend of globalization, the communications explosion (Palloff & Pratt, 1999), internationalization of technology, and economic universalism (Dolatabadi & Dillon, 2009). Meyers (2009) suggests that as students engage within virtual spaces or video games, they begin to participate in this international or global discourse community. These new worlds have become defined by this global culture and the meaning of self and how students view their cultural identity has changed (Graber & Graber, 2010).

The Digital Divide in Education

In past decades, the gap between those who could afford technology and those who could not has been known as the "digital divide" (Stuht & Colcord, 2011). This divide has since evolved to reflect a new meaning in which there exists a growing technological chasm between teachers and their students. The divide and the feeling that education has lost its relevance is

cause for concern as high school graduation rates in the United States hover at about 70 percent. It is estimated that students will change jobs ten times before they turn 40 years of age and that the top ten jobs of 2010 did not exist in 2004. Stuht and Colcord report that online technologies continue to develop and expand in the content available to K-12 teachers in an effort to provide better learning experiences and assist with technology integration. They add that these technologies have the power to give teachers a platform to share resources with one another and increase differentiation, establish ownership and motivation, and provide intellectual challenges, all while saving time on planning and integration. Taking the time to play an action oriented video game is good practice and will give teachers perspective on today's gaming culture while providing insight into how students' brains work. The use of new technologies and the exploration of learning through digital literacies have been constrained by teacher perceptions and the general educational climate (Merchant, 2009). Hudson (2011) agrees with Stuht and Colcord and notes this disparity is cause for concern in that it reflects a divide in how students perceive their use of technology and their teachers' perceptions of technology. In simple terms, Hudson believes that education is falling short of student expectation on how technology can be integrated in the classroom. Students desire to bring what they do outside of school into the classroom though new technologies such as mobile app learning, gaming, and social network sites. Hudson adds that students understand the potential of smartphone and tablet technologies and they view device bans as a hindrance to their learning.

A study conducted by Project Tomorrow (2009) explored students' preferences and feelings on technology integration. The study's population of subjects included 280,000 students who responded by survey. Project Tomorrow found that the majority of the subjects felt that a laptop for each student (52%) and more video game and simulations for teaching concepts (51%)

were high on students' requirements for 21st century learning. In a follow up study in 2010, 6th, 7th, and 8th graders we asked what they felt were the benefits of video or online games as part of their regular schoolwork or classroom activities. The students (61%) felt that difficult concepts would be easier to understand; 58% felt they would learn more about a subject; 57% felt they would be more engaged in the subject; 54% felt practicing problems would be more interesting; and that 43% felt they would benefit from learning to work in teams. Project Tomorrow concludes that these requirements are more than just students wanting to play video games but that this survey illustrates and describes why 21st century learners like games. Schacter (2011) agrees that research has shown that increased technology integration like video games in the classroom is linked to improved academic achievement and supports student preferences for video games. In an analysis of five major large scale studies on technology integration, Schacter found evidence that technology integration does indeed lead to academic achievement. In over 700 empirical research studies conducted in West Virginia, technology integration resulted in positive gains in achievement on researcher constructed tests, standardized tests, and national tests.

While students and parents lobby for increased technology integration in the classroom (Chapman, Masters, & Pedulla, 2010), there are large numbers of teachers who lack the necessary technology skills to successfully integrate technology (Weiss, Banilower, McMahon, & Smith, 2001). In 2000, Weiss, Banilower, McMahon, and Smith conducted a study supported by the National Science Foundation through a grant to Horizon Research, Inc. The researchers collected data on teacher professionalism, perceptions of their autonomy in making curriculum and instructional decisions, collaborative work, and in-service education and other professional development activities. They also looked at technology integration in the classroom. The data

was collected through the 2000 National Survey of Science and Mathematics Education. Weiss, Banilower, McMahon, and Smith designed the survey to provide information and identify trends in the areas of "teacher background and experience, curriculum and instruction, and the availability and use of instructional resources" (p. 1). The subjects for the study included 5,728 science and mathematics teachers in the United States. The survey data measured the perceived professional development needs of teachers. The results of the data reported that topping the list of teachers' needs was learning how to use technology for instruction. They found that the majority of the teachers did not feel prepared to utilize technology during instruction. In a follow-up study published in 2013, Banilower, Smith, Weiss et al. (2013) again found similar results with the 2012 National Survey of Science and Mathematics Education when it came to technology. Teachers were asked about their use of technologies in the classroom and it was found that technology use was low among the teachers. One-third of the classes used the Internet and 21% to 31% used computers at least once per week. The researchers found that the use of instructional technology was more likely to occur at the high school level. High school math classes (43%) were more likely to include instructional technology than elementary classes (29%). Banilower, Smith, Weiss et al. conclude that instructional technology integration was low in K-12 mathematics classes. This data would support Labbo (2006), Ladbrook (2009), and Walsh (2010) who believe there have been positive accounts of teachers engaged in technology integration and negative accounts of teachers who are slow to change their methods.

Despite these limits, there are ways to bridge the digital divide between teachers and students (Hudson, 2011). Younger teachers and scholars are considered the most tech-oriented group of educators to date (Perlmutter, 2011). Ferriter (2010) suggests that teachers spend time exploring video games, websites, wikis, Twitter and other social networking sites to develop

ideas for the classroom and broaden their technology skills (Ferriter & Garry, 2010; Stuht & Colcord, 2011). Hunt (2013) adds that teachers need to facilitate and utilize media-enriched tools that address the individual educational needs of students. It is obvious that teachers need to acquire 21st century competencies so they will be able to tackle new pedagogical approaches to facilitate learning with students (Voogt, Erstad, Mishra et al., 2013). Darling-Hammond and Adamson (2010) suggest that the goal for education should be to prepare students for the jobs of the future that do not yet exist. They believe education should push creativity and innovation in an effort to promote new ideas for products and solutions while understanding that the technologies needed to complete new tasks have to be invented. According to the National Education Association, Tucker (2014), and the Partnership for 21st Century Skills, if the digital divide between how students live and learn continues to widen, the current education system will become irrelevant.

Summary

The purpose of this chapter was to develop a set of themes to ground the study. The following themes emerged from the review of the literature: (1) The Evolution of Digital Literacies and Skills; (2) 21st Century Skills: The "Four Cs"; (3) Video Games for the Development of 21st Century Skills: Gameplay and Game Design; (4) Virtual Identity and the Rise of the Avatar; (5) The Cultural Evolution of Bicultural Virtual Identity; and (6) The Digital Divide in Education. This literature review supports the need for a mind shift in the education system and the need to recognize the technological evolution that has changed the world's global economy and society. It attempts to address and recognize new 21st century skills and literacies that are impacting digital natives through game design and gameplay (Project Tomorrow, 2008). Voogt et al. (2013) find that developments in technology have brought about new digital tools

and collaborative affinity spaces in our society which have shifted the emphasis from reproducing information to content creation. Erstad (2008) agrees and reports the "processes" of user-generated content creation challenges the traditional roles of school, teacher, and student in how content is learned and shared. It reinforces the importance of complex or productive thinking and shifts the focus to emphasize innovation (Higgins, 2014). Myers (2009) adds that society is faced with a future where "the most literate among us will be those who develop the ability to think, invent, collaborate, and express themselves effectively in this new media environment" (p. 40). "The least literate among us will (at best) have the ability to interact with these technologies only passively: playing games, shopping online, downloading music and videos" (p. 40). Gameplay and game design are two avenues educators can use to get children practicing their 21st century skills (Project Tomorrow, 2008) so they are not merely "consumers" of media but the "creators and designers" of future technologies. In order to prepare students for a 21st century economy, students need more creative opportunities to think "deeper" Hilton (2015). Hilton and the NEA conclude that it is time to move beyond the memorization of facts and multiple-choice exams to an education system that promotes learning to develop critical thinking and problem solving; communication; collaboration; and creativity and innovation. Video games and the 21st century skills they can teach are a part of that educational mind shift.

CHAPTER III: METHODOLOGY

This chapter defines the research methodologies and procedures that were followed to conduct a sequential mixed model study. This study is grounded in positivist, interpretivist, connectivist, social constructionist, and social constructivist theories. The research field that studies gaming or virtual environments is rooted in social constructivism, specifically in the educational fields of Math and Science (Klopfer &Yoon, 2005). The social constructivism theory of learning encourages students to learn through collaboration, hypothesis testing, and experimenting (Klopfer &Yoon, 2005).

The theoretical framework for quantitative research is known as the traditional, positivist, experimental, or the empiricist paradigm (Creswell, 1994; Smith, 1983). It is steeped in the empirical tradition of the philosophical authority of Comte, Mill, Durkheim, Newton, and Locke (Creswell, 1994; Smith, 1983). Positivism is a philosophical system that holds that every rationally justifiable assertion can be scientifically verified or is capable of logical or mathematical proof (Comte, 1880). Quantitative methods are thought to be accurate, valid, and reliable (Guba & Lincoln, 1989). The positivist researcher makes generalizations that lead to predictions, explanations, and understandings (Creswell, 1994). For the purposes of this study, quantitative methods were utilized through the means of survey. Two surveys were administered during the two phases of this sequential mixed model study.

In accord with the methods of human sciences, interpretivism is the study of social life and assumes that human action is inherent to unearth meaning (Schwandt, 2007, p.160). Qualitative research aligns with social constructionist epistemology through an interpretivist lens (Crotty, 1998). Individuals make meaning of reality through social, cultural, and historical situations (Crotty, 1998). Since this study is driven by participant experiences, the case studies

in phase II of this study are based in qualitative research methods. The framework was focused through general interpretivist, social constructionist, and constructivist lenses. It provided a theoretical framework to gather interview accounts of the gaming phenomenon. Each participant in the study brought with them a unique set of personal narratives or experiences. Interpretivism recognizes the value of these languages and discourses in qualitative research (Clarke, 2005; Denzin & Lincoln, 2005). In an attempt to comprehend and explain social and human reality, interpretivism emerged in contradiction to positivism (Crotty, 1998). Crotty believes there are assumptions to this framework of research methods. He further adds that interpretivism is a theoretical perspective that addresses the philosophical stance behind a methodology. It is this assumption that defines theoretical perspective and largely has to do with methodology. This assumption is based in the belief that there are multiple truths and realities in the world. A case study that pursues personal experiences and narratives will produce varied research.

Max Weber is a key scholar in the theoretical perspective of interpretivism. Weber (1904) concerns himself with a pursuit for "understanding." Researchers believe Weber is focused on causality and contrasting the interpretive approach needed in the human and social sciences with the explicative approach (Crotty, 1998), hence the emphasis on the different methods of quantitative and qualitative research means. Weber believed what we understand today as the interpretivist approach to human inquiry has historically taken many forms. These forms include hermeneutics, phenomenology, and symbolic interactionism. Interpretivism is an attempt to ground, understand, and explain human and social realities. The participants for this study bring with them different experiences utilizing video games and virtual worlds for educational purposes. The participants have their own perspectives of situations and experiences. Learning for people is not a singular process for everyone. The researcher generated open-ended

questions that encouraged participants to provide description of personal gaming experiences, their acquired learned skills, and how those experiences enhanced their creativity and innovation while looking for trends that might shed light on predicators for academic success. Researching the participants' personal narratives led to multiple truths and understanding which fell within the interpretive lens. Interpretivism allowed the researcher, through case studies, the opportunity to gather descriptive narratives of human and social experiences. This framework provided flexibility needed in order to gather the data. The researcher designed sequential mixed model methods to collect data on learned skills and gaming experiences that could possibly elicit trends that predict academic success.

The researcher utilized a mixed model approach by combining quantitative and qualitative research data collection and analysis. Using such a model allows for the convergence of quantitative and qualitative data (Creswell, 2003). This chapter outlines the two phases of the mixed model study as well as an explanation of the measures and instrumentation utilized to conduct the study. The quantitative surveys are described in this chapter and a timeline notes when the quantitative and qualitative phases occurred. A discussion of the qualitative case study practices is also reported with a description of the coding methods utilized through inductive analysis.

Research Design

The purpose of this sequential mixed model research study was to explore the predictors of academic success and the 21st century skills gamers are learning through video game experiences. A sequential mixed model study mixes the stages or components of quantitative and qualitative methods during the research process (Tashakkori & Teddlie, 1998). The research design for this study had two phases and subtypes within each design (Cameron, 2009). Phase I

of the study included a survey on past gaming experiences. Phase II utilized a combination of both quantitative and qualitative data collection methods (Cameron, 2009). In this phase of the study, subjects received a survey to assess learned skills, which gathered their perspectives on the *Minecraft* project after the completion of a group assignment in class. The responses provided feedback on the overall student impressions using a mainstream video game as an educational tool. Three classes of 3D Modeling and Animation students from a South Texas area Technology Applications program completed a modeling and design project in *Minecraft* during the spring semester of the 2015 school year. The 3D modeling projects were assessed by means of two 3D modeling rubrics designed specifically for the project. Group and Individual Projects were scored based on two project rubrics.

The researcher used a quantitative approach to gather survey data during both phases of this sequential mixed model study. Quantitative research methods test hypotheses and determine the causes or relationships between variables while measuring the frequency of observations (Bowling, 2014; Fowkes & Fulton, 1991; Greenhalgh, 1997). The researcher analyzed the data to examine the potential academic predictors of success in a 3D Modeling and Animation course.

In phase I of this study, the researcher collected data on the entire population of students enrolled in the 3D Modeling and Animation courses at one school. One survey gathered descriptive data related to levels of gaming experience. The second survey gathered data on student perspectives from the overall focus group at the completion of the *Minecraft* project in class, as well as the literacies and applied real world skills they had acquired. It also collected data on their preferences for game-based learning. The justification for surveying the population was to gather descriptive data by polling the whole group. It would not have been feasible to conduct over 200 case studies. A quantitative measurement proved to be a better

approach to measure the general overall predicators for success of the phenomenon associated with video games. Quantitative research is considered an appropriate process of inquiry because it focuses on uncovering the meaning and interpretations of social phenomena (Sale, 2008).

The sub-sample of this sequential mixed model study consisted of four qualitative case studies with experienced gamers from the 3D Modeling and Animation courses. A sub-sample is a smaller sampling of the population which provides greater detail on any unexpected general trends and findings (Byrne & Humble, 2007). In-depth one hour interviews were conducted with each of the four participants to gather descriptive narratives and probe for general trends in regards to academic success, gaming experience, and preferences toward game-based learning. The case studies also elicited perspectives on the *Minecraft* Project as an educational tool in the classroom.

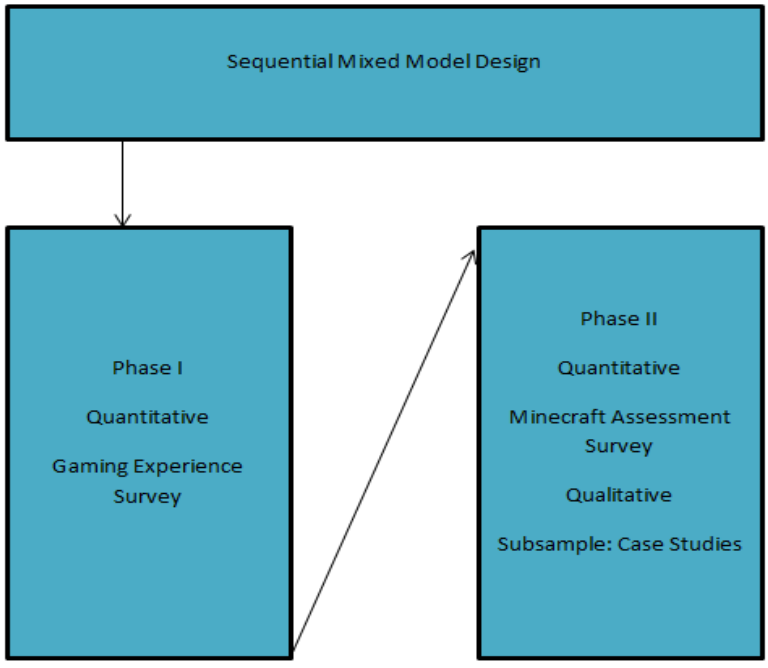

Figure 17. The phases of the sequential mixed model design for this study. Katherine Hewett©

Qualitative research provides an analysis of how the participants and their communities circulate and produce knowledge (Brinkmann, 2011). The definition of qualitative research is described as a multi-method focus that involves an interpretive and naturalistic approach to the research (Denzin & Lincoln, 1998; Silk, Mason, & Andrews, 2005). It stems from a post-positivist historical perspective that denies the positivist notion of "unambiguous and accurate knowledge of the world" (Crotty, 1998). Qualitative data is usually generated from field work and in the form of interviews, observations, and document analysis (Hemphill, Richards, Templin, & Blankenship, 2012). Qualitative research can be practiced wherever people can be interviewed, during situations of importance, and where documents are analyzed (Patton, 2002). Qualitative research is the inquiry that uncovers meaning of social phenomena and it interprets a focus (Sale, 2008). The childhood gaming experiences of the video game youth culture is the phenomenon explored within this mixed model study. It is expected that readers will find similarities to their own experiences and decide whether the information is relevant to them (Brantlinger et al., 2005, p. 203). A qualitative approach of gathering stories is considered an appropriate method for these four case studies. The data included face-to-face interviews, observations, and artifacts documented during the classroom project by means of the screen capturing software *Jing* and *Fraps*. The researcher collected data in person and via the use of an "in world" avatar in the game of *Minecraft*.

Case Study

A case study research method is an empirical inquiry that investigates a contemporary phenomenon within its real-life context (Yin, 1984). It is an in-depth understanding of that contemporary phenomenon (Yin, 2009). Detailed data was gathered from the participants utilizing open-ended questions to elicit direct quotes from the interviews (Jacob, 1988). The

interviewer is an integral part of this investigation (Jacob, 1988). This type of inquiry was different from the quantitative means which sought to gather data through relations, comparisons, and predictions which removed the investigator from the collection (Smith, 1983). The case studies provided vivid experiences within the reader's interpretations and insights (Merriam, 1998).

Case studies are particularistic, descriptive, heuristic, and rely heavily on inductive reasoning (Merriam, 1988). Qualitative data sources include observation and participant observation (fieldwork), interviews and questionnaires, documents and texts, and the researcher's impressions and reactions (Myers, 2009). Case studies are complex because they generally involve multiple sources of data and produce large amounts of data to analyze (Soy, 1997). The case study method is often used by researchers to produce and build upon theory while explaining or disputing the phenomenon (Soy, 1997). Kaplan and Maxwell (1994) believe that understanding a participant's experiences with a specific phenomenon is lost contextually when textual data is quantified.

General inductive analysis was selected as the analytical methodology for the case study phase of this sequential mixed model study. There is a plethora of literature that documents the assumptions and procedures associated with analyzing qualitative data (Thomas, 2003). Many of these assumptions and procedures are associated with specific approaches such as grounded theory (Strauss & Corbin, 1990), phenomenology (van Manen, 1990), discourse analysis (Potter & Wetherall, 1994) and narrative analysis (Lieblich, Tuval-Mashiach, & Zilber, 1998). However, some analytic approaches are generic (Ezzy, 2002; Pope, Ziebland, & Mays, 2000; Silverman, 2000). Thomas (2006) states that the general inductive approach allows for the "research findings to emerge from the frequent, dominant, or significant themes that are inherent

in the raw data" (p. 238). Analytical memos, coding options, and member checking with participants are all methods of inductive analysis (Glesne, 2011; Saldaña, 2009). Saldaña (2009) outlines a process to analyze data by means of encoding, classifying data into categories, and then consolidating data into emergent themes.

Research Questions and Hypotheses

The purpose of this sequential mixed model research study was to explore the predictors of academic success and the 21st century skills gamers are learning through video game experiences. This study examined the predictors of academic success and what is learned through gaming experiences from the perspectives of South Texas area high school students enrolled in three 3D Modeling and Animation courses. These following questions informed this research study:

1. What are the predictors of academic success in a 3D Modeling and Animation course?
2. What do participants learn from working in a video game environment? How might participants apply these real world skills?
3. How do participants apply strategies and collaborate in order to problem solve tasks while working in a video game environment? In what ways do participants apply strategies to help themselves in a video game environment?

This sequential mixed model study explored the relationship between childhood gaming experiences and game-based learning environments through the integration of *Minecraft* in a classroom setting. The study utilized a mixed model to combine quantitative and qualitative data on the connections between gaming experiences and game-based learning (Johnson & Christensen, 2008). This model combined the use of survey and case studies to attempt to uncover predictors for academic success.

Pilot Study

A pilot study was conducted before the research study to test and evaluate the two survey instruments. Due to the limited number of 3D Modeling and Animation courses, three Digital Art and Animation courses at the same South Texas area high school were selected to vet the surveys. These classes share a similar curriculum that includes animation, graphic arts, game design, and programming. Students in the courses were assigned the same 3D modeling project in *Minecraft*. Before they started to build, a Gaming Experience Survey was administered to determine their level of gaming experience. Pilot subjects provided feedback on the survey questions. At the end of the project, they were given the second survey to assess the *Minecraft* Project. The *Minecraft* Assessment Survey asked questions regarding their preferences and what they felt they learned by engaging in a game-based learning project utilizing a mainstream video game in the classroom. The pilot subjects again provided feedback on questions. Minor adjustments to the surveys were made based on this feedback.

A pilot study was also conducted prior to the start of the qualitative phase. Four years ago, the researcher conducted a similar pilot study for a doctoral course that served as the basis for this sequential mixed model study. The one participant was a digital native. At the time of the pilot study, the participant was a junior at the same area high school in which the surveys were vetted and the sequential mixed model research study was conducted. Her story was a snapshot of childhood experiences with gaming and story-based virtual environments.

The raw data gathered for this pilot study included a face-to-face interview, an observation with "in world" photographs, and an "in world" follow-up interview with the participant. The data was coded into categories. The qualitative inquirer utilized an inductive analysis methodology approach when coding the categories and themes for the pilot study.

During the coding process, themes began to take shape through the participant's gaming experiences. The open-ended questions to the pilot study interview served as the foundation for this research study. The questions were revised and updated to fit this sequential mixed model research design.

Setting and Sample

The subjects for the quantitative phase for this study were students from a South Texas area high school with an enrollment of 2,353 students. The research site for this study was a computer classroom environment at the high school. The demographic population for the high school was 68% Hispanic, 0.25% Native American, 5% Asian, 5% Black, 0.30% Pacific Islander, 21% White, and 1% that identified as being of two or more races. The school is classified as low socio-economic and receives Title I funds. Subject involvement in the study was not mandatory in accordance with IRB protocols. The subjects' participation was strictly voluntary and they were allowed to excuse themselves at any point. The quantitative research was conducted in the subjects' classroom during school hours. The 66 Sophomore, Junior, and Senior subjects ranged in age from 14-20 years old and enrolled in three 3D Modeling and Animation (Technology Applications) classes at the high school. Two freshman subjects were dropped from the study after the quantitative data analysis due to no Cumulative Grade Point Average (CGPA) on file. All students were given equal opportunity to participate in the quantitative component of this mixed model study. All students within the three courses were given an opportunity to participate in the study regardless of physical or learning characteristics. The study was conducted over the months of April and May, 2015.

For the qualitative phase, interviews were conducted in the participants' classroom and were scheduled after school. Four students were identified to participate in case studies in order

to explore their childhood gaming experiences and their perspectives on game-based learning upon the completion of a game-based class project utilizing the game *Minecraft*. These participants were purposefully selected for their gaming expertise, classification, and gender. The participants were active gamers and had been gaming since early childhood. Two girls and two boys were selected by demographic backgrounds to represent a variety of ethnicities. They shared a common phenomenological trait in regards to early video gaming experience in that they have experienced first-hand the evolution of these emerging technologies and provide their own perspectives on how video games impacted their literacy skills and what learned skills they have acquired. The case studies attempted to record their ethnographical accounts based on their gaming perspectives. The only inclusion and exclusion criteria for the study were that participants be enrolled in one of the three 3D Modeling and Animation courses.

Procedures

During the spring semester of 2015, information was sent home to parents of the participants. In the information, parents received the course description for the class and an outline of the project. 3D Modeling and Animation consists of digital art created in a virtual three-dimensional world. The Texas Essential Knowledge and Skills (TEKS) require that students taking the course produce various 3D models. The students for this project utilized the virtual world of *Minecraft* to learn modeling, digital art, programming, and film-making concepts during normal class hours. The project objective stated that the student would replicate and build an historic 3D model utilizing *Minecraft*.

The program was part of the mandatory course work for the class, but it was not mandatory that the students must participate in the study to pass the class. The researcher first obtained parental consent for each student. Once parental consent was obtained, the researcher

gathered student assent forms. All students within the three 3D Modeling and Animation classes were given the option to participate in the quantitative phases of the study. Approval and consent was attained from the principal of the high school and the school district through the Office of Assessment and Accountability.

Quantitative Research Question:

1. What are the predictors of academic success in a 3D Modeling and Animation course?

To answer research question one, the researcher utilized two surveys to measure gaming experience and the subjects' perspectives on a game-based learning assignment in *Minecraft*. At the start of the project, the students were given the first survey, the Gaming Experience Survey. The questions were based on the three factors of gaming experience, level of gaming, and preferences. The questions were specific to gamers and the survey was given before the start of the *Minecraft* Project in class. Subjects were asked how many hours per week they play video games, how many years they have been playing, and if their parents were also gamers. The survey asked about their preferences and favorite game genres and if they had competed in professional gaming leagues or created content for video games. Questions ranged from basic gaming experiences to more advanced experiences. How a subject responded to various questions determined the gaming level of experience they had acquired through gaming and virtual spaces. The survey was 20 questions in length and did not take more than 15 minutes of class time to complete.

Students were given a 3D modeling assignment to build an historic place in *Minecraft*. They were given time to research their builds and collect information and photographs. For example, one group of students worked together to build a replica of the Parthenon. Students completed both a group build and an individual build. Their work was graded using a rubric

designed to measure success and mastery of the project. The researcher was not the grader for this project. Two professional educators with knowledge of technology integration and gaming served as the graders of the builds. They were both teachers at the high school the subjects attended. The rubrics assessed the quality of the 3D builds or final product and were used to determine the subjects' grades on the group build project and the individual build they created.

The second survey, the *Minecraft* Project Assessment Survey, was administered at the end of the *Minecraft* modeling project. It was a 20 question survey based on two factors of Learned Skills and Application/Preferences. Subjects were asked if they felt that using a video game in the classroom helped them learn and acquire skills. For example, skills included basic skills to complete tasks, critical thinking skills, problem solving skills, and spatial reasoning skills. It asked students about how they visualized their models, their preferences of working in a group, and what they felt they had learned from the experience. The survey was specific to the *Minecraft* project and it also did not take more than 15 minutes of class time to complete. Surveys were administered through Qualtrics in an online format in compliance with the Internal Review Board (IRB) at Texas A&M University-Corpus Christi. Qualtrics is an online research and insights platform used to generate surveys and collect data.

It was made clear that if a student decided to leave the study for any reason they would not be penalized; however, none of the students left during the duration of the study. All subjects completed both surveys and their data was collected. Data from the two Freshmen boys in the study had to be excluded due to no official CGPA on record till the following school year. That data was de-identified, erased, shredded, and destroyed. The researcher made sure that each subject had taken both surveys by checking that two surveys existed under each student's name. The names were then de-identified after collection.

All data, study materials, consent forms, assent forms, IRB, recruitment materials, pseudonyms list, and surveys will be retained for three years after the completion of the study. Files are being kept in a locked file cabinet at the researcher's home with no identifiable information and will be destroyed by shredder after three years. Digital files are stored on a password protected external hard drive that is kept locked up in a storage file cabinet at the researcher's home. Digital files will be erased after three years.

The *Minecraft* project started at the beginning of April and concluded at the end of May. In order to measure the significance or differences between the three classes, all data was inputted into the SPSS (Statistical Package for the Social Sciences) software program with the intention of employing a Hierarchical multiple regression statistical test method. The researcher used the SPSS software because it can accomplish a wide range of analyses including complex multivariate measures and it is easy to use (Stevens, 2009).

Qualitative Research Questions:

2. What do participants learn from working in a video game environment? How might participants apply these real world skills?
3. How do participants apply strategies and collaboration in order to problem solve tasks while working in a video game environment? In what ways do participants apply strategies to help themselves in a video game environment?

To answer research questions two and three, the researcher conducted interviews with four participants. The students were selected by the researcher from the 66 participants based on their gaming experience. Two girls and two boys were selected for the case studies. A second parental consent and student assent form was distributed to each of the four students chosen to participate in the qualitative case studies. These students participated in both the qualitative

(interview) and quantitative (surveys) phases of this sequential mixed model study. Interview questions asked participants about their gaming experience, preferences, and learned skills from gaming. Each case study provided a narrative of experiences for each participant. Participants were asked to describe learned skills they had acquired playing video games by means of open-ended questions during the interviews. Skills might include problem solving, spatial reasoning, critical thinking, digital literacy, visual literacy, communication, emotional, literacy, or basic real world skills to complete tasks. The interviews were conducted directly after school between four and five o'clock in the afternoon in the researcher's classroom and with parent permission. The raw data from the case studies included face-to-face interviews, observations, and artifacts. The photos were captured in the form of screen shots using screen capturing software (*Jing* and *Fraps*) installed on the computer. Game photographs of the replica builds were collected to document the progress of the project. The data was coded into categories based on the research questions. The interview transcript served as the primary data for the case studies. The students were given pseudonyms to protect their identities. A pseudonym list will be kept in a locked file cabinet in the researcher's home for three years and then will be destroyed.

The qualitative procedures are further discussed in the Data Analysis section of this chapter. The data was coded into categories based on the research questions. The researcher utilized an inductive analysis methodology approach when coding the categories and themes for this study. During the coding process, the researcher looked for themes that emerged through the related experiences of the participants.

Data Collection

In order to explore the predictors for academic success and the learned 21st century skills acquired through video game experiences and game-based learning, the subjects' and

participants' teacher (in this case the researcher) surveyed students to measure their gaming capabilities, experience level, and perspectives on game-based learning. The researcher conducted four case studies with a sub-sample of the total population.

Instruments

All three classes received the two surveys (see appendices K and L to reference the instruments). Surveys were developed by the researcher and vetted with three Digital Art and Animation classes at a South Texas area high school. A survey on gaming experiences was developed to measure the student level of gaming experiences and preferences. Questions varied in level of experience with some questions that were advanced in specialization of gaming. The Gaming Experience Survey was vetted with a population of seventy subjects. Subjects provided feedback and made suggestions on how to revise questions to best target a teenage gaming population. The survey was specific to gaming experiences and was written in familiar linguistics. The revised Gaming Experience survey was given at the beginning of the project in phase I of the study.

During phase II, the second survey was designed to measure and assess subjects' perspectives and acquired skills through the *Minecraft* modeling project. Subjects answered questions on what they felt they learned and whether they felt successful. The *Minecraft* Survey provided an overall assessment into whether the utilization of a mainstream video game in a classroom was an effective and engaging learning tool.

Demographic Data

Demographic data was collected through the school district's Office of Accountability and Assessment. Data included Spring 2015 CGPA, Class Rank-EOY, Ethnicity, Gender, and STAAR Scores from the last three school years. Survey data was analyzed for predictors of

academic success. Interview data was used to provide a deeper understanding into the acquired skills learned through video games. These skills help shed light on trends and those predictors that benefit academic success.

Rubrics

The researcher developed the rubrics to assess the quality and learned skills of the subjects from the *Minecraft* modeling project. Areas assessed included originality, creativity, composition, design, technical application, craftsmanship, and research. The rubrics were vetted by four technology and educational professionals with specific knowledge of emerging technologies and gaming. The four graders received projects with the purposes of vetting the rubrics. Group and individual rubrics were developed to assess academic success utilizing the areas referenced.

Two new graders were selected for the actual study and utilized the vetted rubrics for data collection purposes. These official graders were high school teachers with experience utilizing technology in the classroom. Project grades were recorded and analyzed by Spring 2015 CGPA, Class Rank-EOY, Ethnicity, Gender, and STAAR Scores as possible measures or predicators for academic success.

Interviews

The raw data that was gathered from the case studies included face-to-face interviews, observations, and artifacts. Interviews were audio recorded on a sound recorder and iPad. The interview consisted of a list of open-ended questions related to the research questions. The one-hour interview transcript served as the primary data for the case studies. The data was coded into categories based on the research questions. The researcher utilized an inductive analysis

methodology when coding the categories and themes for this study. During the coding process, themes emerged through the related experiences of each participant.

Artifacts

The face-to-face interview was supplemented with artifacts and observations. The researcher collected photographs as screenshots and videos of participants modeling to document building progress and evidence of group collaboration and research.

Data Inventory

This sequential mixed model study included two surveys, demographics, rubrics, artifacts, observations, and a one-hour interview with each of the four case study participants. Table 4 includes the total number of pages generated as raw data during this sequential mixed model study.

Table 4

Data Inventory

Data source	Frequency	Pages	Total pages
One-Hour Interview per participant	1 interview x 4 participants	10 pages per one hour of transcription x 4	40
Gaming Experience Survey	1 survey x 69 participants	0.1 page per survey x 69	7
Minecraft Assessment Survey	1 survey x 69 participants	0.1 page per survey x 69	7
Demographic Data	1 data set x 69	0.1 page per survey x 69	7

(GPA, Ethnicity, Gender)	participants		
Rubrics	2 Rubrics x 69 participants	0.2 page per survey x 69 rubrics	14
		Total pages	75

Timeline

The time required to complete this sequential mixed model study was four weeks. Table 5 reflects the timeline that was used to complete project items by the researcher and the participants.

Table 5

Data Timeline

Date	Project Item	Participant's Role
April 22, 2015	Gaming Experience Survey	Survey Responder
May 1, 2015	Demographic Data (GPA, Ethnicity, Gender) Request	No Role
May 1, 2015 – June 2, 2015	Case Study Interviews	Interviewee
May 20, 2015	*Minecraft* Assessment Survey	Survey Responder

May 25, 2015 – May 29, 2015	Rubrics	No Role/Grading Assessment

Data Analysis

The goal of this sequential mixed model research study was to explore the predictors of academic success and 21st century skills acquired through utilizing a mainstream video game like *Minecraft* in a (9-12) secondary classroom.

Quantitative Data Analysis

In order to explore the patterns of association among the items, two separate Exploratory Factor Analyses using Principal Component factoring were conducted on the Gaming Experience Survey and the *Minecraft* Assessment Survey. The researcher explored the data looking for predictors of success and acquired learned skills through video game environments. The data was analyzed utilizing the SPSS software program. Reliability for each factor was determined and measured by Cronbach's Alpha. It was the intention of the researcher to conduct Hierarchical multiple regressions to analyze the data by variables. However, the Group Project Grade data was negatively skewed due to similar academic outcomes. A multiple regression would have been irrelevant as the skewed data did not lend itself to make predictions. The scores were obvious that the students performed significantly well on the *Minecraft* 3D modeling project.

Qualitative Data Analysis

For the qualitative data analysis, data was gathered utilizing descriptive coding methods.

The researcher looked for descriptive codes that provided insight into the general demographic categories. To begin the process of analyzing the data the qualitative inquirer generated descriptive codes through initial coding from the case study interviews, observations, and artifacts (Schwandt, 2007). The researcher read each line of the interview transcripts initially to look for similarities and differences in an effort to explore all the theoretical possibilities (Charmaz, 2002). The descriptive codes provided insight into the general categories associated with gaming experiences and the *Minecraft* Project. The transcriptions were typed in Microsoft Word and the researcher utilized the program's note taking and comment feature to code the transcripts. Simple codes were generated and noted on the transcripts. All text and visual data were first initially coded individually for basic themes, patterns, or theoretical representations (Charmaz, 2002).

During the second phase of the coding process, the qualitative inquirer engaged in focused coding methods. Focused coding analyzes the data for frequent and significant codes generated during the initial coding phase (Saldaña, 2009). These codes include larger phrases or passages of text that require in-depth understanding (Charmaz, 2002). In Figure 23, sentences, phrases, and words were tagged in the interview passages and digitally highlighted.

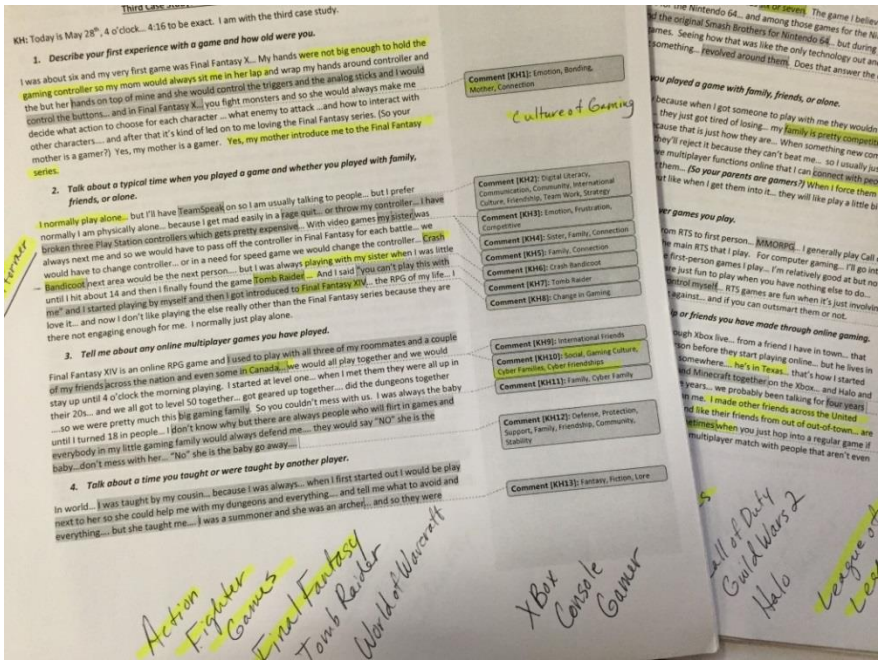

Figure 18. Coded interview transcripts. Katherine Hewett©

Axial coding followed the initial and focused coding phases and creates concepts from the passages and provides the relationship between those concepts (Corbin & Strauss, 2008). The transcriptions of the four interviews were printed and compared side by side. Each question was analyzed and compared between the four different participants. The researcher used a yellow highlighter pen to tag a second set of common categories for each question.

The researcher also coded digital artifacts. Screenshots were taken throughout the project as participants built their historic replicas. These images were imported into PowerPoint and printed with the program's note taking view feature in order to provide a space to record codes in a graphically organized way. The researcher used sticky notes to help organize categories that emerged from the data. Figure 19 illustrates the note taking feature, sticky notes, and coding.

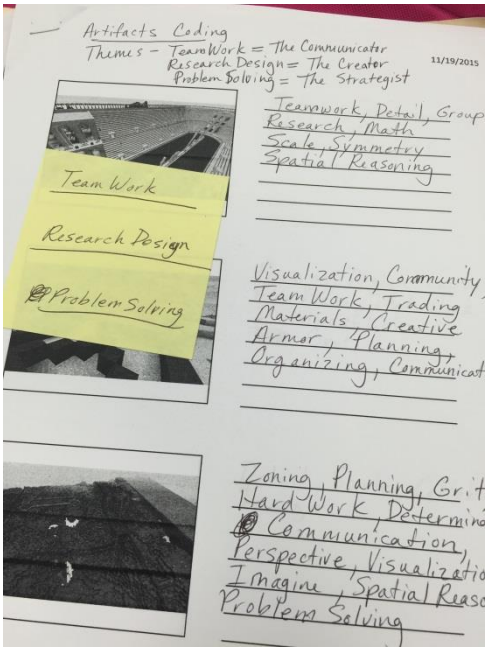

Figure 19. Coded artifacts and photographs. Katherine Hewett©

The researcher engaged in process coding as certain codes tended to repeat throughout the data sets (Saldana, 2009). Codes can repeat naturally or deliberately because of common experiences, actions, and patterns among the informants (Saldana, 2009). The researcher created graphic organizers and tables to help organize the codes. Some codes repeated among case study interviews, as the informants shared similar experiences and ideas. For example, three of the participants talked about how they customized their avatars to look like their real life selves. These codes developed a topic revolving around identity in online games and how the participants related to their avatars in real life. In Figure 20, the table illustrates how the codes were organized and sorted by their emerging themes.

Themes

The Strategist	*The Creator*	*The Communicator*	*The Hero*	*The Techie*
Codes Distributed by Themes (codes generated by the interview transcripts)				
Simple Objectives	Self-Taught	Family Gamers	Competitive	Early Gaming
Cooperative Skills	Connect to Real Life	Social Skills	Conflict	Platforming
Team Work	Science	Relationships	Morality	Engagement
Goal	Modeling	Culture	Judgment	Cutscenes
Motivation	Creation	Bonding	Identity	Higher Level
Suspense	Graphic Arts	International Friendships	Unexpected	Modeling
Knowledge	Business	International	Good Story	Graphic Arts

Figure 20. Coded categories and themes. Katherine Hewett©

To summarize the codes, the researcher used the method of topic coding to look for deeper coded meanings. Topic coding is a method of taking passages and finding topics that best summarize the theoretical meanings for the data (Richards, 2005). Figure 21 shows a concept map or graphic organizer of categories derived from the codes that the inquirer utilized to elicit themes.

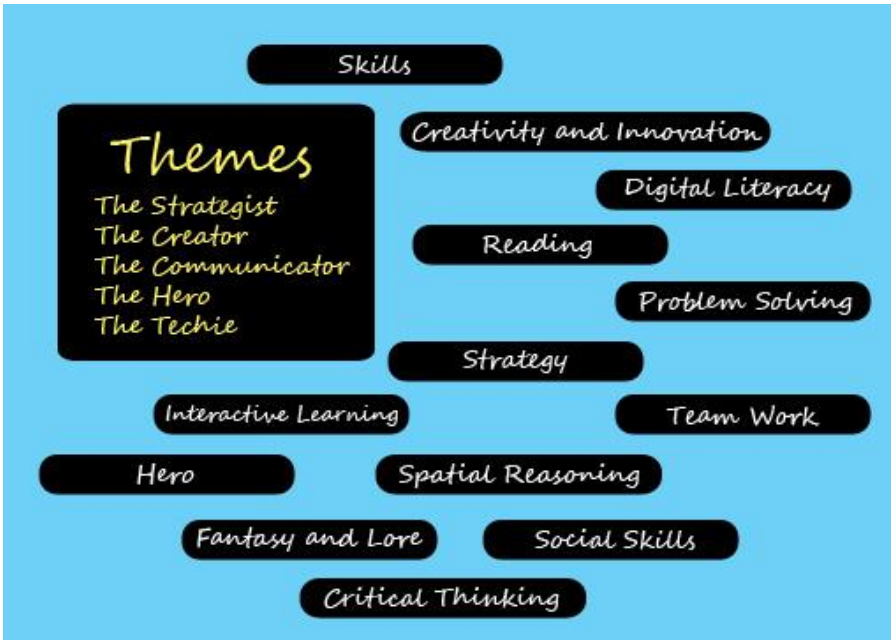

Figure 21. Coded categories and themes. Katherine Hewett©

The final stage of the coding process is the development of themes (Thomas, 2006). When the descriptive and topic codes were identified, the researcher probed further with an analytical approach. Analytical coding elicited data that described what was actually occurring within their stories. It provided the researcher with details about the experiences and furthered an understanding of them. The inductive analysis of the four interviews and artifacts lead to the emergence of five themes: 1.) *The Strategist: Accomplishing the Mission*, 2.) *The Creator: The Art of Gameplay*, 3.) *The Communicator: Building Relationships and Communities*, 4.) *The Hero: To Be the Hero of a Great Adventure*, and 5.) *I am an "Elite": A Digital Native*. Since the goal of the research questions was to elicit responses as to how participants apply strategies and skills acquired through their gaming experience, the themes have taken on the roles of game character profiles that fit the coded skills and literacies. These are the traits of experienced gamers and represent the codes of learned 21st century skills that gamers have acquired through video games.

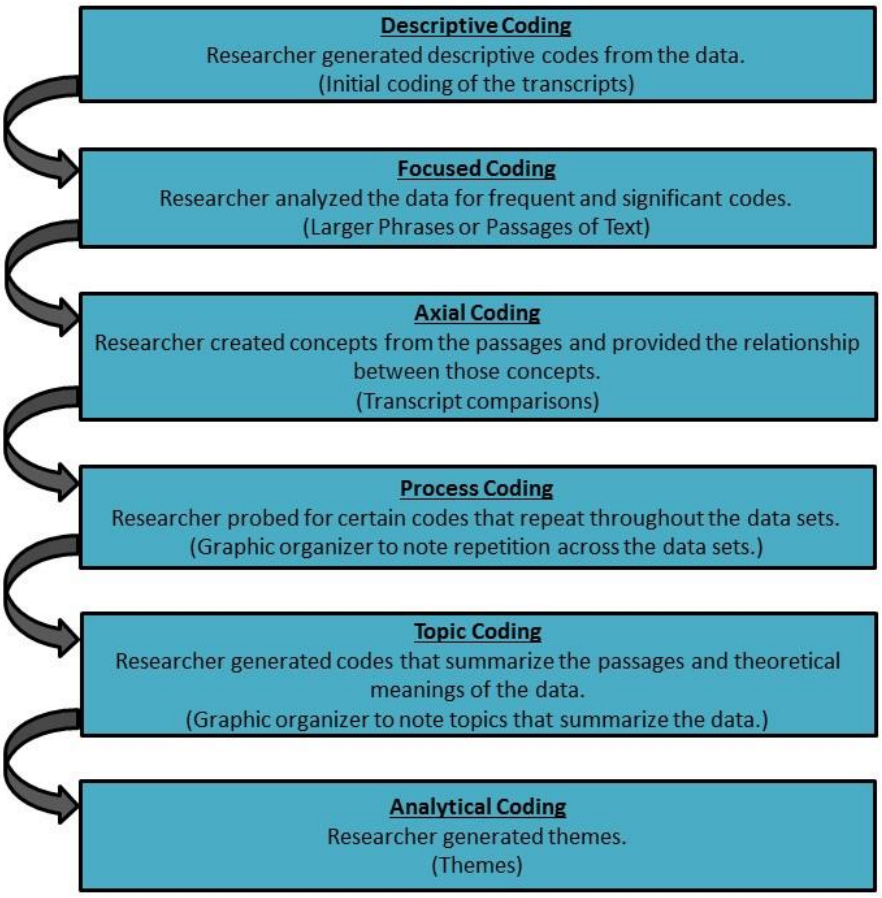

Figure 22. Coding process for the study. Katherine Hewett©

Reciprocity and Ethics

Interviews were conducted in the classroom environment so that the participants would feel comfortable. The researcher obtained parental consent for each student. Once parental consent was obtained, the researcher gathered student assent forms. Upon IRB approval, participants were contacted at school within their 3D Modeling and Animation course. Students were all offered an opportunity to participate in the study. Participation was not mandatory. Since the researcher was also the teacher for the course it was made clear that the study was purely voluntary and not mandatory. No harm came to any student and students were not penalized. This information was made clear on recruitment materials. The researcher held an

after school meeting for parents to explain the project and talked to the students in class about the project. Participants were free to leave the study without penalty at any time they felt it was necessary. Their grade for the project would not have been penalized. It should be noted that no participants left the study. If a participant were unable to take both surveys, the data would have not been collected from that participant. Their data would have been de-identified, erased, shredded, or destroyed. The researcher made sure that each participant had taken both surveys by making sure two surveys existed under each student's name. The names were de-identified after collection.

All data, study materials, consent forms, assent forms, IRB forms, recruitment materials, pseudonyms lists, and surveys will be retained for three years after the completion of the study. Files are kept in a locked file cabinet at the researcher's home with no identifiable information and will then be destroyed by shredder after three years. Digital files are stored on a password protected external hard drive that is kept locked up in a storage file cabinet at the researcher's home. Digital files will be erased after three years. Again, any data and artifacts are filed in personal storage for three years and will then be destroyed.

While participation was appreciated, the cost and feasibility of giving the whole population of the study a token of gratitude was not practical. Since the researcher was also the teacher of the participants it was ethically questionable to give students a reward for completing a regular class assignment and participating in a research study. The researcher did give the students a free day in *Minecraft* to play and build whatever they wanted.

Trustworthiness and Rigor

Multiple data sources were utilized in this study. The data sources for this sequential mixed model study included two surveys, demographics, rubrics, observations, artifacts, and four

case study interviews. The data is a reflection of the outcomes based on the research questions. Case study questions were open-ended to allow participants freedom to tell their own stories without guidance. Data was coded utilizing different methods, including initial, focused, axial, descriptive, topic, and analytical coding with bracketing. The researcher attempted to triangulate and look at the data from different angles to probe further into the research. The researcher engaged in peer review and met regularly with the committee chairs and methodologist to ensure quality and rigor of the study was maintained.

Member checks were conducted to follow up on experiences and to answer questions based off the codes generated during the face-to-face interview. Codes and interview transcripts were shared with the participants to get feedback. Participants continuously shared their video game experiences even after phase II. The researcher noted these conversations and observations. The researcher asked informal questions as needed based on the codes and themes to gain clarification and understanding. These follow ups served as a final member check to explore themes that emerged during the study.

CHAPTER IV: RESULTS

The purpose of this sequential mixed model research study was to explore the predictors of academic success and the 21st century skills gamers are learning through video game experiences. A sequential mixed model study mixes the stages or components of quantitative and qualitative methods during the research process (Tashakkori & Teddlie, 2010). The research design has two phases and subtypes within each design (Cameron, 2009). Phase I was quantitative through the means of survey. Phase II combined both quantitative and qualitative research methods through the gathering of data by means of survey and a set of four case studies based on a sub-sample of the surveyed population. A sequential mixed method design allows for a two-phased study that enhances findings (Creswell, 2003). The collected qualitative research data was coded into categories to elicit themes based on the research questions.

Quantitative Results

During the quantitative phase of the study, the researcher administered two Likert scale survey instruments to collect data from the subjects. The first survey, administered at the start of the study, attempted to measure students' level of gaming experience. The second survey was given at the end (phase II) of the study to assess students' skills acquired through the *Minecraft* Project. These surveys were vetted during a pilot study for the project. Students in three Digital Art and Animation courses were assigned the same project in *Minecraft* during the fall 2014 semester and vetted the two surveys prior to the actual study in the spring of 2015. Students provided feedback on the surveys in relation to question formatting and wording. Other demographic data was obtained through the Corpus Christi Independent School District, Office of Assessment and Accountability. The researcher collected the subjects' Cumulative Grade Point Averages (CGPAs), gender, ethnicity, class rank, and State of Texas Assessments of

Academic Readiness (STAAR) scores from the last three school years. It should be noted that the STAAR assessments are a set of new state exams. Prior to three years, the state assessments were known as the Texas Assessment of Knowledge and Skills (TAKS). Only STAAR scores were requested.

Two outside graders used a rubric to assess both the Group Project and the Individual Project. The scores from the two projects served as one data set for the study. These outside graders were certified secondary teachers with knowledge of technology integration and gaming. The data showed that both graders were consistent in their scoring of the Group Project and Individual Project based on the similarities of the grading outcomes. Prior to the start of the study, a panel of secondary and post-secondary educators and administrators vetted the rubrics with sample student projects and the rubrics were approved to be instruments for the study. The experienced panel responded positively to the design and content of the rubrics. All quantitative data was analyzed with a software program for statistical data known as Statistical Package for the Social Sciences (SPSS).

Quantitative Research Question

The study was guided by the following quantitative research question:

1. What are the academic predictors of success in a 3D Modeling and Animation course?

Subjects

Subjects were selected from a South Texas area high school with an enrollment of 2,353 students. The subjects were classified by gender, ethnicity, age, and grade level. The demographic terminology in Table 6 is based on the classifications for ethnicity and Hispanic utilized for reporting purposes by the Corpus Christi Independent School District. In the report,

51% of the population was ethnically classified as white and 41% of those subjects identified themselves as Hispanic. All ten subjects who were classified as American/Alaskan Native also identified as Hispanic. Subjects ranged in ages 16-20 and were Sophomores, Juniors, and Seniors at the high school. Nine of the subjects were female which supports Gee's (2007) research that there is a need to draw more girls into the technology and programming fields. Admittance to the three 3D Modeling and Animation courses was based on students' elective choice sheets and credits needed for graduation as scheduled through the school's guidance office. The researcher had no influence or selection over the demographic profile of the subjects in the courses that made up the population for this study. It should be noted that a larger population size was desired for the study but was limited by the number of seats available in the three classes. Table 6 illustrates the demographics obtained from CCISD as it was reported to the researcher.

Profile of Subjects

Table 6

Profile of Subjects, Categorical Variables, n = 66

Variable		f	%
Gender	Male	57	86.40
	Female	9	13.6
Ethnicity	White	51	77.3
	American Indian/Alaskan Native	10	15.2
	Asian	5	7.6
Hispanic	Hispanic	41	62.1
	Non-Hispanic	25	37.9
Age	16	6	9.1
	17	30	45.5
	18	21	31.8
	19	6	9.1
	20	3	4.5
Classification	Sophomore	11	16.7
	Junior	36	54.5
	Senior	19	28.8

Note. 51% of the population is ethnically classified by the Corpus Christi Independent School District as White with 41% of those research participants identifying as Hispanic.

Outcome Measures

The outcome measures for this study included group project grade, individual project grade, class rank, CGPA (Spring), and STAAR scale score. Table 7 shows the descriptive statistics for the outcome measures.

Table 7

Descriptive Statistics for Outcome Measures, n = 66

Variable	Mean	SD	Skewness
Spring 2015 CGPA	84.09	5.87	-.13
Class Rank-EOY	241.26	115.75	.18
STAAR Scale Score	4059.83	688.83	-2.98
Group Project Grade	96.06	9.70	-3.75
Individual Project Grade	96.45	9.16	-4.17

Level of Gaming Experience

To answer question 1: What are the academic predictors of success in a 3D Modeling and Animation course, students were first asked to complete a Gaming Experience survey (20 items) to collect data on the level of their gaming experience. The first three questions asked subjects about how many years they have been gaming, the number of hours per week they currently game, and their favorite genre of video game. The remaining questions were aimed at gauging the level of gaming experiences using a five point Likert-type scale (1 = Strongly Agree, 2 = Agree, 3 = Neither Agree or Disagree, 4 = Disagree, and 5 = Strongly Disagree).

The majority of the population reported to be experienced gamers in that they have been gaming for over five years and they spend an average of 5-20+ hours per week playing. Figure 23 illustrates the breakdown of how many hours a week the subjects were playing at the time of study.

Figure 23. How often do you play video games in a week? Katherine Hewett©

Twelve subjects reported to playing over 20 hours a week. Eighteen reported 10-15 hours of gameplay each week. The largest number of subjects (19) played video games for 5-10 hours a week. These three groups of subjects account for 75% of the population. This means that the subjects spent a large amount of time after school and in their free time playing video games at home and with friends. Only three subjects in the class were not playing video games at the time of the study.

In Figure 24, the data illustrates how long the subjects had been playing video games. The data is represented in years. Thirty-six of the subjects reported that they have been playing video games for over 10 years. Twenty-four reported their experience at 5-10 years while five had only been gaming for 2-5 years. Only one subject out of the population reported to have been gaming for less than a year.

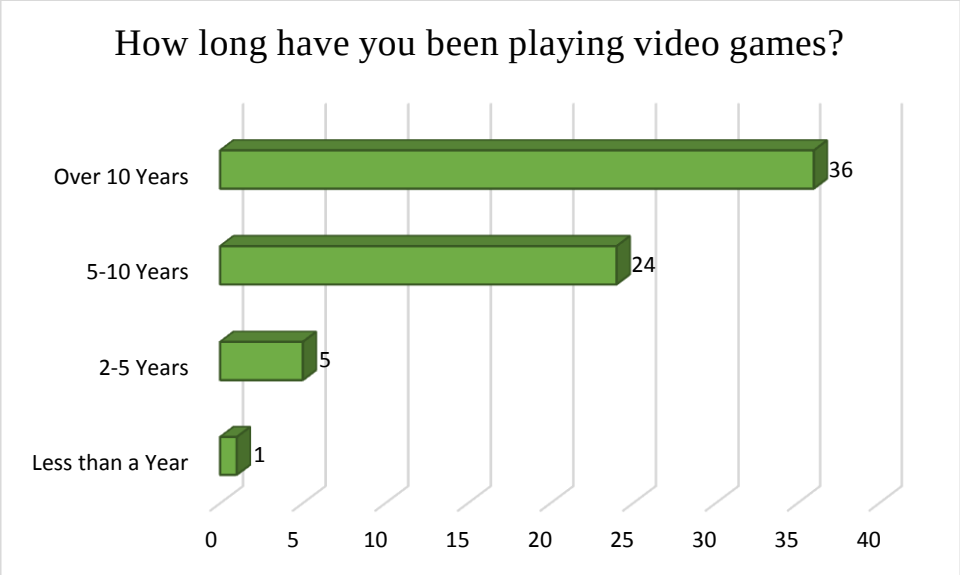

Figure 24. How long have you been playing video games? Katherine Hewett©

In Malcom Gladwell's book, *Outliers*, he explores the cognitive science research that indicates if a person devotes 10,000 hours of study to an area of interest they will become experts or rather "virtuosos" in that field of study (McGonigal, 2010). It should be noted that a maximum of 10+ years at 20+ hours a week equals 10,400+ hours of gameplay for subjects in this study. Based on the data responses and Gladwell's (2008) criteria, 24% of the subjects that had been gaming for over 10 years would already qualify as virtuoso gamers. Considering "the average American gamer living in a strong gamer culture will have spent over 10,000 hours playing video games by age 21" (McGonigal, 2010; Prensky, 2001). This is the "equivalent of working a full-time job at 40 hours a week for five years" (Von Ahn & Dabbish, 2008, p. 58). The 10-15 hour gamers for this study are well on their way of meeting that statistic by the time they turn age 21. Over half of the class (54%) reported to have played video games for over 10 years.

Additionally, 94% of the subjects considered themselves to be an expert in one game

they play regularly and 39% had already competed in organized gaming leagues. When asked which games they preferred, the two top game genres that subjects preferred were First Person Shooter and Role-Play (RPG) games. Within one of their favorite games, 67% of the subjects agreed that they had multiple/role-play characters from which to choose to play for different missions and tasks. This means that the gamers involved in this study have devoted large amounts of time in developing and leveling up multiple role-play characters that they can use for strategic gameplay. These characters' each have an expertise to meet a specific criterion, condition, or game mechanic within the game.

The market for mobile app gaming is a large segment of the gaming industry. The question about mobile app gaming was asked in order to understand how extensive subjects' gaming habits were and if there were any preferences toward gaming devices. A minority of the subjects (33%) agreed they played most of their games using mobile devices for gaming. The majority (43%) disagreed that they did not play most of their games on mobile devices. This implies that most of the gamers in this study chose to use console gaming stations and computers for their gaming. The remaining subjects (24%) neither agreed or disagreed with the question. This would suggest that they spend equal time gaming on mobile devices, consoles, and computers or were indifferent to what types of gaming devices they used.

An action-oriented game is a game with defined objectives and game structures that guide and teach the player how to level up and progress through the game. These games provide an exciting element of action and player vs. player (PVP) combat experiences that are highly engaging to gamers. The gamer plays by the rules of the game itself. In contrast, sandbox games are open worlds that leave the player to determine the rules. Players can create, modify, and define the world based on their own desires. Subjects agreed strongly (73%) that

they played both action oriented games (PVP) and sandbox games. These questions were asked to determine if subjects would have a preference towards action oriented games with PVP over sandbox games. PVP combat in action oriented video games was of interest considering the large number of male subjects in the study. It is noted that 56% of the population did indeed prefer action oriented games (PVP) over sandbox games. However, a sizable minority (33%) neither agreed or disagreed which indicates no preference and that they enjoyed playing both types of video game genres equally. Only seven subjects disagreed with this preference.

To better define the level of gaming experience, the subjects were asked a question to determine if they had grown up in a home culture of gaming. Figure 25 illustrates that the majority of the subjects agreed or strongly agreed that one or both of their parents were gamers.

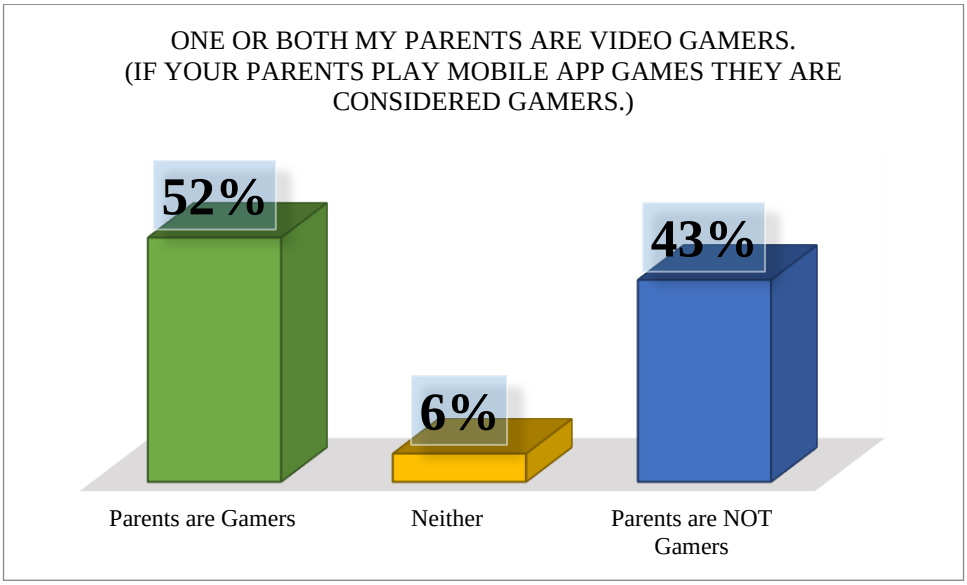

Figure 25. One or both my parents are video gamers. Katherine Hewett©

The data results indicate that the majority of the subjects have at least one parent in the household who plays video games either through mobile devices, gaming stations, or on computers. The minority (42%) disagreed or strongly disagreed that their parents were gamers.

The remaining 6% chose to neither agree or disagree with the question. This could imply that students agreed their parents play video games but they would not classify them as "gamers."

In order to find out more about the subjects' school experiences with video games, subjects were asked if they had played educational games designed specifically for Math, Science, Social Studies, and other core content areas at school. Most of the subjects (70%) had indeed played video games designed for educational purposes in school. It implies that these subjects had at least one teacher who incorporated the use of video games to teach core content areas. For example, one of the case study participants noted the use of computer centers in her elementary school years. She discussed the use of the popular educational game known as *The Oregon Trail*.

The narratives of video games were of interest in respect to the literacy skills acquired through video games. It is noted that subjects reported that the games they played require a good deal of reading to accomplish missions. Figure 26 illustrates how subjects answered this literacy question.

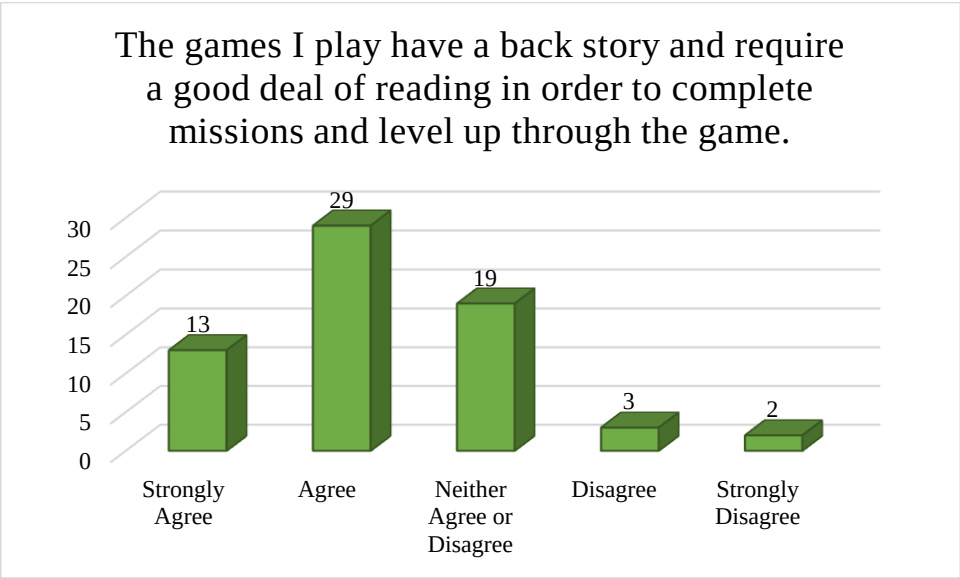

Figure 26. The games I play have a back story and require a good deal of reading. Katherine Hewett©

The majority (64%) of the population strongly agreed or agreed with this question. This supports the literacy research that "games are textually rich and require quite a bit of reading, writing, and critical thinking" (Alexander, 2009, p. 36). This data supports the trend that gamers are acquiring literacy skills while playing video games. The minority (29%) neither agreed or disagreed. Only five subjects were in disagreement with the question.

The acquirement of 21st century skills through video games led to the development of several skill questions. Subjects also reported engaging in a role-play economy system where they traded and sold items for currency, with some of these items earning the subjects US dollars or game currency to purchase new items. Participation in an economy system often leads to content creation in video game worlds. Subjects reported creating content for video games and virtual worlds while 26 of the subjects had already programmed or modified a game. The subjects (45%) belong to community forums, consult websites, or watch YouTube to learn how to play specific games. An 18% of the subjects even used their gaming experience to create video tutorials to teach other players how to play a game and 14% had created a Machinema film. Gamers improve their gameplay through the acquirement of various skills in affinity spaces. These skills often are transferred to the real world. In Figure 27, the data represents the number of subjects who agreed or disagreed to whether they had used a skill in real life that they learned in a game.

Figure 27. I have used a skill in real life that I learned in a game. Katherine Hewett©

An 82% majority reported using a skill in real life they have learned from a video game. Fifteen subjects strongly agreed and thirty-nine agreed with the question.

These questions were posed to subjects to gather data on experiences that are familiar to the gaming world. The more experiences a subject agreed with, the more expertise they possessed with gaming and the technologies associated with the gaming and 3D modeling/animation industries. The subjects report to being creators of content and not just consumers of video games. At the same time, the survey sheds light on the multiliteracies or 21st century skills that subjects brought with them into the classroom through their past video game experiences. The full data table of results for the Gaming Experience Survey is attached in the appendices.

Once the subjects completed the Gaming Experience survey they began working on a game-based learning project in class utilizing *Minecraft* to create model replicas of historic buildings. Each subject completed a group model with fellow classmates and an individual

build of their choice within the confines of the theme. Subjects researched, designed, and collaborated on the construction of these modeling projects.

Minecraft Project Assessment

Upon completion of the project, the *Minecraft* Assessment survey (20 items) was administered to assess the acquired or learned skills. Using a five point Likert-type scaling (1 = Strongly Agree, 2 = Agree, 3 = Neither Agree or Disagree, 4 = Disagree, and 5 = Strongly Disagree), subjects were asked questions based on skills, multiliteracies, applications, and preferences.

It is notable that the data for most of the statements were on the "agree" side of the Likert scale. Subjects felt they had learned skills and were productive during the *Minecraft* Project. Subjects (85%) reported that they were able to spatially reason (imagine) or visualize what they wanted their model to look like and (86%) could navigate the 3D plane well. They reported the application of various 21st century literacy skills, including the application of critical thinking, communication, collaboration, and creativity and innovation. In Figure 28, the data illustrates whether the project challenged them to be creative and innovative.

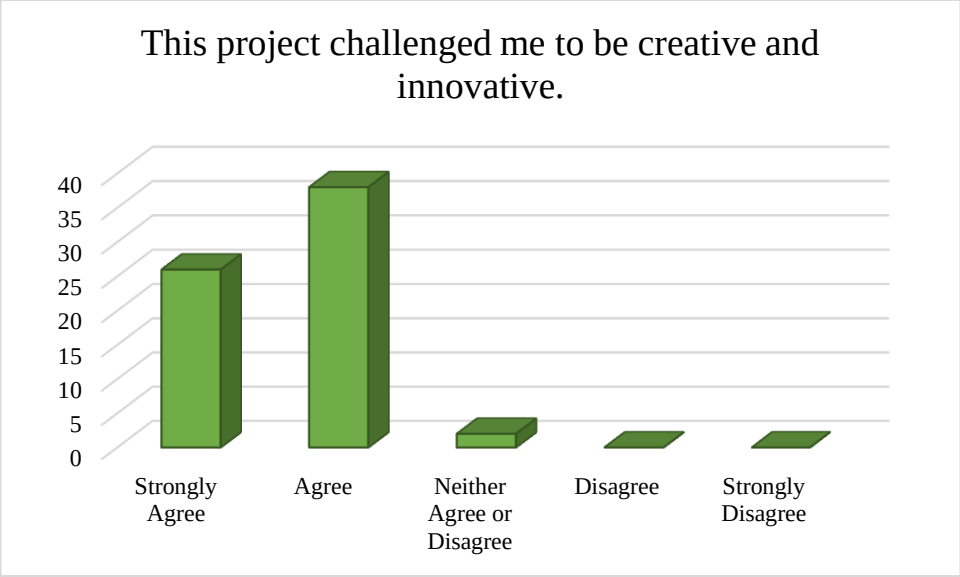

Figure 28. This project challenged me to be creative and innovative. Katherine Hewett©

Twenty-six subjects strongly agreed while thirty-eight agreed the project challenged them to be creative and innovative. That is an overwhelming 97% majority on the agree side. Only two subjects could neither agree or disagree. None disagreed with the question.

The subjects reported the use of communication and collaboration skills in order to model their project. Subjects were asked if they felt their group was productive. 86% agreed that they were able to work well together as a group and 86% equally felt they collaborated well in their group. The subjects (58%) were able to use chat commands to talk with their group. They (55%) were able to use screen capturing software to take pictures and film their groups. The groups (53%) felt they were able to establish a role-play community based on their building theme. This indicates that their ability to communicate and collaborate effectively on the project allowed them to establish roles within their group. They were then able to role-play their part within the community based on the building theme. While the majority was able to be productive as a group, 24% did prefer to work alone and 39% had no preference for working

alone or in a group.

History and replication were two components of the *Minecraft* Project. The students were encouraged to create based on an historical theme. In order to better understand their building process, the subjects were asked about their research and how they designed their 3D builds. In Figure 29, the data shows how many participants used online research as a basis to create the models that they wanted to build.

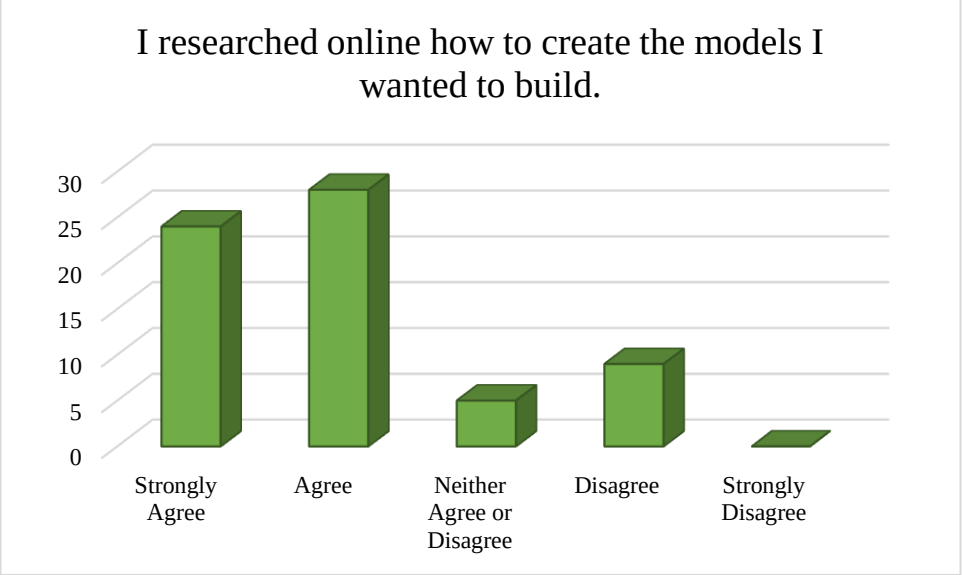

Figure 29. I researched online how to create the models I wanted to build. Katherine Hewett©

Twenty-four of the subjects strongly agreed that they used online research to create their builds. Twenty-eight of them agreed. 79% of the subjects did indeed use research. Only nine subjects did not use research to construct their builds. In addition, 70% reported that researching and then building the model helped them to learn historical content better than a lecture. In Figure 30, the data represents how subjects felt on the question.

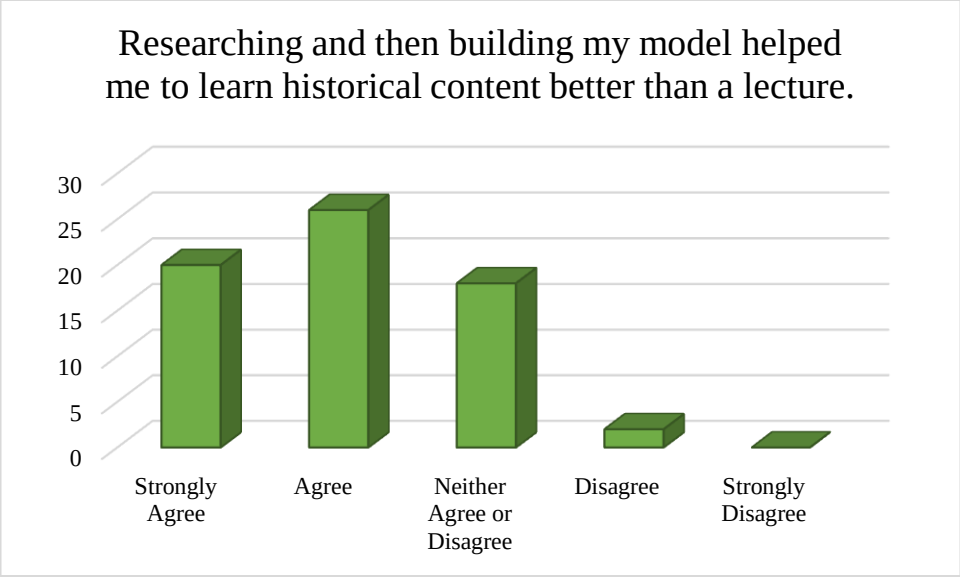

Figure 30. Researching and then building my model helped me to learn. Katherine Hewett©

Twenty subjects strongly agreed and twenty-six students agreed that researching and then building their model helped them to learn history better than a lecture. Eighteen of the subjects neither agreed nor disagreed, indicating that they had no preference for one teaching method over another. Only two subjects disagreed with the question. This indicates that the majority preferred the game-based learning environment as opposed to a traditional lecture style classroom.

The Gaming Experience Survey asked the students if they preferred action oriented games (PVP) over sandbox games. A similar question was asked on the *Minecraft* Assessment Survey. During the *Minecraft* Project, subjects were provided with time to play in Survival and Creative modes. Survival mode is more action oriented with PVP combat. Students must gather food, build shelter, craft, and mine resources for survival while also fighting off monster attacks. Creative mode is a pure sandbox game environment. It is a peaceful environment in which students are given unlimited resources to build and create. It was reasoned that students

might prefer one game mode as opposed to the other considering the preference for action oriented games. In Figure 31, the data illustrates the subjects' preference for Survival and Creative modes.

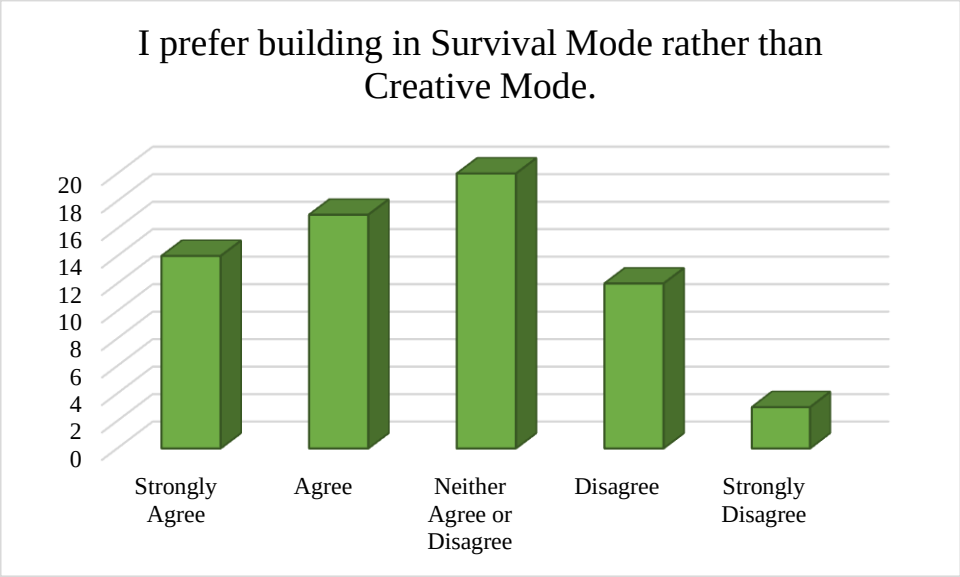

Figure 31. I prefer building in Survival Mode rather than Creative Mode. Katherine Hewett©

Fourteen of the subjects strongly agreed and seventeen agreed that they preferred Survival mode to Creative mode. These subjects together on the "agree" side account for 47% of the population and are the majority. Twenty subjects neither agreed or disagreed with the question indicating no preference. However, these subjects made up a minority of 30%. Those on the "disagree" side of the scale made up the remaining 23%. The majority of the subjects did indeed prefer building in Survival mode with its action oriented structures and PVP combat. They (53%) were able to learn how to mine and craft items in the game and (45%) figure out how to use red stone to power a circuit or irrigation system. The students enjoyed working diligently to gather and craft their own materials for building. The subjects were also asked if modeling in Creative Mode with its unlimited resources was easier for them than Survival

Mode. The majority (88%) of the subjects agreed Creative Mode was easier for them to build.

The students were also asked if they liked playing *Minecraft* at home and not at school. It was a concern that students might not enjoy the game in a school setting and have a preference for playing at home rather than at school. The question was posed to find out if school impacted the enjoyment level of the game. Only 20% of the subjects agreed that they like playing *Minecraft* at home and not at school. 39% neither agreed or disagreed with the question indicating no preference for home over school. The remaining 41% of the subjects disagreed or disagreed strongly which indicated that they liked utilizing *Minecraft* in the classroom for school purposes. School did not lessen their enjoyment playing. In fact, the majority (80%) liked having their teacher playing along with them inside the game.

The subjects were asked whether they were able to learn how to model a building or improve their building skills in class. The majority (83%) of the subjects working on the *Minecraft* Project said that they did. Only four subjects were in disagreement. In fact, most felt they had learned a modeling and design skill or other multiliteracies they would use and apply to their real world futures. In Figure 32, the data represents the number of subjects in their agreement or disagreement with the question.

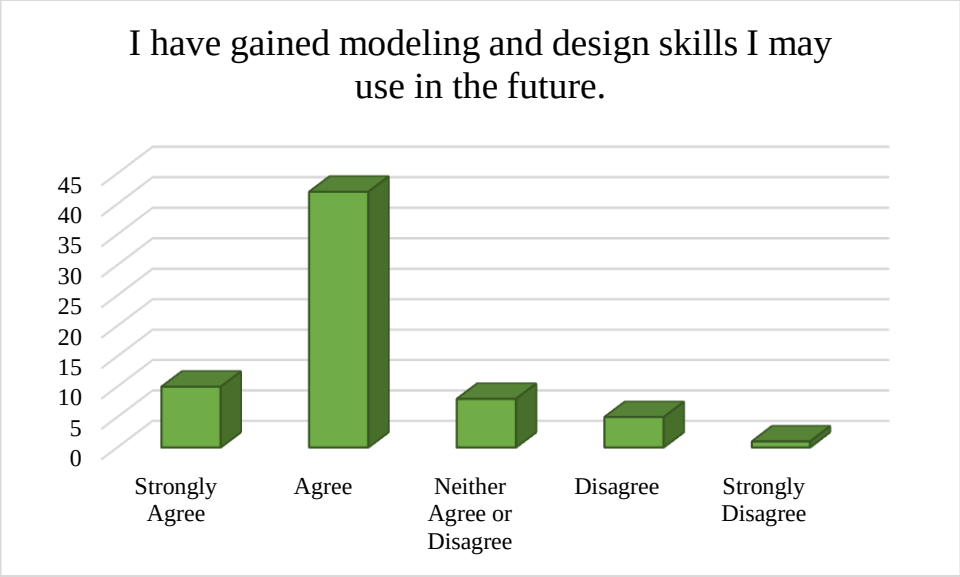

Figure 32. I have gained modeling and design skills I may use in the future. Katherine Hewett©

Clearly, the subjects felt strongly about the 21st century skills they had learned while working on the *Minecraft* project with their groups. An overwhelming 96% agreed that they were engaged in the *Minecraft* Project. The full data table of results for the *Minecraft* Assessment Survey is attached in the appendices.

Data Analysis

To explore the patterns of association among the items from both the Gaming Experience Survey and the *Minecraft* Survey, two separate Exploratory Factor Analyses using Principal Component factoring were conducted. The analysis of the Gaming Experience Survey examined the correlations among the 14 items. The dimensionality of the loadings was reduced to a smaller set of components. The 14 Gaming Experience item loading is shown in Table 8. The scree plot for the Gaming Experience Survey is shown in Figure 33. Although the scree plot indicates that at most, five factors have eigenvalues greater than one, only two factors emerged. Attempts to identify more than two factors were unsuccessful. The factors were named Level of

Gaming Experience and Expertise/Creation.

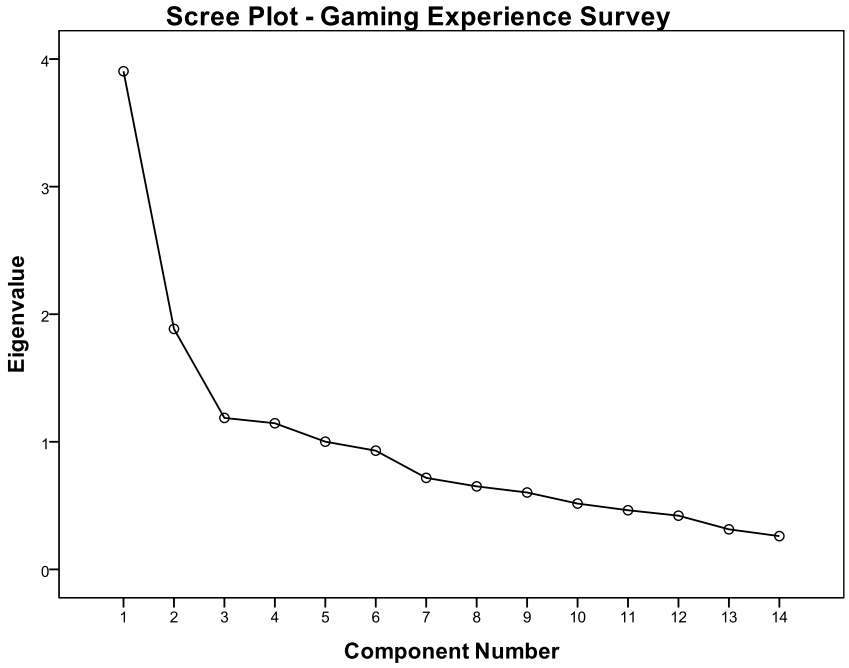

Figure 33. Scree plot – Gaming experience survey

Table 8

Rotated factor analysis indicating the loadings on two Gaming Experience factors.

Rotated Component Matrix[a]		
	Component	
	1	2
I play both action oriented games (PVP) and sandbox games.	.477	-
One or both my parents are video gamers. (If your parents play mobile app games they are considered gamers.	.406	.388
I consider myself an expert and experienced gamer in at least one game I play.	.516	-

I have played educational games at school designed specifically for Math, Science, Social Studies, and other core content areas.	-	-
I have competed in organized gaming leagues.	-	.483
I have created content for video game engines.	-	.724
I have participated in a role-play economy system by selling and trading gear for game characters.	.773	-
I belong to community forums, consult websites, or watch YouTube to learn how to play specific games.	.637	-
I am proficient at customizing my game/role-play character to fit my personal tastes and identity.	.633	-
I have modified or programmed code for a game.	-	.729
I use my gaming expertise to create video tutorials to teach other players how to play a game.	.305	.618
I have multiple game/role-play characters that I can choose to play for different missions and tasks within ONE game.	.803	-
I have created a Machinema film.	-	.725
I have used a skill in real life that I learned in a game.	.575	-

The means and standard deviations by item are presented in Table 9.

Table 9

Gaming Experience Survey subscales with the corresponding questions.

Level of Gaming Experience	Mean	SD
I consider myself an expert and experienced gamer in a least one game I play.	1.56	.704
I am proficient at customizing my game/role-play character to fit my personal tastes and identity.	2.05	1.014

I play both action oriented games (PVP) and sandbox games.	2.08	1.027
I have used a skill in real life that I learned in a game.	2.11	.979
I have multiple game/role-play characters that I can choose to play for different missions and tasks within ONE game.	2.27	1.089
I have played educational games at school designed specifically for Math, Science, Social Studies, and other core content areas.	2.30	.976
I belong to community forums, consult websites, or watch YouTube to learn how to play specific games.	2.41	1.228
I have participated in a role-play economy system by selling and trading gear for game characters.	2.65	1.364
One or both my parents are video gamers. (If your parents play mobile app games they are also considered gamers.)	2.95	1.352

Expertise/Creation	Mean	SD
I have competed in organized gaming leagues.	3.11	1.337
I have modified or programmed code for a game.	3.20	1.205
I have created content for video game engines.	3.24	1.241
I use my gaming expertise to create video tutorials to teach other players how to play a game.	3.65	1.183
I have created a Machinema film.	4.00	1.008

Reliability for each factor was determined, as measured by Cronbach's Alpha. Both factors had acceptable reliability coefficients, Level of Gaming Experience ($\alpha = .766$) and Expertise/Creation ($\alpha = .694$).

The analysis of the *Minecraft* Survey examined the correlations among the 19 items. The 19 *Minecraft* Survey item loading is shown in Table 10. Scree plot for the *Minecraft* Survey is

shown on Figure 34. Although the scree plot indicates that, at most, six factors have eigenvalues greater than one, only two factors emerged. Attempts to identify more than two factors were unsuccessful. The factors were named Learned Skills and Application/Preferences.

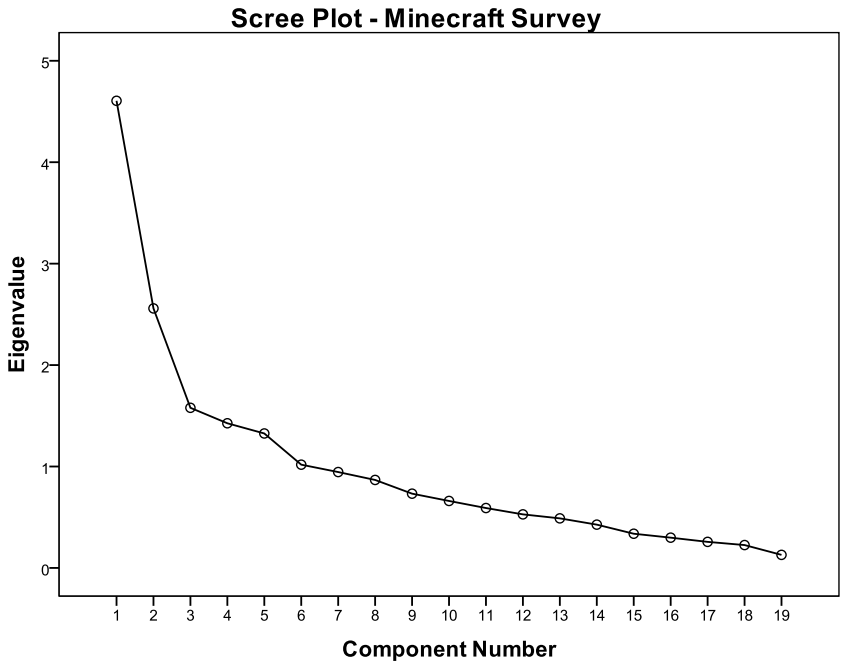

Figure 34. Scree plot – *Minecraft* survey

Table 10

Rotated factor analysis indicating the loadings on two Minecraft Survey factors.

Rotated Component Matrix[a]		
	Component	
	1	2
I liked having my teacher's avatar inside the *Minecraft* game with me.	.574	-

I like playing *Minecraft* at home and not at school.	-	.505
I prefer building in survival mode rather than in creative mode.	-	.609
I learned how to model a building or improved my building skills in class.	.576	-
I was able to spatially reason (imagine) how I wanted my model to look in *Minecraft*.	.403	-
I collaborated well with my building group (classmates).	.551	.522
I researched online how to create the models I wanted to build.	.364	.414
I was able to navigate the 3D environment quickly.	.309	.545
I was able to use the chat commands to talk with my group.	-	.592
I was engaged in this project.	.718	-
Researching and then building my model helped me to learn historical content better than a lecture.	.658	-
I was able to use the screen capturing software on my computer to take pictures and film.	-	-
I have gained modeling and design skills I may use in the future.	.597	-
This project challenged me to be creative and innovative.	.620	.300
Modeling in creative mode with its unlimited resources was easier for me than in survival mode.	.392	-
My group was able to establish a role-play community based on our building theme.	.503	.323
I was able to learn how to mine and craft items in the game.	-	.648
I was able to figure out how to use red stone to power a circuit or irrigation system.	-	.733
I felt my group was productive.	.635	-

The means and standard deviations by item are presented in Table 11.

Table 11

Minecraft Assessment Survey subscales with the corresponding questions.

Learned Skills	Mean	SD
I was engaged in this project.	1.56	.585
This project challenged me to be creative and innovative.	1.64	.545
Modeling in creative mode with its unlimited resources was easier for me than in survival mode.	1.71	.799
I collaborated well with my building group (classmates).	1.80	.932
I felt my group was productive.	1.83	.815
I learned how to model a building or improved my building skills in class.	1.86	.839
I was able to spatially reason (imagine) how I wanted my model to look in *Minecraft*.	1.92	.708
I liked having my teacher's avatar inside the *Minecraft* game with me.	1.98	.754
Researching and then building my model helped me to learn historical content better than a lecture.	2.03	.841
I have gained modeling and design skills I may use in the future.	2.17	.834
I was able to use the screen capturing software on my computer to take pictures and film.	2.44	.879
My group was able to establish a role-play community based on our building theme.	2.48	.965

Application/Preferences	Mean	SD
I was able to navigate the 3D environment quickly.	1.65	.794
I researched online how to create the models I wanted to	1.98	1.000

build.		
I was able to use the chat commands to talk with my group.	2.27	1.046
I was able to learn how to mine and craft items in the game.	2.39	1.021
I prefer building in survival mode rather than in creative mode.	2.59	1.150
I was able to figure out how to use red stone to power a circuit or irrigation system.	2.61	1.135
I like playing *Minecraft* at home and not at school.	3.21	1.015

Reliability for each factor was determined, as measured by Cronbach's Alpha. Both factors had acceptable reliability coefficients, Learned Skills ($\alpha = .791$) and Application/Preferences ($\alpha = .694$).

Subjects' projects were graded by two experienced educators at the high school. Graders utilized two rubrics to grade the Group Project and Individual Project. Those scores were analyzed in SPSS. The results in Figure 35 illustrate a left-skewed distribution curve and histogram for the Group Project Grade data. It is negatively skewed due to similar outcomes.

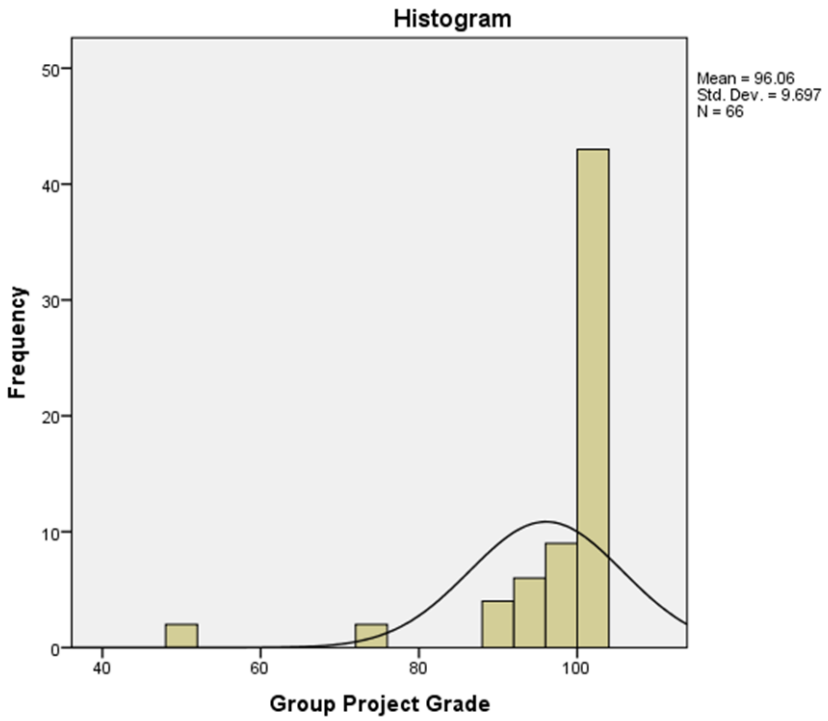

Figure 35. Histogram – Group project grade

This finding indicates that a multiple regression analysis of the data would be irrelevant because the skewed data does not lend itself to make predictions. In Table 12, the data indicates that 43 of the subjects received a grade of 100 by two separate graders. That is 43 out of 66 subjects receiving a perfect score on their *Minecraft* 3D modeling group project.

Table 12

Group Project Grade

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	50	2	3.0	3.0	3.0
	74	2	3.0	3.0	6.1
	90	4	6.1	6.1	12.1
	92	3	4.5	4.5	16.7

94	3	4.5	4.5	21.2
96	4	6.1	6.1	27.3
98	5	7.6	7.6	34.8
100	43	65.2	65.2	100
Total	66	100.0	100.0	

This data could indicate that the groups were highly motivated and successful at working together as a team to build their part of the classroom project. The students worked in groups of four on key areas of the project and then as a whole group when needed. Good communication, collaboration, and problem solving skills (Four C's) among the groups could be factors that led to this skewed result. The researcher did not expect that so many of the subjects within their groups would score so well on the Group Project Grade. However, the final projects visually were well done and grand in scale. The level of detail most certainly indicates why so many of the subjects received perfect scores. Photographs of the builds are included in the qualitative results (see Figures 47, 48, 49, 50, and 52).

Another factor that could explain the high performance is the heavy concentration of gamers in this study. The researcher had no control over the demographics of this group. The population was determined by the students' choice sheets for graduation and what technology courses fit their student schedule. The researcher did not expect that the 3D Modeling and Animation course would attract a certain demographic or gender, but the results indicate that the Group Project Grade data was heavily skewed by a high concentration of Hispanic male gamers. When Figure 35 is compared with Figures 23 and 24, it is evident that the majority of the population did indeed report to be experienced gamers. These subjects have been gaming for over five years and they spent an average of 5-20+ hours a week playing video games. It would

make sense that the students' comfort levels with this digital medium would be high and could positively impact the outcome of their academic performance. Therefore, this could be an indication as to why the Group Project Grade results reveal a left-skewed distribution.

The data results also indicated two outliers within the group. These subjects were different from the group and scored a 50 on their project. These students were basketball players and had missed a great deal of school for games at the time of the project. The students seemed uninterested in the project and unmotivated to make up their absences. They both indicated that they were only in the class to receive a technology credit for graduation. Their project work was not as detailed as the other groups. The two graders were unaware of these circumstances and graded according to what the students turned in as their final project. These two outliers failed to produce 3D models of equal detail to the others and the quality was obvious to the graders as indicated by their score.

It should also be noted that two students received a score of 74. These male students were autistic which would explain the lower grades in comparison to the whole group. The graders were unaware that the two students were special needs students. They graded all the students blindly without interference from the teacher. Had the teacher of the two students acted as the grader for the project, the scores for the two autistic boys would have been higher and graded accordingly with their abilities. Their final grades would have been similar to the whole group. The students' buildings were very different in appearance from the others and not as detailed. Instead of building a large replica of a historic building, these autistic boys chose to build small Greek temples, houses, and buildings. The researcher noted that the boys preferred to divide up the work and build separately. Both boys indicated on the *Minecraft* Assessment Survey that they felt their group worked well together. However, one of the boys indicated that

he preferred to work alone. Communication and collaboration can often be difficult for children with autism. The boys utilized the local text chat to communicate with each other instead of speaking. It should be noted that these students were the only autistic children in the population. This result indicates that the students' autism may have played a significant role in placing their results on the edge of the distribution curve.

Supplemental Quantitative Analysis

When the regression analysis results for the four variable model predicting Class Rank was examined, the variable Gender was nearly a significant predictor (p = .07). The study sample included nine females and 57 males. Gender was of interest due to the small population size of females enrolled in the 3D Modeling and Animation course. Class Rank indicated a nearly significant predictor and further investigation into this matter was desired to explore the academic differences between males and females taking a 3D Modeling and Animation course. Table 13 shows a tabulation of Gender vs. Class Rank, Spring 2015 CGPA, STAAR Scale Score, and Group Project Grade.

Table 13

Academic Differences in Males and Females enrolled in a 3D Modeling and Animation Course

Variable	Gender	Mean	Std. Deviation
Class Rank (EOY)	Male	256.96	111.33
	Female	141.78	95.98
Spring 2015 CGPA	Male	83.46	5.81
	Female	88.12	4.79
Group Project Grade	Male	95.68	10.36
	Female	98.44	2.19
STAAR Scale Score	Male	4080.89	581.23

	Female	3926.44	1211.29

The mean class rank for the 9 females was 45% lower than the mean class rank for the 57 males. The lower the mean class rank the better the actual Class Rank. An analysis of the difference in mean class rank was performed using an independent sample *t*-test. The results showed that there was a statistically significant difference between males and females on the basis of Class Rank, $t(64) = 2.93$, $p < .01$. This indicates that the females had significantly better Class Ranks and overall academic success than their male counterparts.

Qualitative Results

To explore research questions two and three for this sequential mixed models research design, a subsample of the population was selected based on level of gaming experience, gender, and classification for a set of four case studies. A case study is a research method of an empirical inquiry that investigates in-depth understanding of a contemporary phenomenon (Yin, 2009). The four cases studies examined the phenomenon of gaming and which 21st century skills and literacies are learned through gaming experiences from the perspectives of South Texas area high school students enrolled in three 3D Modeling and Animation courses. Interviews, photographic artifacts, and observations were used to explore the gaming experiences, gaming culture, and the building process of the participants. By drawing from various data sources, the descriptive quality of the study was enhanced and revealed different perspectives on the phenomenon (Denzin & Giardina, 2011). Saldaña (2011) remarks of the benefits of utilizing multiple data sources which allows for a "greater spectrum" of understanding and dimension (p. 76). The open-ended questions were posed to elicit a personal narrative and look at the phenomenon of gaming in general.

The participants for this study assented to be a part of a modeling project in which the popular mainstream game, *Minecraft*, was utilized as an educational modeling tool. The project required that they work as a classroom of builders to model replicas of famous historical sites in order to attempt to uncover learned skills and multiliteracies acquired through game-based learning. At the start of the project, each of the three 3D Modeling and Animation courses were tasked with brainstorming themes on which to base their projects. One class chose to build famous castles of England, Ireland, and Scotland. The second class chose to build Rome and Greece at the time of the Macedonian Wars. The third class recreated the D-Day invasion of Normandy, with the intention of building the invasion forces storming the beaches and Mont Saint-Michel. The researcher photographed the participants' modeling process in *Minecraft* by means of screenshots of their avatars building "in game." In-world observations were also captured with digital screenshots and video.

Qualitative Research Questions

The qualitative case studies for this study were guided by the following research questions:

2. What do participants learn from working in a video game environment? How might participants apply this learning?

3. How do participants apply strategies and collaborate in order to problem solve tasks while working in a video game environment? In what ways do participants apply strategies to help themselves in a video game environment?

Participant Descriptions

Participants for the study were students at a South Texas area high school enrolled in three 3D Modeling and Animation courses. Four participants volunteered and were chosen by the researcher based on their level of gaming experience, gender, classification, and enrollment in the 3D Modeling and Animation course through purpose sampling. It is best to select participants based on rich experiences and what you want to know (Patton, 2002). Purposeful sampling aims to discover an understanding obtained through the phenomenal insight of informants (Merriam & Tisdell, 2015). In this case, purposeful sampling was aimed at discovering insight into what 21st century skills or literacies are learned through gaming while deepening understanding of what predicators shape academic success.

The four participants consisted of two males and two females and all had been gaming since early childhood according to the data collected from the Gaming Experience survey in Phase I of the study. The participants' grade classifications consisted of two Seniors (male, and female), one Junior (female), and one Sophomore (male). Freshmen (2 males) had to be omitted from the study after data collection due to no official CGPA or class ranking on file with the district's Office of Accountability and Assessment until the following school year. The four case study interviews were conducted during the last two weeks of the school year in May (2015) on the site of the participants' high school campus and in their 3D Modeling and Animation classroom directly after school. Each interview was one hour in length. Follow up interviews and member checks were scheduled accordingly due to time constraints to be flexible with the participants' schedules. Each participant selected their own pseudonyms for the study to protect their identities.

Nano

Nano has been gaming since the age of four or five with his brother and father. His first gaming experience was a platform game known as *Crash Bandicoot*. He was 18-years-old and a senior in high school at the time of the study. He is classified as American Indian and also identifies as Hispanic. His CGPA at the end of the study and spring semester was an 84.6 and was ranked 224 out of 463 in his graduating class. Nano games over 20 hours per week. He enjoys playing all types of game genres with no favorites reported. At the time of the study, his games of choice were *PayDay, Call of Duty, Counter-Strike: Global Offensive, Team Fortress 2,* and *Smash Bros*. Nano is also a content creator for games and spends much of his time creating digital art, films, and 3D models. He is the most experienced content creator or artist of the four participants. He started creating digital art in elementary school when he attended a public magnet art academy. Figure 36 is a screenshot of Nano's avatar in *Xbox Live.*

Figure 36. Nano's avatar for *Xbox Live*©.

Celeste

Celeste started gaming on her father's computer with her twin sister at the age of five. She was also eighteen-years-old and a senior at the time of the study. Celeste is demographically identified as a White Non-Hispanic student. Her CGPA was a 93.6 with a class ranking of 106

out of 463 seniors at the time of graduation and the study's end. She spends 15-20 hours a week in online gameplay and prefers Massively Multiplayer Online Role-play Games (MMORPGs). Her current game of choice is *Guild Wars 2*. Celeste has a preference for "healing" job roles that allow her to use magic to help people and prefers support job classes in video games. Celeste considers herself to be a PC gamer but enjoyed playing on her older brother's console when she was younger. Celeste moved to South Texas three years ago from the Midwest and reports having taken other digital art classes at her previous schools. She is a graphic artist and enjoys creating art work for video games and contests. She has a preference for creating 2D art. Figure 37 are screenshots of Celeste's melee fighter in *Guild Wars 2* and her healer in *World of Warcraft*.

Figure 37. Celeste's avatars in *Guild Wars 2*© and *World of Warcraft*©.

Wonder

Wonder started gaming with her mother when she was just old enough to sit on her mother's lap but not big enough to hold a game controller on her own. The 19-year-old also identifies as White Non-Hispanic like Celeste. Her CGPA is an 87.7 and her junior class ranking at the end of the study was 101. She also enjoys MMORPGs and spends 15-20 hours playing per

week. She is a level 50 summoner in *Final Fantasy XIV: A Realm Reborn*. Wonder has several high ranking job classes leveled up in *Final Fantasy* which allows her to play multiple class roles within her party or guild. She considers herself a console gamer. Wonder is a 3D graphic artist and enjoys creating 3D models in *Blender*. She has a passion for coding and is learning how to build and program her own *Linux* server. She has been teaching herself computer languages in her free time through *Code Academy* for the past three years. Wonder is planning to study game design and programming in college. She lives on her own and supports herself financially with earnings at her minimum wage job at a local dollar store. She rides her bike to and from school and work each day. During her senior year, Wonder was accepted early to an area college and is trying to make ends meet until graduation when she can take on more hours at work and apply for financial aid. Figure 38 is a screenshot of Wonder's avatar in *Final Fantasy*.

Figure 38. Wonder's avatar in *Final Fantasy*©.

Sterling

Sterling had his first gaming experience at the age of six or seven. He was a Sophomore at the time of the study. He is classified as White and identifies as Hispanic. The 16-year-old had a CGPA of 82.7 and was ranked 244 in his class at the conclusion of the study. Sterling is identified as Gifted and Talented and attended the local elementary school for GT children. He

reported that he games 15-20 hours a week and prefers First Person Shooter games. Sterling enjoys becoming the character and "looking the part." He enjoys strategy, magic, fantasy, and lore in his gameplay. Sterling is a highly ranked player in his favorite game, *League of Legends*. His ranking allows him to compete in gaming leagues and he is the youngest of the participants. Sterling has taught himself how to use redstone and explosives to power circuits and pistons in *Minecraft*. In Figure 39, he enjoys creating elaborate interactive spaces with triggers.

Figure 39. Sterling's avatar in *Minecraft*. Katherine Hewett©

The participants were eager to be a part of the study and volunteered with their parents' permission. Assent and consent forms were collected prior to the start of the study for both the quantitative and qualitative data collections. For the purposes of this study, the participants are referred to by their chosen pseudonyms (Nano, Celeste, Wonder, and Sterling). The participants are digital natives who have been gaming and exploring virtual environments since early childhood. They have experienced first-hand the evolution of these emerging technologies and provide their own perspective on how gaming has impacted their real world skills. Their stories provide perspective into childhood gaming experiences, predictors for academic success, and the *Minecraft* project.

Data Analysis

The data collections in the qualitative phase of the study led to the development of five themes: 1.) *The Strategist: Accomplishing the Mission*, 2.) *The Creator: The Art of Gameplay*, 3.) *The Communicator: Building Relationships and Communities*, 4.) *The Hero: To be the Hero of a Great Adventure*, and 5.) *I am an "Elite": A Digital Native*. These themes were elicited by common categories among the case study interviews. They represent character traits of experienced gamers and are correlated with the The Partnership for 21st Century Skills' framework for Critical Thinking and Problem Solving, Communication, Collaboration, and Creativity and Innovation, also known as the "Four C's" (National Education Association, 2015). Each theme is a descriptive trait with its own set of learned 21st century skills and multiliteracies that the participants acquired through their gaming. The four participants shared these common traits of categories through varying experiences and on different levels.

The Strategist: Accomplishing the Mission

The strategist in game worlds is the gamer that will utilize a variety of 21st century skills and multiliteracies to accomplish a mission. This gamer will do all they need to do in order to ensure they meet the objective with their team or guild. The strategist recognizes the fact that their ability to advance further in the game depends on their ability to strategically execute game objectives with the help of others. These strategies are 21st century skills and literacies that participants learned through their gaming experiences.

Team unity and collaboration. The discussion of team unity and collaboration became a pattern throughout the case study interviews. The participants related stories of how they worked together with other players and friends to advance themselves further in gameplay. Sterling, the most vocal strategist of the four case study participants stressed the necessity of

working together and how that impacts his game. He described how he utilized strategy to maximize his game characters' traits, powers, and specialties. Coordinated strikes executed by two ally players on an enemy in *League of Legends* is one example of this form of team unity and collaboration.

> Sterling: "*Mechanically the game works out well… as in… many champions have interlocking abilities. Some abilities can only be activated if the champion was knocked into the air. So, if you have a said champion that gets knocked into the air and another said champion then activates on someone in the air… those two can correlate their attacks and defeat someone easier. Things like that tend to happen a lot if you're not prepared for it and they can easily happen if you're prepared to activate them yourselves. There is a lot of teamwork by providing vision on the map and trying to pinpoint the enemy's location… so someone isn't caught out in the open without any help.*"

Teams learn to work together to support and launch offensive assaults together. These highly collaborative environments teach students how to work together and be a team.

Strategy and problem solving. Learning to use strategy to solve problems was another theme the participants revealed in their case study interviews. Their gaming experiences had challenged them to solve problems to complete quests. By setting a goal, Nano found that overcoming obstacles was easier if he focused on the issue at hand and solved it first.

> Nano: "*Usually to get a job done in the game Skyrim… I want to make sure I can at least set a goal for myself and then I make sure I get that done. That usually just keeps pulling me in more and more… keeping me up at night. I try to get certain things done within the game. It is a motivational thing. I want to be the best at it… Skyrim.*"

To be the "best", Nano feels learning to set goals and focusing on one thing at a time is key. He believes in achieving a level of expertise in one thing before leveling and advancing further in the game. Nano reveals that the problems he encounters in game worlds impact his real life. A quest, mission, or problem will keep him up at night until he is satisfied and solves it. The challenges he is tasked with in game worlds motivates him to be the best. He reveals his determination with a sense of grit. Like Nano, Sterling also displays this same sense of determination as he and his team try to plan out a course of action in the game *Halo Wars.* He enjoys the mental challenges of real-time strategy games known as an RTS.

> Sterling: "*RTS games are fun when it's just involving strategy and the IQ of the person you're playing against… and if you can outsmart them or not*."

Sterling enjoys playing games that challenge his mind and decision making abilities as well as develop his strategy skills. In *Halo Wars,* he describes a strategic map of gameplay in which the members of his team have to problem solve their locations on the map to survive. They brainstorm their ideas to figure out how to advance and level up together.

> Sterling: "*One of the most prevalent things that comes to mind is Halo Wars which is the RTS that I spoke of earlier. An RTS is a top view type of game where you create your own army. You're the commander of the army that is being created. It ranges from military units… like personnel to vehicular units… to air units that travel across vast expansive maps… and you try to like find your enemy's basin. You take it out while their attacking you and your base. My friends and I play, bounce ideas, and strategies off each other. We try to help each other become better because there is a drastic ranking system in the game. If you suck, you are going to keep on sucking and there is no way out of it. So, my*

friends and I bounce idea strategies and try to correlate our movements on the map. If one of us is rushing, the other two will build up defensive units and guard our bases. So, if they try to push back after a rush fails we will counter it and they won't be able to do anything. We will just keep on doing that until we can build up some pace and fight back."

Players learn quickly that the ranking system requires them to work together in order to level up and win the game. Sterling describes how this teamwork becomes a strategy and how brainstorming ideas gives teams the edge they need to advance across the map.

Problem-solving, teamwork, and the use strategy was also observed during the *Minecraft* Project. Participants were tasked with various problem solving scenarios during the modeling process. Participants used aerial views to help layout and zone their parcels or build sites. By planning ahead, the builders were able to zone a layout of the land to map out how much room they would need. This prevented them from building too closely. Participants had to figure out the dimensions of the buildings according to scale. Groups discussed and came to a consensus on the scale of the world. Participants utilized their math and physics skills to ensure proper scale and placement. In Figure 40, the students are zoning and planning their workspaces.

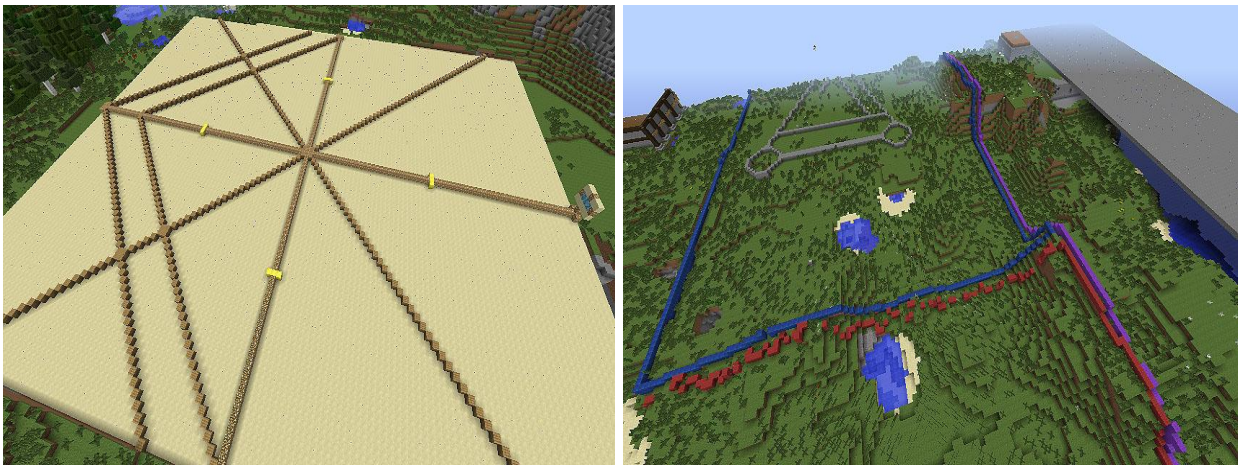

Figure 40. *Minecraft* scale and placement. Katherine Hewett©

Minecraft journals became a handy way of keeping track of such scaling and placement. Participants engaged in the replication of landing craft and ships for the D-Day Invasion. The researcher observed that the participants were keeping journals in *Minecraft* to help them remember the number of blocks and scaling they had decided as a group to use. The journals were the result of the students self-organizing their project. The idea was student driven without any involvement or guidance of the teacher or researcher. In Figure 41, the student is reviewing notes in his *Minecraft* journal.

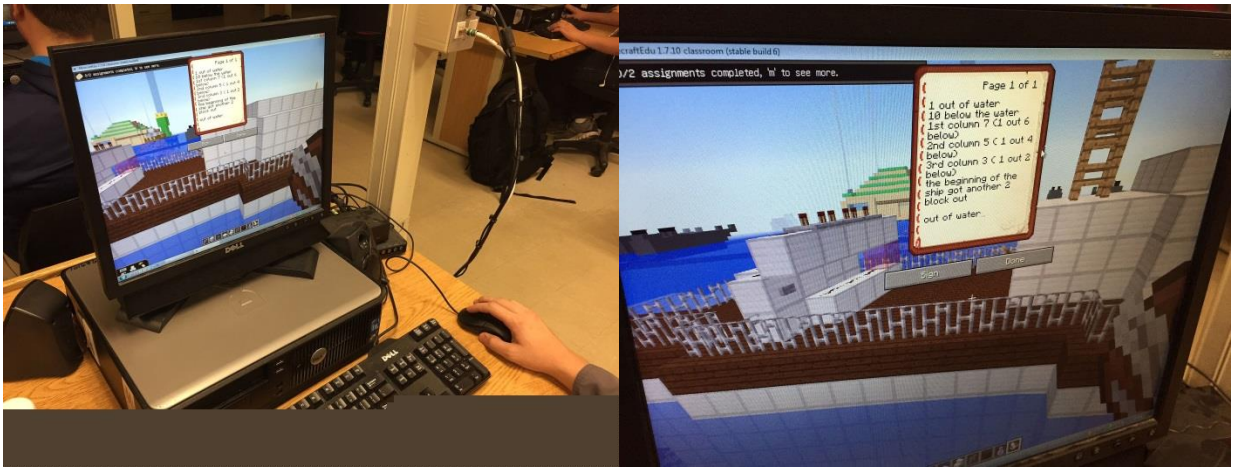

Figure 41. *Minecraft* notes and journals. Katherine Hewett©

Research played a key role in problem solving issues. The participants referred to websites, photos, and floor plans to help them map out their buildings to scale. In the photos below a student is reviewing a floor plan of the Mont Saint-Michel Abbey. Participants were able to find great detail about their time periods and buildings through various websites and online museums. Historic floor plans were compared with aerial screen captured images of the

build projects. In Figure 42, the student is researching floor plans of Mont Saint-Michel in Normandy, France and comparing it with their model in *Minecraft*.

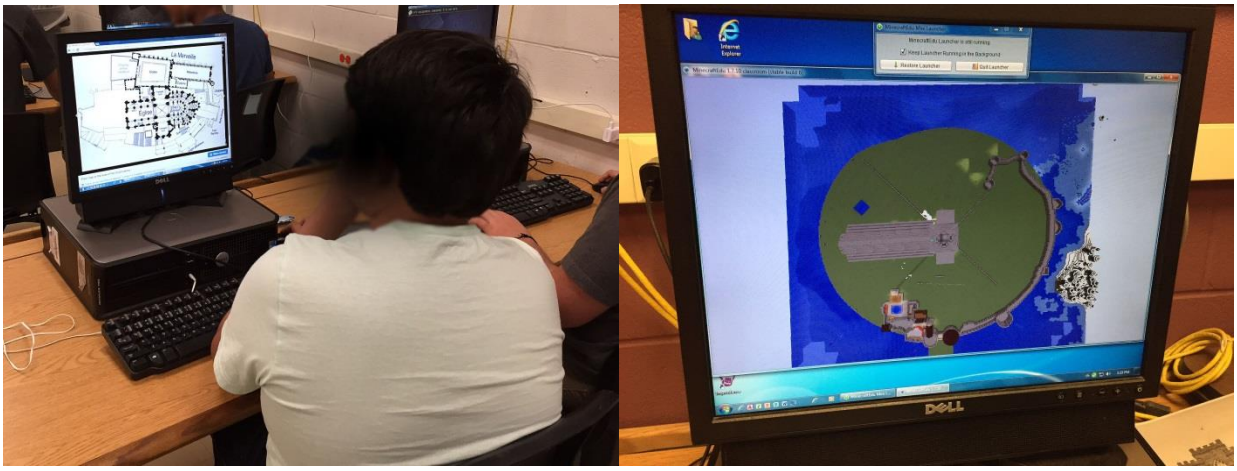

Figure 42. *Minecraft* floor plans and research. Katherine Hewett©

A unique problem surfaced during the construction of the USS Nevada battleship. The participants were challenged with the issue of building in the water. Water in *Minecraft* is programmed to function like real water. Participants tried to sand bag the water to hold it back but soon found fighting back the water to be difficult and time consuming. They brainstormed that the teacher privileges in the game might allow the teacher to remove the water by utilizing a feature in the build tools that allows for the removal of large sections of land in one click. After a server crash, participants re-logged to find a large section of water gone. By building pillars in the water on the four corners, the water was removed when the land pillars were deleted using a distance building/edit tool. In essence, the students found a loophole to trick the game into deleting the water. Figure 43 illustrates this moment of tricking the game to delete water.

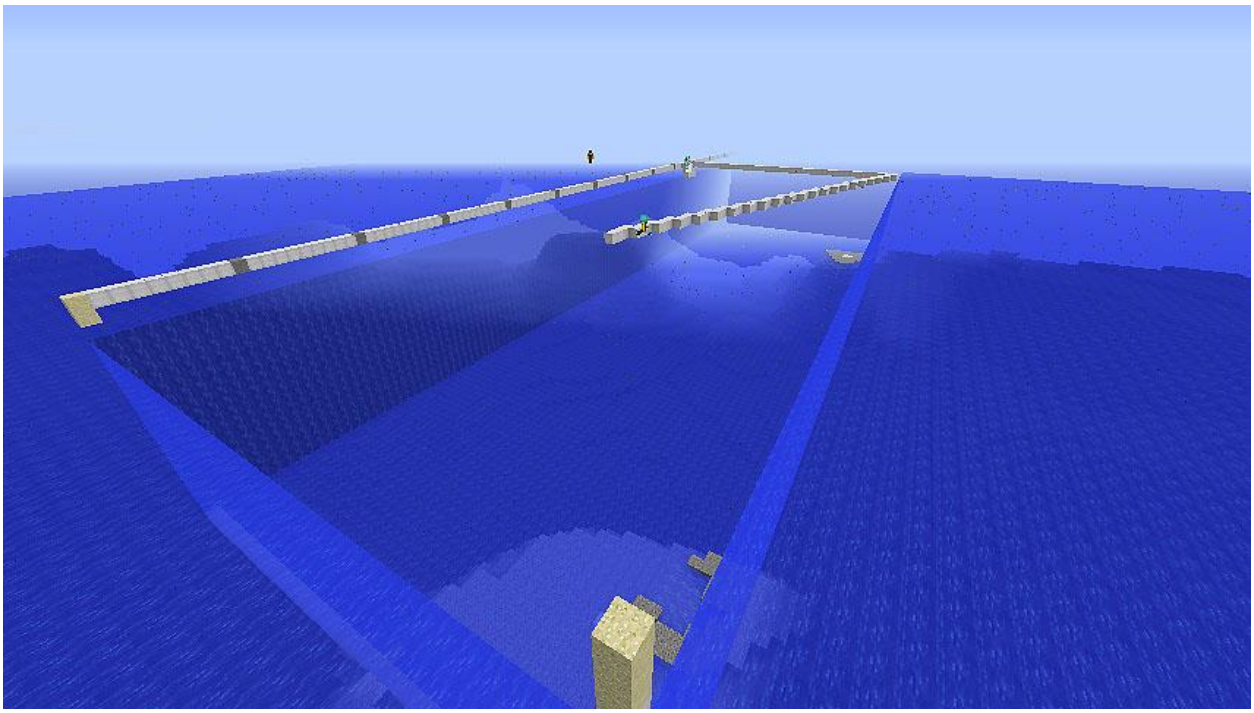

Figure 43. *Minecraft* tricks and problem solving. Katherine Hewett©

Game theory: patterns. Patterns are a common theme in gameplay. These patterns can lead to success or defeat. The key is recognizing them to best use them strategically. Nano describe such patterns in the game *Portal* and *Portal 2* by means of observance.

> Nano: "*Puzzle games like Portal and Portal 2… I am definitely into those. You have to have a keen eye and to make sure you look everywhere. Progressing while having this story set to it… it's just challenges you. It challenges you at another level rather than just playing a game. It's like you actually have to think and its stuff that you actually know. You use it to the best of your ability*."

Having a keen eye to be observant to the details in gameplay is challenging to Nano. The observance or "patterns" unlock the next level of the game. He describes being challenged at another level of gameplay, meaning that games require thought. He mentions "stuff" that is

known or learned by the gamer which hints to the mechanics or structure of the game. Quests and tasks received will always be at the threshold of a gamer's ability. The game provides a natural structure of learning to get gamers to certain points or levels within the game. It only requires that the gamer use already learned skills to advance. The game is testing what the gamer already knows, as Nano describes.

In a popular multiplayer online battle arena (MOBA) known as *League of Legends*, Sterling describes the setup of the game. He describes multiple lanes in which the point of the game is to destroy the enemy's nexus. Champions can vary in skills to accomplish specific tasks. Sterling specifically talks about making the mistake of playing by patterns.

> Sterling: "*League of Legends is a MOBA… multiplayer online battle arena… in which it pits teams against each other in a battle to destroy the enemy nexus. There are a large amount of champions to play the game with… all with varying skill sets and abilities. This allows for multiple play through opportunities of the game… there's always something new and different to try out. There are three lanes on the map. Top lane is usually a tank gear champion that just deals out damage without being killed too fast. Mid lane would be an AP… would just be ability power… like magic users. In the jungle, there's just a mix of fighters and tanks that go around and try to help out the other lanes. Bottom lane usually supports or attack damage carriers. So, in a sense it creates a sense of unity between your team. The fact is that you need to work together or you'll just lose undoubtedly every single time. If you play by patterns and they find out your pattern and you're not prepared for it… they'll just shut you down. Your game just ends right there.* "

Sterling describes patterns in how the game is set up with lanes but he also talks about how performing the same actions or making the same moves can lead to failure. Players are constantly analyzing one another's decisions to theorize their opponent's next move. He further explains the phenomenon by using the following analogy.

> Sterling: "*A perfect analogy would be MLG (Major League Gaming) players versus just your average player. You can have Call of Duty for example. Some of the pros that play for money, you can get one of them to play with you versus a team of seven or eight regular people. The pro will still win. The other team wouldn't even have a chance because these players have mapped out their own strategies… their own movements around the map… their own spots that they want to be in. They know you're going to walk around the corner and they're just gonna be there every time. That's how they play. They play strategy. They don't just want to run around the map seeing what they can do… they know what they can do… and they will do it*."

Sterling describes how playing patterns can be a weakness for average gamers. The skill of the gamer is determined by how well the gamer utilizes their abilities and applies strategy. He talks about how professional gamers can beat whole teams of players all on their own. These strategist gamers are going to map out their strategies and anticipate the moves of average players because they know their next move. The participants described these categories of team unity, collaboration, strategy, problem solving, and game theory as means of excelling in their gameplay. The participants' experiences of working together and applying strategies were skills acquired through gaming. The strategist is going to be an expert at defeating other players. Like Sterling says, "they know you're going to walk around the corner and they're just gonna be there every time."

The Creator: The Art of Gameplay

The creator is the gamer with an artistic streak. The creator is involved in the creation and crafting of game content whether it be "in game" or extending outside the game into the real world. Many gamers are using their 21st century digital art skills to create content for their favorite video games. The participants related stories of creating content or crafting items for games.

Creativity and innovation. Nano, the most experienced content creator of the four participants, describes how playing *Team Fortress 2* led him to take an interest in how games are designed and created. He talked about how he began to notice other players selling their creations on the internet-based digital distribution platform known as *Steam*. Here is a description of how he began to create textures and participate in the *Steam* community and economy.

> Nano: "*When I started up on Team Fortress 2, I saw that fans were actually making their own texture replacements and coming out with them. Eventually, it came to the point that a lot of these people would make mods and go on to sell their product once approved by Steam. Once they were approved they were actually making a decent amount of money. All these Steam workshops… creators… and all these people were trying to contribute to the community. And I thought it was pretty cool that they could make something and if it fit well with the game… people liked it and you get paid for it. That experience and this class has helped me get into using 3D programs and game engines. I remember not being able to use Z brush for a long time. I didn't know anything. Then I saw a lot of people with their weapon creations. That sort of made me want to like try creating for myself. Now I am a bit adept in Z brush and other 3-D games and 3-D programs*."

Nano talks about his realization that not only could he play video games but he could actually make money from video games by creating content. Participating in an economy system backed by US dollars was an interesting moment for Nano because he realized he could create textures for games that he could then profit from even at his young age. This realization encouraged Nano to learn how to use digital graphics and 3D modeling programs. Nano goes on to describe his experience creating a texture pack for the video game *Minecraft* and how that led him to take an interest in learning how to 3D model in *Unity 5* and *Unreal Engine 4*.

> Nano: "*I tried my hand at replacing on Minecraft with my own texture pack. Mainly because the main default look is so, "Blah." So upping the resolution and then having my own texture to place… I thought was pretty cool. As I moved on to 3D modeling recently, they have been offering different software for educational purposes for college students. I have Unity 5 and Unreal Engine 4 which are some of the game engines that a lot of these games are coming out for. So, I thought… "You know, why not test it out to see what I can do with it." Luckily there are tutorials. I never come to a complete project but certainly I am still trying to figure it out. How to trigger an event or how to set certain objectives. There is still a lot of discovering to do. I just started getting into making actual objects for different things but there is still a lot to learn*."

Nano describes this culture of self-teaching that is common among gamer communities. The desire to create has opened up a need to learn via online tutorials. Nano speaks of learning to 3D model from other players or designers by using *YouTube* tutorials. *Unity* and *Unreal Engine 4* are 3D game engines and developer tools that have made their software programs free for downloading for educational purposes. This expansion of available freeware programs are providing children like Nano with the opportunity to teach themselves modeling and digital art

skills. His gaming experiences have evolved into developer experiences that tap into his own creativity and innovation.

Wonder also has been devoting time to learn how to 3D model. Her program of choice is the freeware 3D modeling software program known as *Blender*. After playing the game *Final Fantasy*, Wonder began to think about how the characters and scenes for the game were made. In this passage, she describes her observant connection between playing the game, modeling in *Blender*, and watching *YouTube* tutorials.

> Wonder: "*Yes, you can tell... like the monsters and with the way they move. If you watch any tutorials on YouTube about Blender. I went and looked up making different items in Blender and this guy had made a jabberwocky that they made and then animated. It looks almost exactly how one of the Ogres run and it finally led me to click that, "Oh my God, these were made in Blender!" It's actually pretty cool when you do look around "in game". You wonder, "How's that made?" I wonder, "Who made that? How they make it? How long did it take render? How many particles is that? How many hours of work? How much did they get paid*?"

Wonder's experiences through gaming have led her to venture out beyond the game and learn how to create the worlds and characters she loves so much from her favorite game *Final Fantasy*. Wonder's acquired skills through gaming are fueling her desire to be creative and innovative to develop her own game content and pursue game design in college. Like Nano, she has made the connection that creating content and developing her modeling skills can earn her money.

Celeste is an accomplished 2D artist. Her skills favor the drawing and digital art side of game design. Like Nano and Wonder, she also is engaging in online gaming communities and forums by using her skills to create digital content. Celeste talks about how playing video games inspired her to enter art competitions.

> Celeste: "*I have done a lot of graphic design for the games. All games have a forum and you can login and have a little signature at the bottom. I love taking pictures. I find beautiful spots and I will take a picture of my character and then I will go on Photoshop and edit it. I've also done contests for the game where you can enter to win items. I always choose the art ones or the graphics ones. I did one for a game where you created your own fish. Fishing was a new part of the game. They wanted you to create your own and I went on to draw my own little fish. It was the water one and you could actually win items. Everyone just posted on the forum to show their work and everything they had done. I always love that part of the game. It's not just a game but also has other parts to perform*."

Celeste was rewarded for her artwork by winning game items, but also in sharing with a larger worldwide community that appreciated her work. Celeste describes a rewarding experience that allowed her to express her creativity and receive instant feedback from other gamers in the forum. She describes her gaming experience as "not just a game" but "other parts to perform." Celeste communicates that the gaming experience is far more than what one would expect and that games have a whole community, economy system, and culture that rewards and inspires average players to take an extra step to create content from the outside world.

Creating content for video games often is born out of a common activity in games known as crafting. Crafting is the gathering of game world resources to craft items for sell, trade, and use. The participants described elaborate crafting systems that fueled their favorite game economies.

> Wonder: "*I craft things in Final Fantasy. When you craft, you are pretty much building items for the game… like clothes and dye. You're crafting clothes or your building alchemist items…. or jewelry, food, spells, or anything like that. But you have to go out and either find the items… to make the item… or you have to go out and buy it*."

The extent and complexity of the crafting system depends on the game itself. The systems exist in both massively multiplayer online (MMOs) games and in single player games. In MMOs the system is fueled by actual real world players, while in single player games the crafting systems are utilized by one player and non-player characters known as NPCs. Simply stated, gamers either sell or trade with other real life players or NPCs. Vanity items are a way for the player to express their identity and character. These items can be very expensive depending on the demand, the rarity of the item, and how difficult it is to craft. Specifically, the participants discussed the types of items they crafted. Some chose specific job classes that would allow them the ability to craft these specialty items.

Wonder described the crafting system in *Final Fantasy* and how she was able to obtain and craft items to get what she wanted. She talks about the necessity to manage money in order to be able to make special items. Crafting an item can be laborious and time consuming. Some players chose to specialize in the gathering of game world resources for sale rather than make them on their own. Players can go out and gather all items for a recipe, but that would require

the leveling of multiple job classes in order to obtain the items. Players like Wonder found it easier to buy certain resources in order to craft her items. In the passage below she talks about the system and how lanolin became an expensive and rare item for her to obtain.

> Wonder: "*Final Fantasy is a perfect example for that. You have a house and your private room that you can decorate and spend your money on. Depending on what you want to buy or what you need in order to create an item, you go and spend money at your market board. You learn how to manage your money because in order to craft that item you need certain resources. Those certain items may be really expensive like lanolin. It's a weird word but it's sometimes expensive and it is not used for many things. As I was leveling up one of my characters, I needed it. So, I realized that I had to put away money and postpone getting a nicer glamour gear just to get this item*."

Wonder is an alchemist in *Final Fantasy* and needed the lanolin to craft an item from her crafting log. In the game, lanolin is crafted with water shards and Karakul skin. A player would have to become a botanist in the game and level their character high enough to craft the water shards. Then the player would have to find Karakul to hunt and obtain skins. Hunting the skins might be an issue for a lower level character since certain beasts and animals are only found in specifically ranged areas. Karakul are level 35 beasts. An alchemist must obtain level 40 in order to craft lanolin. This complexity of the process, with the multiple job classes determining what items can be crafted and by who at what level, encourages players to rely on each other to fuel the market. This is yet another example of how the game sets up a dependence on other players in order to advance within the game. Otherwise, the player will spend a great deal of time leveling multiple job classes in order to craft all items on their own. This takes great patience and can be quite tedious and routine. This grit to level up is what gamers commonly

refer to as “grinding”. Celeste describes how she also crafts items, but that she would prefer obtaining her items by fighting and completing dungeons for rewards.

> Celeste: “*Yeah, I craft the clothing and the weapons. That’s mostly what I craft but most of time I like going out and getting the items myself (dungeon items). I am not much of a gatherer where you have to go out and knock down a tree… in which you have to do the same thing over and over. I rather be out doing the fighting*.”

In one case, Sterling talked about how certain job classes and races were able to craft better swords than others. Their class and race provided a boost or bonus to the weapon because it was a skill that was inherent to their culture in the story.

> Sterling: “*One of the games I play that has a lot of interaction with money and items is Reckoning which is the consul-based MMO. It’s an open world format and there are different cities run by the AI (artificial intelligence or NPCs) throughout the world with varying quality and abilities per item. And if there is a sword over in a human town… and there is a sword in a Dwarven town… then the quality of the swords would be different because the dwarves are by their trait skilled craftsmen for weapons and armor. So you really have to know… okay… this is made better by these people. I need to go there and buy it. Which goes to say… in our world today when considering quality and money*.”

The desire to acquire the “best” items is referred to as being “geared up”. Each item that a player wears in the game provides a level of protection against damage and a boost to a skill level or class. Sterling talks about wanting quality items because he knows that the better “geared up” his character is the better chance he has at winning. This desire to be the “best”

drives gamers to craft their own clothing, potions, food, and weapons. Creating such items is beneficial to their gameplay and the amount of money they can earn. All four participants described experiences with crafting and selling items in video games. It is clear that participants are using creativity and innovation skills while playing video games. Specifically, they are developing and utilizing their graphic arts and modeling skills to create original content. This creation and interaction with a worldwide community of gamers extends beyond the confines of the video game into the real world. Gamers express their creativity and innovation through artistic expression and through the creation of needed game items. Creative problem solving is needed by the player to obtain items via a complex crafting and economy system.

The application of real world skills. The ability to transfer and apply 21st century gaming skills can benefit a student's capacity to contribute to the real world. These creative skills teach students how to do various life tasks like manage money effectively, sell and market their creations, research information, be resourceful, and work as a team. These real world experiences go beyond skills learned in the classroom. Students make connections and then realize they can apply them into the real world. For example, the participants relayed stories of how they were able to either make money or interact with gaming economies in and outside the game. In this passage, Nano describes his first interactions and observations of the rarity of items posted on the *Steam* community marketplace.

> Nano: "*They opened up the Steam marketplace. It wasn't official but it was for people that had earned trading cards, gifts, or wallpapers for their Steam profile. If it was something that you earned in the game and worked for, they allowed you to sell it and build Steam funds. You could go on to buy another game or collect more to sell. It's a whole cycle. One interesting thing in Team Fortress, is you can buy a key. It opens up a*

crate and there is a chance of a really rare item, sort of rare item, or common item. If you have luck you have a chance at getting a really rare item. People will want that because they'll be in love with the game… as I was. The fact that a rare weapon that is painted gold and given to a few players can have so much demand is astonishing. I think there are 10 to 15 people out of the millions that have it. And right now, it's worth at least $20,000. It's crazy that people will build up their virtual funds in order to pay for it or pay for it through PayPal."

Nano discusses how the marketplace grew from simple trading of game cards to the selling of rarity game items that can fetch large sums of money online. In this case, he observes that a virtual weapon sold for 20,000 dollars. An item that cannot be held in real life and can only be used within a video game astonishes Nano. He makes the connection that he can apply his own digital art and finance skills to earn money. Nano talked about his own personal trades he made with other players through the *Steam* website and how he used his *Steam* funds to purchase new video games to play. He began trading cards online.

Nano: "*I have a lot of items that they would give for the Christmas events or summer events. They would have a summer trading card or a winter trading card. You could talk to other players and say, "Hey, you want to trade?" That way we both earned a badge, leveled up our Steam profile, and got game items." If you don't want to trade… you can sell on the marketplace. When I wanted to move on to a different game. I'd use the funds I built up with the stuff I sold. I haven't myself actually purchased or sold anything with the requirement of PayPal. Everything through the marketplace that I have bought has been with US dollars. It is still stuck within Steam. I can't take it out of the account. I use it mainly for buying game software whatever they offer on Steam.*"

Nano describes how the marketplace allowed him the opportunity to earn *Steam* funds and US dollars he then could use to purchase content he would not be able to afford at a young age without money from a job or parental help. Trading cards and selling on the marketplace taught Nano how to manage money and participate in an economy system that mirrors real life. Items were valuable depending on supply and demand. Items could be sold outright or were open for bidding. Nano learned at a young age he could work the system to get what he wanted through skillful trading, selling, and saving funds. It is interesting to note that if Nano wanted to activate his account to access *PayPal*, he could have access to those US dollars he has saved up and have them transferred to his personal bank account. This is a common monetary practice within game communities and their economic systems. A gamer can convert game coins or funds into dollars and earn real money. Nano considers these as real life application skills that help him manage his money from his after school job at an area toy store.

Celeste also has experience managing money in game worlds. Her creative way to make money is simply to research and fight for it. Her approach is different in that she uses websites, *YouTube* videos, and forums to gather information. Gaming communities generate and record lore and general information on all aspects of the game to help new players. For example, the *World of Warcraft* wiki is one of the largest wikis in the world. It is a virtual encyclopedia of anything a gamer would like to know about how to play the game and how to become a better gamer. Celeste uses this knowledge and applies the strategy of researching game dungeons online to find out what type of items she can earn and how much gold she can score in a raid. She uses strategy to pick her dungeon target, researches information online so that when she does go inside the dungeon she knows exactly what she is looking for and how to get it with her party or guild.

Celeste: "*With the money, I have noticed a lot of the games have their own money system with gold. Then with Guild Wars, they have the silver and bronze that just keeps adding up for the trading and buying. I thought that was fun but I am not much of a math person to sell everything. So, I would just earn it in the best way for me. I will spam a dungeon over and over to get the money and the items. I would just go online to look it up and it tells you what dungeon you can do. When you group up with a whole bunch of friends on the same thing, it's a bonding experience to get all the money*."

By spamming dungeons, Celeste was able to use her research and fighting skills to accumulate gold, silver, and bronze coins to purchase whatever she wanted in the game. This strategy worked the best for her needs and abilities. Learning to be creative in her ways of earning money in the game, she figured out how to apply real world skills to get what she wanted. Celeste makes the connection between game world economies and the real world.

Celeste: "*I have played a game… It is an online game where they actually had a stock market and you had to earn your own money and spend it. I found I would throw it all in the bank. All the money that I didn't use I would put in the bank. I could get items that I wanted and that really relates to the real world so much. I realize that now and "wow" that's exactly what you would do in real life, too. I was surprised I learned all about that from just a game*."

Another applied real world skill that resonated with the participants is the skill of teamwork. At the end of the *Minecraft* project, participants were asked to talk about any skills they felt they might apply in college or their future careers.

Sterling: "*The teamwork. You can be tasked with group work in college. Like in robotics for example, robotics is prominent in a lot of colleges where teams of 5 to 6 people will get together and they have to communicate, pitch ideas, and bounce ideas off each other. They keep going till the final product is something worth showing other people*."

Figure 44 illustrates Sterling's example of teamwork.

Figure 44. Minecraft teamwork and collaboration. Katherine Hewett©

Celeste also expressed a sense of teamwork as a skill she felt she acquired through utilizing a video game in the classroom. She had little experience working with people other than her twin sister. She talked about how teamwork is a skill that she feels can benefit her in the future. She hopes to work in the animation film business after college. Celeste realizes that the film making process is complex and requires the skills of many animators to accomplish a project. She discusses her thoughts on teamwork below.

Celeste: "*Teamwork… I would say. Because you can't have one person to build all that. You need a group. And I know like animators… like for movies… they take one section of the movie and then they do it… and they just add it on. It takes a lot of teamwork be able to work with other people. I plan to go into movies. It helps with that because I am not used to working with all those people*."

In Figure 45, Celeste is working with her twin sister to create the floor plan of their castle model.

Figure 45. *Minecraft* teamwork and collaboration. Katherine Hewett©

Celeste goes on to describe how modeling a large project within the confines of *Minecraft* challenged her to "think outside the box." *Minecraft* is a sandbox world of voxels. This cubism like world provided an extra challenge when trying to replicate buildings from the real world.

Celeste: "*You have think outside the box a lot for that. It is all squares. "Like how are you going make a triangle out of a square? And how do you turn a square into a circle?" So much we tried to get right. We finally got a square circle. Like if you zoom out, it was like "Yay, we did it!" A little slanted but you can't have that in Minecraft. Just don't go up too close. You have to zoom out and look at it from a distance*."

Figure 46 illustrates Celeste and her twin sister creating circular towers with squares.

Figure 46. Minecraft - Thinking outside the box. Katherine Hewett©

The four participants related stories of how building in *Minecraft* challenged them with the materials they had to use in the game. The participants researched real life photography of their buildings and each group had to decide how best to replicate the architecture with blocks and proper scale. Creative problem solving encouraged the participants to "think outside the

box." These skills taught them to assess a problem, look at it from another perspective, and find a creative solution.

Spatial reasoning skills. Spatial reasoning is one of the nine intelligences that Howard Gardner describes in his *Theory of Multiple Intelligences*. Gardner (2006) defines it as "a human computational capacity that provides the ability or mental skill to solve problems of navigation, visualization of objects from different angles and space, faces/scenes recognition or to notice fine details" (p. 6-7). The participants challenged their spatial reasoning skills through the *Minecraft* Project.

The participants were able to navigate the 3D space easily based on their previous gaming experience. Survey responses in the quantitative phase of this study reflected this trend. Students were able to adapt quickly to the *Minecraft* world and visualize what they wanted their builds to look like when complete. Participants had to decide what they could model based on research and photographs and then transfer those ideas into the 3D space of *Minecraft*.

The vast size of the Roman building known as the Circus Maximus was a challenging undertaking for the builders. The participants tasked with building the Circus Maximus rebuilt the base and foundation several times to get the right visualization of the size and detail of the arena. Participants had to navigate the X, Y, and Z planes in order to accomplish their vision. The amount of detail in the build itself reflects an attention to detail with its box seats for the Emperor, stands, shops, and cafes down below under the arena. The historic Roman chariot arena was complete with horses and villagers. The participants demonstrated that they thought about the objects and their placement in the 3D plane. The symmetry of the build demonstrates the mirror effect in the building process. Participants had to build both object sides in reverse of

each other. By orbiting their model, they enhanced this capacity to think of the object from multiple perspectives to get the right detail for the replica. The build was so massive it was difficult to photograph with all details completely formed. Figure 47 illustrates the immense scale of the build and the builders' attention to detail.

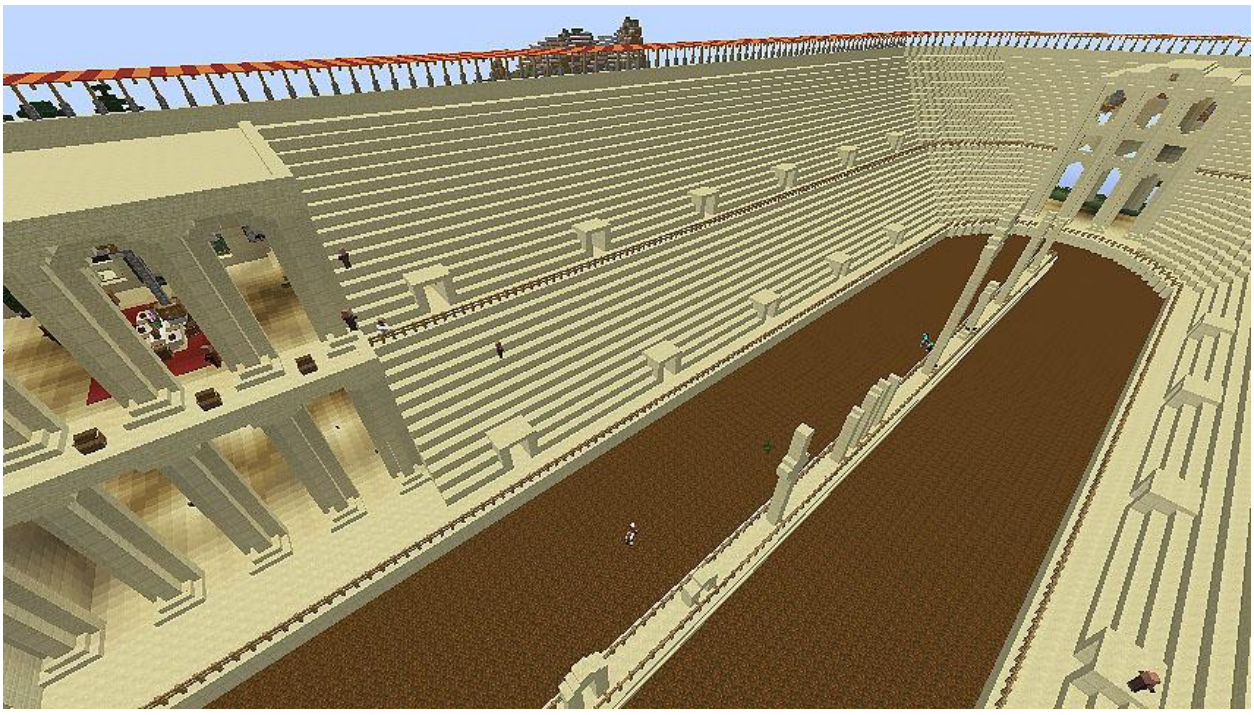

Figure 47. *Minecraft* 3D modeling and spatial reasoning. Katherine Hewett©

Visualizing the placement of the 3D objects proved to be challenging during the zoning phase of the *Minecraft* Project. After participants had researched their builds they were allowed in world to find the right land area for their project. Students had to imagine the size and scale of their buildings on the allotted space and determine if the area was sufficient. In the photos below, the participants in two separate groups find that their zoning and planning was a bit off. They experienced some issues with their spatial reasoning in regards to the placement of the castles in the 3D space. They obviously miscalculated visually how much room they would need

in order to build their castles. They underestimated the scale of their builds. The two castles ended up infringing upon the other's space. In Figure 48, zoning proved to be a challenging aspect of the modeling process.

Figure 48. Minecraft visualization and spatial reasoning. Katherine Hewett©

The D-Day Invasion of Normandy proved to be the most complex building process for the third classroom of participants. The scope of the building from the landing craft to the construction of Mont Saint-Michel was an ambitious visualization. Participants built landing craft and included troops inside each craft. The ships and German barricade on the beach all had working guns. The builders learned by trial and error. Students applied physics, built red stone circuits, and used explosives to power the guns and launch projectiles. Each gun had to be calibrated to fire at certain distances and directions. The participants researched photographs of WWII gunnery as well as blueprint specifications and how far the guns could fire. The construction of the USS Nevada was a major spatial undertaking for the participants. In Figure 49, the placement of the ships to the landing craft in the 3D plane had to be planned and mapped out.

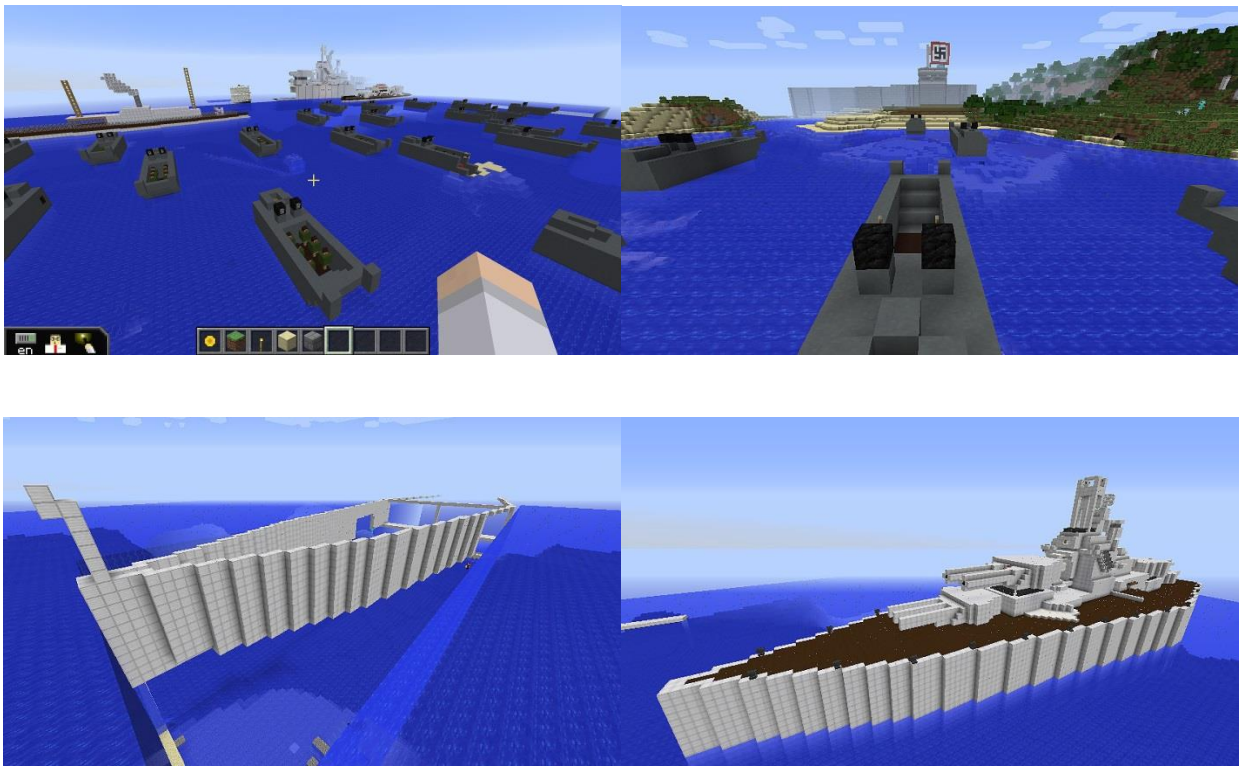

Figure 49. Minecraft visualization and research. Katherine Hewett©

Navigating the 3D world of *Minecraft* helped the participants develop their spatial reasoning skills. They felt they could visualize and adapt well to the environment. In this passage Wonder describes her visualization process and how she determined where to place certain objects based on her Greek mythology research.

> Wonder: "*When I found out we were doing the Parthenon… I immediately said, "I am going to build a Temple." And normally temples when you walk in you will see all the names of the goddesses and gods. If you walk further down, you'll see the shrines of the gods and their personal information and what they are all about. I tried to do something like that*."

In Figure 50, Wonder and her group work on their temple.

Figure 50. *Minecraft* visualization and research. Katherine Hewett©

Wonder's attention to detail in her research reflected in her build of the Parthenon. She visualized the temple in her mind based on what she had read and modeled it accordingly. In her description, she took into consideration the status of the gods and goddesses and built accordingly.

Celeste also is descriptive in her visualization process. She tried to imagine what her build would look like in *Minecraft* while selecting her build project. Celeste worked closely with her twin sister to find photographs, maps, and floor plans. All while considering what the castle they chose would look like in *Minecraft*.

> Celeste: "*Well, we first went online looking for random castles. We looked through thousands of pictures and if we shall one we liked we would show them to each other. We settled on Caeverock castle because it is a unique triangular castle in Scotland. After we found the castle we wanted, we would go online and search for floor plans. It was a top view floor plan and we said, "Look at that. That section is pretty easy." Then we tried imagining what it would look like in Minecraft and we said, "Ok, let's do that!" We just imagined and used our heads and put that floor plan on top and we just imagined the basic shapes*."

In Figure 52, Celeste and her twin sister research their castle's history and floor plan.

Figure 51. *Minecraft* floorplans and research. Katherine Hewett©

> Celeste: "We only went two blocks up in case there was anything that we needed to change. That way we wouldn't have to build all the way up and all the way back down having to destroy it. Then after that we said, "Ok, I think that looks good." When we zoomed out we said, "Alright, guess we are building it up" and we just built it right back up. We filled in the little holes. After we had all the floor plan we decided we had some extra time so we decorated it. We looked online to find out what the rooms actually were. We put them in there. Some of the rooms didn't say what they were because it was a pretty old and a ruined building. So we would use our creativity and just decided to throw in what most castles have."

Figure 52 illustrates Celeste's modeling and planning process.

Figure 52. *Minecraft* 3D modeling. Katherine Hewett©

Minecraft is an open-world sandbox environment. At the beginning of the project, students were offered the choice of building in a flat land world with no trees or a random generated world with terrain and geography. The students chose a generated world with trees which challenged their navigation skills. Some students got lost wandering off into the forest and various landscapes as they explored on foot and by air. In order to improve navigation "in world," the participants established base camps to serve as destination hubs. Participants created maps in *Minecraft* to keep in their storage chests and inventory. Teleport stations were set up to allow for easier and quicker navigation between job sites. The stations became a complex

transportation system for the participants. Students created landmarks, signs, and large beacons to help them orient and navigate. In Figure 53, students are creating a symbol on the ground to be used as a visual for navigation when flying above.

Figure 53. *Minecraft* problem solving and navigation. Katherine Hewett©

Some participants also adjusted their game settings and graphics to help accommodate their styles and speed of gameplay. Experienced gamers tended to move quicker "in world" and were accustomed to faster paced visual cues. Cognitive research has shown that action oriented video games improve spatial reasoning skills and that gamers tend to have quicker response times (Bavelier, 2012). It was observed that participants altered their game settings before launching the *Minecraft* server world to increase the visual speed of mouse look in both first and third person.

The art of gameplay covers various forms of visual literacy through creativity and innovation. These skills allow participants to develop their spatial reasoning and apply them to

real life. In some cases, participants benefited financially on their gaming experiences through content creation or strategy. These skills shed perspective on the predicators for academic success. The more experience participants had in gaming the more the demonstrated attention to detail through their creativity, innovation, and spatial reasoning skills. This was reflected in their grades on the *Minecraft* Project.

The Communicator: Building Relationships and Communities

The communicator is the gamer who makes an effort to build friendships and communities to help advance their gameplay. They are social players and establish online friendships with other gamers from around the world. They immerse themselves into the culture and role-play a character to establish a way of life or an alternate reality. It is not uncommon for the communicator to see their online identity as an extension of their real life identity. Game worlds provide a stage to develop 21st century social skills that can be translated into real life. It should be noted that the participants did not relay any predatory encounters with other gamers online. They discussed an understanding for internet safety and were aware to be cautious when meeting other people online. They mentioned that real life can be just as, if not more, dangerous than online worlds. This theme is strictly addressing the communication that is developed among a community of gamers and the positive connections that can be made.

Online relationships. A common trend among gaming communities is the building of friendships with gamers from around the world. These relationships are formed through common interests and shared experiences. These communications and relationships provided participants with opportunities to develop friendships and learn about other cultures. Nano talked about how he plays video games with people from countries like Sweden and as far away as Japan.

Nano: "*I've definitely met a lot of people through these games and it's kind of a really cool experience. When you find that one common interest than that it just expands from there. I know a friend from Canada… there is one in Wisconsin… one in Japan actually… and one in Sweden. Let me see…. And some live in Florida. I keep in touch with my friend. He now resides in Hawaii so we occasionally play*."

Sterling has had similar experiences making friends with people from different parts of the United States and other countries. He talks about hearing other languages and accents through *TeamSpeak* or "voice" through the game chat. He describes a four-year online friendship he made with another boy in Texas.

Sterling: "*I have a friend named Justin whom I met through Xbox Live from a friend I have in town. They knew each other by meeting in person before they started playing online. He lives in Texas somewhere on some vineyard. As a group, we would play Call of Duty and Minecraft on the Xbox… and Halo and the other games. I've kept in touch with him over the years. We have probably been talking for four years now since I first met him. I have made other friends across the United States just from talking to my friends that I know and their friends from out-of-town. Some are like WAY out-of-town. They have different accent sometimes*."

Sterling goes on to describe the sense of teamwork and unity he has built up through online relationships. He describes the equality he experiences in game. Sterling observes that in game worlds there are no borders or races and it does not matter what you look like. Gamers are judged by their abilities and actions in game worlds. It is an international culture and community that is blind to country, religion, race, appearance, and gender.

Sterling: "*It can definitely create a sense of teamwork and unity between different people and races… and different heights and weights. Whatever you want to say about people's physique because you don't know unless you know them in person. You're just playing with other people. You know? It's basically just… Are you good at the game or not*?"

For other gamers the bonds of online friendships run deeper as they form long term relationships through parties, guilds, or free companies. These relationships develop over years of communication. For Wonder these relationships provided her with an online family on which she could depend for support and level of protection.

Wonder: "*Final Fantasy XIV is an online RPG game. I used to play with all three of my roommates and a couple of my friends across the nation and Canada. We would all play together and stay up until 4 o'clock in the morning playing. I started at level one. When I met them they were all up in their level 20s. We all got to level 50 together… got "geared up" together… did the dungeons together. So we were pretty much this big gaming family. So you couldn't mess with us. I was always the baby until I turned 18. Everybody in my little gaming family would always defend me. They would say "NO, she is the baby…don't mess with her… go away!*"

Wonder is a social gamer in that she forms attachments to selected friends in game. She chooses to develop these relationships and feels connected to them like family members while also respecting internet safety. Wonder even describes one friend as her online father figure in *Final Fantasy*.

Wonder: "*I have a friend in Houston. His game name is River. He is pretty much like the daddy of us. So my friends and I were pretty much a big family online. My mom even*

thought so… She was kind of happy that even when I was stuck in my room, I pretty much had a family with me so I was never alone."

Wonder goes on later to describe how her online family provided her with great support and taught her to communicate better with others in real life. Her mother expressed happiness that Wonder had an online family. As a child, she moved around the country and she talked about changing schools often growing up. Her online family provided her with a stability and continuity that supported her during times of transition. When asked how much information she shares online, she said she never shares more than basic gamer information. Her online family only knew her by her game name and in which state she lived. Basically, the participants tended to share experiences but not personal information. However, many gamers do share real life information with long-term online friends.

Celeste's online friendships were formed more out of a desire to play well and advance through the game. She spends most of her gameplay time with her twin sister. The relationships Celeste developed were formed more for strategic reasons.

Celeste: "*I never have had a deep relationship online where I would talk with them every night besides my sister. Whenever I was questing and playing with others, I would always find people in the same areas as me. We would share the little monsters to fight. We would pick up the quests and party up in order to help each other with the quests. One time, I did have a friend who I would wait online for so we could quest together. But it stopped because somebody would go on vacation, be too busy, or had school work. So most of the time I was just with my sister because we could always mashup at same time*."

The participants relayed stories of building friendships in games. They described the importance of friendships in games because it makes the playing experience more fun. Many players do not like to play by themselves. They will often jump from game to game until they find a game that provides them with a chance to socialize and build friendships. These friendships help the player advance within the game. Wonder talked about how playing games alone was fun at first but eventually the appeal of continuing to play alone diminishes. There has to be a social connection for players to keep coming back. These social and communication skills are developed through a desire to connect, play, and have fun within the gaming community.

Community and culture. Wonder described the interactions she had with other players around the world and what she learned by playing a game with them. Learning new languages exposed Wonder to new cultures. Video games provided her with an opportunity to meet people she would never have the chance to meet in real life. Games are a door way to the world for her. While she plays she is learning a bit of a foreign language at the same time.

> Wonder: "*Final Fantasy is my favorite just because of the interactions and the fun you get to have. When you have so many people in the game with so many cultures mixing… so many languages mixing… you learn more languages through the chat. I learned more Spanish through the game chat than I had learned in my three years of Spanish classes. I would translate the chat so I could know what they were saying*."

Wonder learned how to decipher languages through online translation websites. She used her digital literacy and research skills to find these translation tools to understand her game conversations. She describes a diverse world of players who come together to find a common

ground through the video game. In order for a group to win they must communicate effectively. She sheds light on an international gaming culture and a world where players make the effort to bridge language barriers to communicate.

Communication in video game worlds is not just for socializing but also for teaching. The participants talked about how a new player shows up in a game and does not always know how to perform certain tasks. Games are designed to level the player and provide instructions as the player advances through the game. Often players will research online how to perform and complete a quest. *YouTube*, wikis, and other forums provide comprehensive guides on game play. Gamers create *YouTube* videos of their gameplay to provide tips and instruction on how to level up, raid a dungeon, or craft an object. These web resources are generated online by communities of gamers. Video game worlds are self-organizing environments driven by the need to learn and level up. It is known that if humans are left to their own devices they will self-organize and teach themselves (Mitra, 2013). Self-teaching and the teaching of other players is a common trend in game worlds. All four participants related occasions of teaching themselves and others in video game communities. The culture, values, and lore of the community are passed from one player to the next.

> Celeste: "*I remember this game called Sherwood. It was a role-play game played with knights and you would adverse each other. Somebody asked me to join their guild and so I did. They asked, "Can I fight with you to see how you play?" I said, "Sure." I didn't do the best because I was new to the game. They gave me tips on how to use the shield and move around. Then he invited me to the guild and we just played together. He learned to play from others and he wanted to transfer what he learned to me. I then*

became a recruiter and helped other people. We would all meet up in the guild and teach each other the things that we had learned and just pass it on down."

Celeste describes a community self-organized to perpetuate the game's culture continuously from one player to the next. These communities are organized to establish social bonds among players and develop friendships. They reinforce a dependency on other players to promote team building skills and unity. Gamers need the help of others in order to win.

Social and emotional learning. Coping is an essential development skill of growing up. Children often feel moments of stress at home or at school. The participants related stories of how video games had taught them to recognize their feelings and aspects of themselves. It helped them to cope with the problems and pressures in their lives. Nano talks about "going into the zone." He described how video games gave him an outlet to escape from the troubles of daily life and how exciting the experience would be. Video games made Nano feel better and provided a sense of enjoyment.

Nano: "*I feel excitement. I get sunk into the game always. As they say, "Go into the zone." Usually whenever there was a conflict back then when I was child at home… either small or major… I would just go into the game and forget about it*."

Nano channeled his focus into completing the objectives of a game to take his mind off his troubles. Wonder also found herself using video games as a way to destress. At the time of her interview, Wonder had begun living on her own. Her move prevented her from renewing her monthly game subscription, as she was saving her money for rent.

Wonder: "*I haven't been able to play Final Fantasy in a long time. For about a month now… maybe two… but I will still get on my TeamSpeak every once in a while and talk with my friends. It is like an instant stress reliever*."

Wonder conveys her desire to connect with her online family through the *TeamSpeak* voice stream. Both the game and communicating with her friends were instant stress relievers for her. The stability of her game family provided her with a place where she could be herself and not worry about stress. Video games for Nano and Wonder were places to escape and have fun.

The participants were asked to talk about what they were able to accomplish in game worlds that they felt they could not accomplish in real life. Wonder related a desire to heal people and then turned introspectively about herself. She discussed her difficulty in interacting with other people and talks openly about her issues involving her speech.

Wonder: "*For me it's interacting with people. I have a stutter and a lisp… and sometimes when I talk to people in real life they will point it out and make it worse. I have to walk away. But in game I just type in chat… they can't hear my stutter or lisp… and it's like I am just another normal person. Sometimes I look at screenshots I have taken and I see my character there with other people and it's amazing. I can't interact like that with people in real life. I don't like being touched by people other than by my boyfriend, of course. But for some reason he's the only one I really let touch me. I don't even let my mom. My mom has looked at him and said, "I haven't had a real hug from her in years." I don't like being touched but in a game you can hug and it is fine. It doesn't bother me. I don't feel like there are bugs crawling on me or anything. Really it*

is just interacting with people and the rest of it is just fantasy. It is about ideas and imagination."

This is a common theme in game worlds. Often people with disabilities or conditions will find a sense of freedom and equality inside video game communities. As players, they are not judged by their physical real world limitations. These communities can often be healing to players like Wonder. Learning to deal with emotions in a safe environment has provided her with a simulated world in which to practice her coping skills. Wonder talks about how games provided her with an outlet to express her affection for friends and interact with others. The game allowed her to connect to other players and develop friendships based on her written words through the chat feature. She describes a world where she was not judged by her lisp or inability to interact with others. Wonder believes that her experiences playing video games helped to her to cope with some of her social issues in real life.

Sterling believes that video games have taught him about guilt and forgiveness. He talked about the importance of displaying good sportsmanship within the game. Gamers can choose to be kind or unkind to other players. Sterling reflects on his own personal feelings about winning and losing.

Sterling: "*It's given me a better sense of remorse and mercy. When you go into a game and you lose, you feel bad. You know you lost. You finish second place sometimes. But when you win badly and you rub it in, they don't take it well and you wouldn't take it well in that same scenario. You know, if you beat them badly and you say it was a good game and that you had fun… they will be like… "Cool, let's play again." But if you're like …*

"You're so bad at this game. I can't even believe you're playing the game like that." You are disliked. That is a no way to win scenario."

Sterling describes how video games taught him to be a good sport. He describes a world where being unkind to others is not going to help your overall game in the long run. He goes on to say that he often gives advice to those who need help. It makes him feel good to win but also to help others. He would rather be judged by his peers than by those who do not understand. There is a sense that Sterling feels judged by the real world for his enjoyment of gaming.

Sterling: "*About myself… good. In a group sense… if I'm winning against the people that I'm playing with, I feel good because it makes me feel like my time "wasted" … quote on quote… as some people would say… paid off. I would rather be judged against my peers then by the people that don't understand. Gaming is a sense of enjoyment or something to do in my free time rather than just… "Oh, you're wasting your life*."

Wonder also feels a sense of happiness and enjoyment from video games. Like Sterling she too has felt some feelings of judgment from the real world but in a different way. Sterling feels judged for his love of playing video games based on the amount of time he likes to devote to his favorite past time. He feels others judge him and think he is "wasting" his time playing. Wonder feels judged by her gender. This was a common theme among the female participants within the study. The small group of girls involved in this study is reflective of a stereo-type that gamers are male. It demonstrates a difficulty to recruit girls to take a technology course that promotes modeling, programming, and game design. Both Wonder and Celeste have faced these real world issues related to sexism in game worlds. In this passage, Wonder discusses her

enjoyment of playing and how she feels a freedom of not being judged but then in the next sentence relates experiencing sexism.

> Wonder: "*It makes me feel happy because you could be playing right up alongside of somebody and you're not being judged. Your character might be judged but not you actually. I'm a girl gamer… and if you are a girl gamer…. it's like "Oh my God, you're are a girl?!?" When you are in the game nobody knows who you are and you're just as good as the best player in a dungeon. That gives you a sense of pride because you worked for hours to get that good. I am playing just as good as everybody else… if not better. That makes me happy*."

Gaming certainly gives Wonder a sense of pride, accomplishment, and happiness in her abilities. She believes these experiences have taught her about how to deal with sexism in game worlds and in real life. She is resolved to present herself as a strong competitive female gamer and takes pride in her abilities. She is determined to work hard to be as good as any player in any game. Wonder is equally determined to make her dreams of becoming a game designer and programmer a reality. When asked why she thought this stereo-type existed she describes a cultural mindset that exists with players from the real world.

> Wonder: "*Because most people now see it as women shouldn't be gaming because it's a male thing for some reason. But when they find out I am a girl… who is whooping their butt… they freak out. I don't know why but they do. It is hilarious because you get that, "Oh my God, it's a girl! Girls shouldn't be playing. Go in the kitchen!" And I am like, "No, I am whooping you. You get in the kitchen!" I don't know why people think that but honestly it's pretty funny*."

Wonder tries to find humor in the situation, but the sexism bothers her. Both Celeste and Wonder talked about the perception that only male gamers are good. It is assumed that if a gamer is skilled there is a male player behind the avatar. It is very common in game worlds for men to play as female avatars. These players are often referred to as "GIRLs" which is a gamer's acronym that stands for "guy in real life." It is jokingly referred to in cases of female gamers and it perpetuates an assumption that good female avatar players must be a "guy in real life". This common phenomenon adds a twist to identity and gender in game world communities. Celeste has also learned to deal with gender stereo-types as a female gamer. She described an experience when she volunteered to help another gamer learn to play the game.

> Celeste: "*Yeah, I was helping this girl in a game and we were talking to each other. And I said, "I am Celeste." Then she asked me if I was a girl. I said, "Yes, I am girl." She said, "I don't believe you. Every person I have met on here is male." I said, "Really? I am telling you I am a female." She said, "People lie just so they can talk to me on here. I think you are male." I asked, "What can I do to prove it? Why won't you believe me?" I couldn't do anything to prove I was female. She thought it was an all-male game. In response I said, "How do I know you are a female?" She was torturing and picking on me for that. So we just went back and forth. That was one major thing I remembered. I was shocked*."

Despite the fact that 44% of gamers are female and "women age 18 or older represent a greater portion of the game-playing population (33%) than boys age 18 or younger (15%)," the stereo-type persists (Entertainment Software Association (ESA), 2015, p. 3). In this case, both female participants shared common experiences of sexism in video games. Having these encounters taught and motivated both Celeste and Wonder to become strong female gamers.

Gaming has also taught Wonder a sense of empathy. Video games created moments for her to feel empathy for her online game family. She describes a moment when she overheard her "game dad" having a tough evening at home.

> Wonder: "*I honestly can say that I hated people more before I started gaming. I did. I didn't like people at all because they were rude. But gaming taught me that while I might be having a bad day somebody else could be having a worse day. So the best thing is always to be nice. I would always be on chat and I could hear people in their houses arguing. One-time River was having a very bad argument with his son. He needed to be distracted and I could hear the argument. There is a way you can get characters to follow you in the game. So I told him to put his character on follow. I just dragged him around through this low level area and cast a spell around him so things would attack him. So, his health was slowly withering away. He was cooking… and he said… "Wonder, I saw that… I am gonna get you!" So I made his day better just by doing a little funny thing. You should always think about your reactions and how your actions are going to impact others. Sometimes gaming in gaming worlds will teach you that… I learned it through Final Fantasy*."

Instead of focusing on her own problems, Wonder realized that others have bad days, too. She developed empathy and compassion for other people. She talks about the importance of being aware of how actions and reactions impact others. Wonder believes in trying to be kind to others. She goes out of her way to try to cheer people up through her actions. Video games allowed her a safe place to work out her feelings of hatred toward people and turn those feelings into empathy skills. Her feelings towards people in real life have changed. Video games

allowed her to meet friendly people outside her immediate world and her feelings altered as a result.

Celeste describes how negative encounters in game worlds are easy to avoid. If a gamer has a bad experience with another player, they can just remove themselves from that person and move to a new location. Celeste feels in real life that people make assumptions about her before they even know her. This makes her feel self-conscious about who she is. She talks about how games allowed her to be more comfortable with herself.

> Celeste: "*Well it taught me more to be myself. In the game you don't see the people and they don't see you. They have never met you before. So, you can act more like yourself. If other people don't like you, you never have to see that person again. You'll never meet them again and you can just walk away or teleport. Go to a different spot and they will not be there*."

Celeste describes a veil of protection in video games. She feels like she can be more herself because the other players do not know her in real life. She describes first impressions and how video games offer less risk for rejection based on physical appearances. They don't see her to make judgments. Players can pick and choose who their friends are and with whom they choose to surround themselves. Participants mentioned that people do not always get these choices in our real lives. Celeste feels playing video games taught her more about who she is in real life and that this boosted her self-esteem. The participants all shared similar stories of an emotional nature. They described how gaming communities provided them with opportunities to learn social, empathy, and coping skills and related experiences that improved their self-esteem.

The Hero: To Be the Hero of a Great Adventure

The hero wants to save the day. This gamer desires adventure through interactive experiences and enjoys reading a good story to accomplish missions. This love of 21st century gaming literacy inspires the hero to embark on fantastic journeys steeped in lore and magic while accomplishing world-saving missions. They help, heal, and save other players and rally with their party or guild to advance themselves further in the game. A role-playing game (RPG) is a fictional world in which players take on the character roles of the game's storyline (Harrigan & Wardrip-Fruin, 2007). The game world provides a stage for the players to act out their roles through the narrative of the story (Grouling, 2010) and improve their literacy skills.

Altruism and identity. Altruism and identity were common themes among the participants. They expressed their desires to be the hero of a great adventure. Video games allowed the participants to step into the roles of those characters. While the participants enjoy the hero's journey, they also feel a strong sense of identity with their avatar forms. In the passage below, Nano talks about the fun he has getting lost in the storyline, as the fantasy world allows him to be anyone he wants to be.

> Nano: "*I guess it lets you be someone that you always wanted to be. A lot of role-playing games allow you to be something in a society where it's completely different. They will place you in this whole different world… different environment… and you will be able to play it. You experience all these interestingly different kind of things. It is probably one of the greatest things about games*."

Nano talks about his enjoyment for the many experiences video games have to offer. He can be a rogue in one game and a healer in another. The high quality graphics immerse the

player in rich landscapes and scenes. Each world offers a new set of missions and tasks to complete. Nano enjoys this diversity and it gives him an opportunity to escape into a good story. At the same time, he likes to maintain a sense of his own identity in game worlds through the customization of his avatar's appearance.

> Nano: "*I like to step away from the usual. I know a lot of people like to make their avatars look as cool and edgy… as best as they can… but in all honesty I like to do something that would describe me. I would customize it to be exactly like me. Even if it's like a plain Jane avatar or something then I wouldn't mind. It is always interesting to me. There are those customization options… it's pretty diverse… sort of like Skyrim or any of those games where you can adjust facial position and features*."

Like Nano, Wonder likes to bring part of her real life identity into games. She is particularly attached to her game avatar in *Final Fantasy*. In the passage below she talks about how she customized her character.

> Wonder: "*I love my avatar. I love her. They are coming out with a new expansion where you can change your class. Everybody wants to buy the new Fantasia potion to change their class. I can't for some reason because I see my character as a human. I can't change her physically. I can change her hairstyle but I cannot change her face or anything else about her because it's just… she is like me as a character. I am her in real life. She does what I wish I could do*."

Wonder speaks of a common theme in relation to identity. Many gamers feel their avatars are extensions of their real world selves into game worlds. The game avatar becomes part of their identity. Friends online and in real life equally become a part of the gamer's life.

To Wonder it makes perfect sense that her avatar would look like her real self. Celeste also likes to customize her avatars to look like her real self.

> Celeste: "*Whenever I create my avatar I always have brown hair like my own hair. Then if I ever find any avatars with my bangs… I love how my bangs are in real life because I have always had them since I was a kid. For clothing, if I could wear some of those clothes in real life … that would awesome. I always put my characters in anything I would love to wear in real life. It's a reflection of yourself. One of the best parts of the game is creating the character. I will like spend an hour trying to get it all perfect*."

Sterling chooses a different approach to customizing his avatars for games. He prefers to "look" the part or like the role he has taken. He talks about it from a strategy perspective. He wants his role in the group to be clear.

> Sterling: "*My avatars… what I usually do for MMO's… you're usually given a race to choose from. If you choose to be human, you are from a certain region. I usually try to customize depending on the class. If I were to be a mage, I'd make my guy like an older typical mage. Something that can be easily identifiable to other people without them having to actually ask. I try to make my avatars specific to the area that I start in. So, if there is ever factions and stuff I can get in really easily and they'll know I'm on their side. I'll know who to attack and they'll know that I'm going to attack them. I can get into the role-play easier… play my part*."

Sterling's description of his avatars reflects the mind of a gamer who prefers to keep it simple and stick to strategy. He believes the avatar persona is part of the strategy of the game. Looking the part of the hero enriches the experience for him.

The participants were asked to discuss what kinds of expertise they felt they possessed when playing video games. All four participants expressed an altruistic feeling toward helping others in game worlds. There is a desire to be called to action and to save the day. This was a common feeling among participants. They expressed a longing to be trusted with a world saving mission. The participants all felt a sense of caring, as well as, a calling to help online friends, guilds, and parties. For Wonder and Celeste their responses expressed an expertise in healing, providing support, and making others feel better.

> Wonder: "*I'm an expert at making the people feel at home in game. Sometimes people aren't so nice to new players and they need somebody to help them. A person at a low level… They will be having to go through a very hard area in order to get to a lower level area because they can't teleport yet. I will invite them to my party and I'll get them through… and say … "Anything else you need?" I always offer to help and I have had a lot of people tell me that I make them feel comfortable. I make them feel like this is a good community*."

Wonder finds it fulfilling to help other players in video games. She thinks it is the right thing to do. Helping others and being kind to lower level players is an expertise she feels good about. It means something to her that a new player feels welcome in the community. Celeste shares similar feelings about her love for magical healing roles.

> Celeste: "*I always like the magic… to shoot from a distance. Other than that… I love healing or being a supporting role where I can help people. One time I was doing a dungeon with this person and I didn't know anything about how to heal a person. So I would lock onto them and constantly heal them with any spell. I didn't bother healing*

myself. When we finished they said… "You are the best healer I ever met on here." That always made me feel good. I actually made a difference and helped him. He said, "A lot of people just heal themselves."

Celeste enjoys playing her priest character in *World of Warcraft*. As a healer, she accompanies a party of three other players into dungeons. A basic or "light" party is usually made up of a tank player, two damage per second (DPS) players, and a healer role. Each member of the party plays a specific role in a dungeon. The tank pulls the "aggro" or the threats inside a dungeon and diverts their attention. These threats are monsters known as "bosses" and "mobs." Tanks are heavily armored to endure a great deal of damage. The two DPS players support the tank by doing as much damage as possible. Some DPS are close range melee fighters that work near the tank as support. Other DPS players are long range damage dealers. For example, an archer would provide long range damage and also help protect the healer. They position themselves near the healer to execute their long range attacks. The characters are dependent on the video game and their storyline, roles, classes, and races. Celeste's favorite role is healer, and her job is to heal the tank and the DPS players when they endure damage from the monsters as evidenced by their "health bars". Healers provide a key support role as they can heal their party and also do long range magic damage. This is the role that Celeste enjoys the most because it is something that makes her feel good and gives her a sense of healing power.

Celeste: "*Well, I have always been that nice person that likes supporting people. I never like bringing anyone down. So, I like helping them. If they die, I would be right there to revive them because it always makes me feel good about myself*."

Healers also have the ability to revive other players in the game. In some games the healer can have such strong powers that they can raise their entire party from death. Usually, these powers have fantastic graphic displays of light and are enjoyable for the players to watch. Celeste finds this power extremely satisfying and it fulfills a desire to be a force for good. Her altruistic nature in game worlds make her perfect for the role of a magical healer. This connected feeling to magic and adventure taps into Celeste's desires to live a life of fantasy and to be a traveler of time.

> Celeste: "*I've always wanted to have an adventurous life. Like how life was for people back in the medieval times. You can't really have that in real life. But if you play a video game, you are able to let your mind go into their time and do their chores. I have played Zelda…. like The Legend of Zelda on the Wii. I would always find myself… my mom would say it's time to eat… and I would be yelling, "No, I am trying to save the world!*"

Celeste talks about how video games can provide a simulation of historical life. She enjoys the ability to travel back in time and immerse herself in the daily lives of the characters. It is a romantic notion of the past and taps into a desire to experience another life of fantasy and heroes. All four participants expressed that video games brought out these altruistic feelings. Celeste does not stop to take time to eat dinner and tells her mom, "No, I am trying to save the world!"

Fantasy and lore. A life of fantasy and lore is a life all four participants would love to experience. These desires tap into their love for reading fiction. The participants describe video games as if they are interactive storybooks or graphic novels. All four discussed in detail the amount of fantasy reading and lore they absorb through their video games. Reading is a key

element and strategy in leveling up a character. In order to play the role, understanding the storyline of the video game or reading the details of a mission is key. Literacy in video games can take the form of quests, cutscenes, lore books, dialogue, scrolls, puzzles, and gaming websites. A role-play game (RPG) always has a story full of characters to play.

> Wonder: "*RPG… Well, for the Final Fantasy series they all love to depict different realms… and it's pretty much a book. You're pretty much living a book. For example, in Final Fantasy X you are in a world called Spira and it's totally different than our world. There is black magic and warriors. You have to read. If you follow the story you see the interactions, character development, and conversation. When you finish one game of Final Fantasy, you are left wanting more. So you want to play the next one and it's a totally different story. Right now there are 14 games. It pretty much sucks you in and gets your mind off things that could be stressful like school or work*."

Wonder describes the Final Fantasy series as if they were a book series she reads. She has followed the characters throughout the entire series and is familiar with each story. Other participants also talked about the various video game series they have played. It is common for gamers to get absorbed into the fantasy and lore of the stories. The idea of having magical powers is what draws Sterling into these fantasy worlds. He imagines what it would be like to have these powers in real life.

> Sterling: "*Magic… You know there comes a point in everyone's life where you wish you could just throw fireball at someone. You are going to want to just yell, "Thor!" and smite someone with a lightning bolt. It just has to be done. All the things we have heard about mythology and stuff… there is always a sense of magic and mystery to it all. That*

intrigues me. To have those powers. To be able to do that is really cool and inspiring to me."

Using his magical powers in game worlds seems, for Sterling, to be a way of dealing with stress. He enjoys that sense of magic and lore. The stories of King Arthur and Merlin are steeped in lore and legend. Celeste also shares this love of fantasy for magic and action.

Celeste: "*I've noticed a lot of the games I play have action scenes of battling… a lot of them are fantasy scenes. I can't really get that anywhere else. Playing games, you get to be that fantasy player. I love being able to shoot magic bolts from my hands and the characters always get to do that. So, you have action and adventure. I love going around the world and traveling. I love seeing all the beautiful sights the programmers have created. The waterfalls and all that. It is always so beautiful to see the work they put into it*."

Celeste describes how much she loves to shoot magic bolts from her hands. It is a sense of power to be able to perform magical spells. She also describes the fantastic worlds of scenery and landscapes that the creators of the video games build. She finds herself often exploring the land and admiring their artistic beauty. The theme and graphic design all add to the mystique and lore of these fantasy worlds.

Interactive reading experiences. The participants described video games as interactive books as containing profound literary experiences. Scholars recognize that video games and their narratives are a now a form of literacy. These interactive reading experiences have even proven to build and improve literacy skills with young readers. The participants for this study connected strongly with video games because they desire to be the "hero" of these great literary

adventures. Adventure was a common theme among the participants. In the passage below, Nano talks about his favorite genre of game, the lore, and the beauty of the worlds.

> Nano: "*Let's see… adventure games… if it's a game that can get you into the story. You get into the environment and the lore. If they are able to tell the story and to visualize it in a beautiful way. Then I am going to be sucked in. There are a lot of those kinds of games like Dark Souls for one. There is always a hidden story. You think you are just going around but there's actually a story as you talk to the NPC's. If there's a good story and it's a long progressive one… adventure is definitely the way to go*."

Interactive reading experiences are a way for the video game to communicate important information about the story or quest. Nano talks about the fact that the player has to be aware of hidden storylines situated through the narrative of the game. These hidden pieces of narrative are secret puzzles that will help the player figure out the next move in the game. So, being observant and reading the details are key elements to successful gameplay.

> Nano: "*I know there is a lot of revealed information in most games if you make the effort to go that extra step. Metal Gear Solid games are known for their extremely long cutscenes. Some people might skip through these hour long cutscenes but they are actually informative bits to fill you in on exactly what you're doing. You are learning what is piecing the story together. They are actually pieces to a puzzle. I've also read a lot in the Call of Duty games. The older ones told great narratives for World War I and World War II. Whether you are reading about history, physics, or chemistry. You have to find the details. There is a lot of reading in games. Now it's like piece together things, read through everything, explore everything, and then find out*."

Nano describes an interactive reading experience with cutscenes, NPCs, and story puzzles that all tie together to advance the narrative and the leveling of the character. The character's leveling process is driven by the main story. Nano also introduces a common theme in video games as related to learning. He talks about applying scientific practices through physics and chemistry. The fact that Nano learned about various historical events through video games is evidence of how a mainstream video game designed for entertainment purposes can have educational value.

> Sterling: "*I read a lot in the games like The Elder Scrolls series and a game called The Reckoning which is a console-based MMO. In Guild Wars, you'll follow the storyline that you are creating by yourself but there are predetermined paths that you can choose to follow and it'll continue your story… as in… you are the person in the game. There's also a lot of reading in League of Legends as in there is lore behind every champion in the game. Paragraphs of it that you can read on their website or within the game itself. Looking through your own champions will help you feel out your character better*."

Researching a character, class, or race can add to a player's knowledge base. Sterling reads up on the lore associated with his characters. He enjoys interacting with his characters and the world through literacy. He absorbs as much information and narrative as he can acquire.

> Sterling: "*I tend to know a lot about the games that I play because I like to pay attention to details. If I want to know something, of course I'll go to Google it and find it out. I like to feel it out for myself and gather the information that people wouldn't have. Like the game Borderlands, it's a very in-depth game. There is a deep back story within the game. It's an open world and the main story is easy-to-follow. There are many side*

missions that give a lot of insight to the story. You understand what's going on between the antagonist and the protagonist group that you're playing as. You know what they're doing to the planet you are on and why you're trying to stop it. All the stuff that isn't directly explained in the main story."

Sterling likes to possess knowledge about the game and the story that other players do not have. He will seek out and gather detailed information both "in game" and outside the game via websites. He talks about utilizing the Google search engine to research details about his character and the lore. Understanding how the video game series relate to one another through their narratives gives the player a deeper understanding of the antagonist and protagonist of the story. The player better comprehends their role in the game. Wonder also researches and reads as much information she can gather. She talks about the conversations, instructions, and riddles she has encountered and how the game challenges her literacy skills.

Wonder: "*Well, there are conversations and instructions. In Final Fantasy, there's a quest where you have to go around and read these messages left by a deceased character in riddles. These riddles lead to places with more conversations and characters. There are some words that I had to look up and then define. It's more challenging than my English class. I can read a class book in a couple hours… maybe a day or two. It's been three years and I still haven't figured out. In video games we are always reading. It's just not what they want us to read*."

Wonder has been puzzled by a riddle for three years. She has looked up vocabulary in the dictionary to better understand the context of the riddle in an effort to solve it and find its location in the video game. She describes it as something so challenging that it makes her books

in her English class easier to read and comprehend. Wonder is a veracious reader. She reads traditional books, online books, and the stories in video games. She brings up the point that she is always reading, even if through local chat, text messages, and other forms of media. Her comment, "It's just not what they want us to read," speaks to teachers and schools that have failed to acknowledge digital text and media as acceptable literacies. Wonder believes that narratives in video games can have as much literary value as traditional literacy forms. She believes that playing video games has developed her literacy skills. Celeste also enjoys the interactive reading experiences of video games and describes video games as books.

> Celeste: "*I love the reading. In every game you will have questing and the quests always have a back story. You get to read through… it's a book… and once it's done you get to do all the actions and then you go back and continue off what you just did. On Guild Wars, it has a little interaction every once in a while. Then you have the back story of your family. You're living that person's life in the game*."

These interactive literary experiences have shaped all four participants' literacy skills. They speak to what can be learned by playing a mainstream video game. These worlds provided the participants opportunities to become the heroes of their own stories. By stepping into the character's life they learn valuable research and literacy skills that enrich their passion for fantasy and lore.

I am an "Elite": A Digital Native

According to the participants, an "elite" gamer is the highest skilled gamer. The participants in this study all strive to be an elite. In order to become an elite, the gamer must master the character, class, race, powers, missions, dungeons, and the story of the game. They

are masters of strategy and understand the role of every player in the game. They must also be proficient in their technology skills to be able to master the physical tasks of missions. The gaming computer and console are their tools or instruments that allow them to control their character's movement and perfect their fighting skills. In a world where a split second can have great impact on gameplay, these elites are aware of computer specifications. For example, they know the limitations of their computer's processor, graphics card (image fidelity), and internet speed. Elites will buy or build the best gaming systems they can afford in order to be quicker and reduce lag time. This desire to be the best gamer drives many players to learn as much as they can about hardware. The participants in this study are like those players. They are digital natives with a comfort for utilizing technology. They do not just play video games. They acquire 21st century technology skills.

Digital native. Digital natives are defined as a generation who has spent their entire lives using computers, playing video games, and integrating various forms of media into their everyday lives (Prensky, 2001). The participants have been gaming since early childhood and have grown up in this culture of digital natives and elites. In the passage below, Nano talks about his first gaming system and his gaming experiences.

> Nano: "*I believe my first gaming experience would have to have been Sony's PlayStation One and I would play a lot of Crash Bandicoot. I don't know if there was a certain title but it was Crash Bandicoot for PS1. I believe I was around four or five years old. It is one of the defining games for 3D platforming. It had a good feel and a lot of people played it because it had a simple objective of get to the end of the level*."

Sterling also began gaming very early. He started playing platforming games on a gaming console. His years of gaming experience have allowed him to become a high level and ranked player on *League of Legends*. He has graduated from console gaming to using a gaming computer. This interest in computer specifications has promoted an interest in programming and hardware. In this passage, Sterling talks about the first games he played on the *Nintendo 64* game console.

> Sterling: "*My first experience with a game was probably when I was six or seven. The game I believe I played was Mario Kart 64 for the Nintendo 64. Among those games for the Nintendo 64 included the game Donkey Kong and the original Smash Brothers for Nintendo 64. During my childhood, those were generally my go to games. Seeing how that was the only technology out and it was a part of my home life when we were not out doing something else. My home life revolved around them*."

Wonder was six years old when she started gaming with her mother. She describes her experience as a family connection. Playing *Final Fantasy* was a bonding moment and one of her earliest memories with her mother. Like the other participants, she also started out as a console gamer. She now plays both on console and a laptop computer.

> Wonder: "*I was about six and my very first game was Final Fantasy X. My hands were not big enough to hold the gaming controller so my mom would always sit me in her lap and wrap my hands around the controller. She would put her hands on top of mine and she would control the triggers and analog sticks. I would control the buttons. In Final Fantasy X, you fight monsters and so she would always make me decide what action to choose for each character. What enemy to attack and how to interact. After that, it kind*

of led me to loving the Final Fantasy series. My mother is a gamer. Yes, my mother introduced me to the Final Fantasy series."

Wonder's first game was quite different from a platforming game. Playing the game required the help of her mother. She was too small to hold the controller on her own but for her it was more about bonding with her mother. Gaming for Celeste was also a bonding experience. Here, she remembers gaming with her twin sister.

Celeste: "*I was probably around five or six. I remember being on my really old computer that my dad had. My twin sister would pull up a chair and we would go on an online website called Neopets. Then we had this one game that we would always play when our babysitter came. It was a little monkey game with a volleyball that would go back and forth. That was our bonding moment we had when we were young. We grew to play more games like that together*."

Celeste's closeness with her twin sister is obvious. When she games she is not playing to be social with other players. She has a gaming partner with whom she grew up digitally. Each participant enjoys the dynamics of gaming for different reasons. These earliest memories of gaming are evidence that the participants are indeed digital natives.

Emerging technologies. The utilization of emerging technologies in the classroom setting was a common theme among the participants. As digital natives, they have grown up with emerging technologies like video games. In their lifetimes, they have witnessed advancements in gaming technologies and design. The discussion of how video games should be integrated into every day classrooms for educational use was a hot topic. Having just completed a modeling project with *Minecraft* in their 3D Modeling and Animation course, the participants

were eager to think of various ways this emerging technology could be utilized and why it should be used as an education tool.

> Nano: "*Video games are great. They are more beneficial than a lot of people used to think of them. In the past, they thought games would kill your brain cells… and it would turn you into a bad person or zombie. But with the games that people are creating nowadays… you know… there's definitely a lot of benefits that you will get from playing different video games. They are really great and I love video games*."

Video games model learning because they demand active participation (Tekinbas, 2006). The effects of video games on the brain include improvements in spatial reasoning, critical thinking, and eye sight (Bavelier, 2012). Children can positively improve their cognitive, motivational, emotional, and social skills by playing video games (Granic, Lobel, & Engels, 2014). These were benefits that the participants described throughout the case study interviews. In this passage, Sterling describes why he thinks video games are needed in the classroom.

> Sterling: "*I think video games in the classroom are a very good idea. They're having fun but they don't know they are learning. It's more fun, interactive, and more in depth. They can understand what's going on because they're wanting to do it. See, if you throw a kid into school and say you have to do this. They are thinking, "Why am I doing this? I am not doing it for myself. I'm doing it because you told me to do it." If you say, "Hey play this game." They'll play it and it tricks them into learning*."

Sterling describes the need for relevance in education. He expresses a desire to know why something that is taught in class is meaningful to his future. The use of emerging technologies as an education tool is relevant to his world and future as a digital native. It taps

into the skills he has already acquired through playing video games. Wonder also expresses this desire for relevance and technology integration. She feels that learning with emerging technologies will help prepare her for her future career. In the passage below, she discusses how using the video game *Minecraft* and other software in her 3D Modeling and Animation course helped give her the relevant technology skills she will use in college.

> Wonder: "*I want my future job to be game creation, game design, and computer graphic design. I actually learned a lot through Blender. I have always wanted to build a game and be able to play it. Whether it is creature design… set design… clothes design… or avatar design. Through Blender you learn how to make 3D model. You can make little things like a bowl on a table, a lamp, or a sword. Through Minecraft you can learn how to visualize settings before you create them and in Photoshop you learn how to design things. How to fix images that you could then import into a game engine. I think with the experience from this class, I will go into college knowing more than other Freshmen in my courses*."

Wonder feels that the skills she acquired through her 3D Modeling and Animation course will benefit her. She says the use of *Minecraft* helped her to visualize her modeling project. This was the first time she had enrolled in a course that integrated the use of a mainstream video game as an educational tool. Celeste also agrees in the learning and engagement benefits of video game integration. However, this was not her first time using a video game in school.

> Celeste: "*I like video games for teaching. This was not my first experience using a video game in a classroom. At my other school… when I was in elementary… we had our computer time. We played the Oregon Trail game where you role-play a person. You*

learn and experience what those people did back then from playing a game. Another time in math, we got to play a video game. It was a little car wash game. If you got the number right, you had a chance to beat the level. That helped me with multiplying my "3s". I wanted to get pass the level. So, I had to come up with ways to help me remember my multiplication. Gaming is becoming a big thing because of all these new technologies like the Oculus. I think a lot more people are going to be drawn to it. I think the schools should change."

Oregon Trail has been a popular video game since it was first created in 1971. Celeste's early experiences with the game left a big impression. She enjoyed traveling back in time and living the life of a pioneer. Video games also helped her learn basic multiplication. She talks about the evolution of gaming into the 3D world of Oculus Rift and how that presents an exciting new opportunity to learn and experience content. Celeste feels traditional classrooms are not fast-paced. She describes a disconnect with the lack of technologies in the classroom. Nano agrees and states that traditional classroom lectures are lacking interaction. He connects these emerging technologies with a new type of learner or learning style. He describes this type of learner as visual, auditory, and hands on. It is an interactive learning style based on immersion and experience.

Nano: "*If you are able to get their attention and to peek someone's interests with this style of learning then chances are a lot of people will want it. Rather than the usual sit in class, listen, and take notes. It would be actual learning as you're going and experiencing it for yourself… sort of way… I just think that would be pretty cool*."

It is clear that digital natives enjoy emerging technologies and would advocate for more integration. For Wonder, gaming is like "home" to her. She describes the feeling of her classroom environment when the whole class sat down to 3D model in *Minecraft* and her reactions and thoughts to utilizing a video game in a classroom.

> Wonder: "*It felt like I was at home playing with lot of people in my living room. I knew the controls pretty much going in. I was able to visualize how my building would turn out. Minecraft did make it very easy that way. I had never had a game-based class before but it was actually entertaining. You don't realize you were learning. Every time you play a different game you get another experience. I think most kids are averse to learning. Video game integration in schools would work for a vast majority of people. Out of all the kids who fail in school it is because they don't want to learn. You learn more when you don't realize it and you are not consciously thinking, "I need to memorize this" or "I need to store this."*

Wonder believes that video games can be used as an educational tool to engage struggling at-risk students. Like Sterling, she feels video games have a way of "tricking" the student into learning through immersive gameplay.

Digital natives' gameplay in self-organized learning environments. A SOLE is a self-organized learning environment, a place where groups of children can work together with access to technologies and the activity is driven by their interests and what they want to learn (Mitra, 2013). For video games, the environment where learning takes place is the virtual game world. Within that game world the participants explored areas of interests that directed what was

learned and which skills were acquired. These self-organized worlds were places to learn and teach others how to play.

> Nano: "*There was a lot of newcomers in the free to play games. One example is the open world survival game Rust. It is sort of like Minecraft. There are no instructions or any sort of tutorials on how to play it. Other than other players, you are figuring it out on your own. On this one server, I knew my way around and had plenty of gear. There occasionally would be new people walking around with rocks. They would just go around hitting other rocks and chasing after people not knowing what to do. All I would do is just teach them*."

Nano describes open world survival games that provide little to no instruction. The player is left to figure out what to learn and how to progress throughout the game. It quickly becomes obvious that other players are a good resource for learning and surviving. These game worlds are structured to force players to depend on one another in various ways. This dependency leads to a sense of collaboration, problem solving, and unity. It forces the players to self-organize when no other organizational systems exist. Nano became the expert and teacher in these worlds he described. It is a natural process that in the absence of an authority figure, children will self-organize and take the leadership and mentoring roles in a group of their peers (Mitra, 2013).

> Wonder: "*In game world, I was taught by my cousin. When I first started out, I would always play next to her so she could help me with my dungeons and everything. She would tell me what to avoid and where to stand. She taught me. I was a summoner and*

she was an archer. So they were completely different classes but when we switched roles we would help and teach each other. I have also taught other people how to play."

Wonder describes another example of this self-organized learning. In this case, she was learning with a family member. She and her cousin taught each other how to progress and perform functions of different classes. Wonder reveals that she has taught other people in real life how to play. This talk of self-teaching and self-organizing led to a discussion of the teacher's role in the game world. Participants reflected on their experiences modeling in *Minecraft* through their 3D Modeling and Animation course.

Celeste: "*They should be "in world" sometimes. But students should have alone time to think for themselves and not depend on them. They need to think "outside the box" and do it for themselves*."

Celeste's response brings in to question the role of the teacher in classrooms that are integrating video games for learning. While the data from the quantitative phase of the study reflected that a majority enjoyed having their teacher with them in the *Minecraft* project world, Celeste points out that teachers should assume more of a facilitator role in game worlds. She believes that students should be forced to think "outside the box" and do for themselves.

In conclusion, all four of the case study participants related experiences attached to gaming and learning. Five common themes were developed from the data collections in the qualitative phase of the study: 1.) The Strategist: Accomplishing the Mission, 2.) The Creator: The Art of Gameplay, 3.) The Communicator: Building Relationships and Communities, 4.) The Hero: To be the Hero of a Great Adventure, and 5.) I am an "Elite": A Digital Native. Each participant exhibited aspects of each game character trait illustrated by each theme. Within the

participants' narratives, there were truly varying levels of the strategist, creator, communicator, hero, and elite. These descriptive traits were 21st century skills and multiliteracies that the participants acquired through their gameplay. These gamer traits provide perspective into the possible predicators for academic success in a 3D Modeling and Animation course. The final chapter discusses these findings, draws conclusions, and explores the implications for the outcomes for the study.

CHAPTER V: DISCUSSION

This chapter is a discussion of the major findings of both the quantitative and qualitative phases of this sequential mixed model study. The following themes for discussion emerged from the findings: 21st Century Virtuoso Gamers, 21st Century Reading Experiences, 21st Century Gaming Experiences and Academic Success, 21st Century Video Games and Gender Roles, 21st Century Skills Learned through *Minecraft*, 21st Century Themes and the "Four Cs" for Academic Success, and the 21st Century Skills Gamers Are Learning through Video Game Experiences. The chapter ends with conclusions, implications, limitations, and recommendations for future studies.

21st Century Virtuoso Gamers

In Phase I of the study, the research subjects' level of gaming expertise was measured by the Gaming Experience survey. The survey questioned how many years and how many hours per week the subjects engaged in gameplay. Based on the Gaming Experience survey, the majority of the subjects were experienced gamers who engaged in gameplay an average of 5-20+ hours a week. According to Gladwell's (2008) cognitive research in his book, *Outliers*, a person that devotes 10,000 hours of study in an area of expertise will be considered a virtuoso. It is noted, that the subjects' maximum response of 10+ years at 20+ hours a week equals 10,400+ hours of gameplay for a percentage of the subjects in the study. This means a portion (24%) of the subjects in the study that have gamed for over 10 years were indeed "virtuosos" with expertise in playing video games. The majority (52%) grew up in a culture of gaming with one or both of their parents playing video games at home. This is significant because "the average American gamer living in a strong gamer culture will have spent over 10,000 hours playing video games by age 21" (McGonigal, 2010; Prensky, 2001). According to Von Ahn, and

Dabbish (2008) 10,000 hours is the "equivalent of working a full-time job at 40 hours a week for five years" (p. 58). Over half of the class (54%) reported to have played video games over 10 years. If the 10-15 hour gamers for this study continue with their gaming habits, they are well on their way of meeting that average by the time of their 21st birthday. Other survey questions varied in level of experience with some questions asking for more specialized gaming experiences that are unique to "higher level" players. The more questions a student identified with in agreement the higher their expertise. Twenty-six subjects reported they had even competed in organized gaming leagues. Organized gaming leagues are competitive gaming associations that attract high level and professional players into their ranks to compete for cash prizes and commercial endorsements. While 24% of the subjects in this study had been gaming for 5-10 years, the majority (36%) had been playing video games for over 10 years. Sixty-two percent of the subjects considered themselves to be an "expert and experienced gamer" in at least one game they played. These subjects belong to the current generation of 21st century youths who have grown up in the video game era (Bogost, 2007; Leonard, 2003; Martinovic et al., 2015). The high concentration of "gamers" within the 3D Modeling and Animation course was evidence that gaming can be linked to student interest in STEAM courses and future IT careers (Gee, 2007). Overby and Jones (2015) note that playing video games like *Minecraft* leads to an interest in learning to code and piques interest in 2D and 3D graphics programs.

21st Century Reading Experiences

It was also noted that 42% of the subjects reported they agreed or strongly agreed that the video games they played required a good amount of reading to level and advance within the game. Alexander (2009) describes the literary significance of this concept and explains that the textually rich worlds of video games do indeed require quite a bit of reading, writing, and critical

thinking to level up and advance through the game. This induces a discussion of video games as a means or medium for teaching literacy skills. What I have observed is that "gamers" look upon their video games as books come to life. They allow the reader to step into the character and become the hero of the story as they level up through the game. The narrative becomes an integral part of the leveling process and the more a gamer reads the further they advance. Reading is encouraged and rewarded by the game creators. This promotes a discussion that video games and their narratives should be recognized for their literary value. The United States Supreme Court agrees that video games should be considered protected works like books, plays, and movies (Brown v. EMA, 2011; Buchanan & Vanden Elzen, 2012). Scholars who have taken the time to play a video game are acknowledging that the narratives of modern video games do rival the narratives of novels (Buchanan & Vanden Elzen, 2012). Not only do "gamers" read in game worlds but they are also fans of traditional forms of literacy. Three of the participants in the qualitative case studies were avid readers of books, eBooks, and video games. This finding shows that students are reading, but because of a digital divide in the classroom, teachers may not realize the shift in literacy mediums.

21st Century Gaming Experiences and Academic Success

The first major quantitative finding from the data analysis involved the Group Project Grade. The results were heavily skewed as the majority of the students received a perfect score on the *Minecraft* Project. It was noted that 43 out of 66 of the students scored a 100 on their Group Project Grade and that two separate graders were responsible for grading the subjects based on a rubric. This skewed result could be explained by the high concentration of gamers enrolled in the course. It makes sense that students with high levels of gaming experiences would exhibit a comfort level with this new literacy and technology. This familiarity with game

worlds would make it very easy for them to adapt to a game-based learning environment utilizing a video game as an educational tool or medium. It also indicates that the groups worked well together to collaborate, communicate, and problem solve on the project. While the grades were not expected to be similar, the data makes sense due to the high concentration of gamers in the courses and their familiarity with the medium. MMOs like *Minecraft* support 21st century learning strategies and pedagogies like other forms of literacy. So it was not a surprise that students had developed these skills through their past gaming experiences and their involvement in the *Minecraft* Project. Games like *Minecraft* give gamers a chance to collaborate, communicate, and problem solve issues in pursuit of a shared goal (Gee, 2003; Schrader et al.; 2009: McCreery et al., 2011; Squire, 2006). The mean average Group Project Grade for the females was a 98.44 and a 95.68 for the males in this study. Both genders performed extremely well and exhibited a strong level of comfort with the literacy medium. Again, in total 60% of the subjects had been playing video games for 5-10+ years and the majority had played *Minecraft* before enrolling in the 3D Modeling and Animation course. This data connects the subjects' level of gaming experience with success on a video game-based assignment in the classroom. The Group Project Grade data results are so obvious that a multiple regression would have been irrelevant.

21st Century Video Games and Gender Roles

The second quantitative supplemental research finding from the data analysis involved the variables of Gender and Class Rank. As stated in the summary, the females outranked their male counterparts when it came to their class ranks for graduation. The female subjects had a 45% higher class rank than the males. Their Group Project Grade was 3 points higher on average and their CGPAs were higher on average by 5 points. Overall their academic

performance was better than the males. This induces a discussion related to gender and women's roles in the engineering and technology fields. Gee (2007) notes that girls give up gaming in the middle school years around the same time they give up math and science because it is seen as unfeminine. Girls are focused on other interests during the high school years when boys begin developing programming and design skills. The desire to be the best gamer often motivates players to learn more about hardware, and some actually learn to build a gaming computer to specs. Despite this four-year gap, girls do return to gaming later in life as 44% of gamers are now female, and "women age 18 or older represent a greater portion of the game-playing population (33%) than boys age 18 or younger (15%)," (Entertainment Software Association (ESA), 2015, p. 3). Even though women make up nearly half the working population, in 2011, only 26% of STEM workers were women while 74% were men (Landivar, U.S. Department of Commerce, & United States Census Bureau, 2013). To explore the gender gap further, the American Community Survey (2011) reported that women made up "13% of the engineers, 27% of the computer professionals, 41% of the life and physical scientists, 47% of the mathematical workers, and 61% of the social scientists in the STEM fields" (Landivar et al., 2013, p.5). Clearly educators need to find ways to attract more girls into STEAM courses and STEM careers. The lack of female subjects (9 out 66) for this study is evidence that there is work to be done to attract both genders into the STEM field.

So why then do these stereo-types persist? Both female participants for the case studies (Wonder and Celeste) reported experiencing sexism in video game worlds. They described the perception that only males play video games and that only males are good players. Wonder described experiences of being teased for being a girl, "*Oh my God, it's a girl! Girls shouldn't be playing. Go in the kitchen!*", and Celeste described being distrusted for telling another player she

was a girl, "*What can I do to prove it? Why won't you believe me? I couldn't do anything to prove I was female.*" These participant comments are supported by gender studies that expose the sexism of the video game industry and the problems educators have in luring girls into STEAM courses.

21st Century Skills Learned through *Minecraft*

On the *Minecraft* Assessment survey, the subjects reported the application of various 21st century literacy skills, including the application of critical thinking, communication, collaboration, and creativity and innovation. The majority of the students (55%) felt they learned or improved modeling skills and 52% felt they had gained modeling and design skills they might use in the future. When asked about their spatial reasoning skills 56% agreed that the *Minecraft* Project had helped them to visualize their models. Students said they were comfortable navigating the 3D environment (57%), which also helped them to develop their spatial reasoning skills. Students (57%) indicated that they were able to collaborate well with their group in *Minecraft* and 52% successfully researched online how to create the models they wanted to build. The subjects (64%) felt the project challenged them to be creative and innovative and 58% agreed that the creative mode made it easier for them to complete their 3D models. Overall, 34% felt their modeling experience was productive and that *Minecraft* Project proved to be an engaging way for them (63%) to learn 3D modeling and game design concepts.

While these percentages represent smaller findings, they represent survey majorities that reveal the 21st century skills the students acquired through the *Minecraft* Project. These majorities contributed to both the major quantitative and qualitative findings. These percentages are supported by the research of 21st century skills and video games as described in the literature

review for this study. They provide perspective as to why gaming experience proved to be a possible predicator for academic success in a 3D Modeling and Animation course.

21st Century Themes and the "Four Cs" for Academic Success

Qualitative results from the four cases studies led to the development of five major findings. The themes represent the character traits of gamers and the 21st century skills acquired through gaming and the *Minecraft* Project. These themes and categories complemented the quantitative results and the study's literature review on 21st century skills. The themes correlate with the "Four Cs" (Critical Thinking and Problem Solving, Communication, Collaboration, and Creativity and Innovation) (National Education Association, 2015).

The first major qualitative finding or theme was titled, "*The Strategist: Accomplishing the Mission*." The strategist gamer utilizes a variety of 21st century skills to obtain what they want in a game. The participants for the study reported the use of strategies in order to meet objectives, accomplish missions, and advance within game worlds. Team unity and collaboration were strategic skills noted throughout the case study interviews. The ability to be "flexible and willing to collaborate to solve problems in pursuit of a common goal" (Partnership for 21st Century Skills, 2010) proved to be a successful way to advance further in gameplay. These highly collaborative video games taught the students to "work effectively and respectfully with their diverse teams" (National Education Association, 2015). The participants relayed personal accounts of teamwork and collaboration in groups. Their strategies soon led to goal setting and achieving a level of expertise which required the use of their critical thinking skills. Problems were solved in "both conventional and innovative ways" (National Education Association, 2015). Game theory patterns were a common theme among case study participants. They learned to recognize game patterns from their need to reason and respond effectively to

specific gameplay situations. Playing by patterns led to either success or defeat and it depended on the strategy of the gamer.

The second major qualitative research finding is based on the creativity and innovation skills acquired through video games. "*The Creator: The Art of Gameplay*," was the title for this common theme. This gamer has an artistic streak to create content for video game worlds. According to the Partnership for 21st Century Skills, creativity and innovation is related to a student's ability to think creatively, engage in creative collaboration, and implement new innovations (Donovan et al., 2014; National Education Association, 2015). The participants talked about the acquirement of skills and their ability to apply them to the real world. In phase I of the study, 54% of the research subjects reported on the Gaming Experience survey that they had used a skill in real life they first learned in a video game. The application of these real world skills proved to be evident through the multiple stories of the participants creating game content with various 2D and 3D modeling software. The participants discussed the sale of items they had created in game worlds and profits that were made through digital distribution platforms like *Steam* website. At the start of the project, 36% of the research subjects reported that they had participated in role-play economy systems by selling and trading gear for game characters. The four case study participants described a culture of self-teaching and the development of spatial reasoning skills. Forty-five percent of the 66 research subjects indicated that they belonged to community forums, consulted websites, or watched *YouTube* videos to learn how to play specific games. The participants went a step further to include consulting these information sources for ways to learn how to create content for their favorite video games. They collaborated and shared digital art in these virtual spaces. This is evidence of a culture of self-teaching, creativity, and innovation in video game worlds.

The third major qualitative research finding was titled, "*The Communicator: Building Relationships and Communities.*" The communicator is a gamer who specializes in making and building relationships online in order to advance their gameplay. These bonds are made through common interests and shared experiences. This finding explored the categories associated with online relationships, community and culture, and social and emotional learning. It is obvious that the social nature of MUVEs, MMOs, and MMORPGs led to the development of online friendships for participants. The collaborative nature of these types of affinity spaces make it necessary to develop friendships to advance further in the game. The community and culture creates a dependency on others and rewards players for working together as a team. These cultures are diverse and unique to each game. Players from all over the world engage in gameplay together. It was not uncommon for the participants to make friends with players from all over the world. Their gameplay introduced them to a global culture beyond their immediate family and local cultures. Participants even reported the acquirement of foreign language skills. This diversity calls for students to be able to effectively communicate their thoughts with others and utilize a variety of communication tools specific to video games (Donovan et al., 2014). Communication tools consist of game text chatrooms, game voice chats, or websites like Teamspeak that allow players to host their own audio stream. These encounters with other players provided opportunities for social and emotional learning to occur. This supports the research that children can positively improve their cognitive, motivational, emotional, and social skills by playing video games (Granic et al., 2014). The participants relayed stories of how encounters with other players in video games had changed their perspectives and helped them work out their real life issues.

The fourth major qualitative research finding is, "*The Hero: To Be the Hero of a Great Adventure*." This gamer is always in the mood for a good story and seeks to be the hero of the journey. A common finding among the participants was a desire to be a force for good. This altruistic sense to help other players in a variety of ways is evidence of the good will the participants demonstrated toward other players through their gameplay. Helping others through collaboration, communication, and problem solving were ways to succeed as a team. Often these feelings influenced the participants' senses of identity in game worlds. They created their avatars based on psychological preferences, gaming role-play characteristics, and, in many cases, for social purposes (Yerbury, 2010). Nano, Wonder, and Celeste relayed that their avatars were an extension of themselves in game worlds and they customized their avatars accordingly. In phase I of the study, 51% of the research subjects indicated that they were proficient at customizing their game/role-play characters to fit their personal tastes and identities. This piece of data supports the trend that identity does indeed play a role in the creation of an avatar. The customization of avatars adds to the fantasy and lore of the video game experience. Participants described playing video games as if they were interactive reading experiences, graphic novels, and books series. This love for reading fiction taps a desire for adventure and role-play. Video games set a stage for character creation in which student avatars can then write fanfiction, create machinima films, and produce video guides (paratext) on social media sites to assist and teach other gamers how to improve their skills (Gerber & Price, 2011). Literacy in video games can take the form of quests, cutscenes, lore books, dialogue, scrolls, puzzles, and gaming websites. The participants described how reading was a key strategy for leveling and advancing through a game. The more knowledge a player has about the story and game the more skilled the player becomes and is then respected for their gameplay.

The fifth major qualitative research finding was titled, "*I am an "Elite": A Digital Native*." The participants described the "elite" gamer as a professional or high-level player who has earned the status and respect of other players in video game worlds. These players have grown up in the digital era and are fluent in the practice and application of various digital literacies. Digital natives are defined as a generation of those who have spent their entire lives using computers, playing video games, and integrating various forms of media into their everyday lives (Prensky, 2001). They are open to emerging technologies and enjoy a high level of comfort learning and adapting to them. "Elites" understand how hardware can improve their gameplay and take the time to develop their knowledge in this area. All four case study participants exhibited characteristics of the "elite" gamer. All four case study gamers also started gaming at the ages of 5-6 and described learning about computer specifications, programming, and hardware. Their gaming evolved from basic platforming games into MMOs, MOBAs, and MMORPGs. The utilization of emerging technologies in the classroom setting was a common theme among the participants. The participants described video games as learning environments. Game worlds often lack instructions and gamers end up self-organizing in an effort to teach themselves how to play. These self-organized worlds are places to learn and teach others. This finding supports the concept that video games are SOLEs and that if students are left to their own devices they will teach themselves (Mitra, 2013).

21st Century Skills Gamers Learn through Video Game Experiences

Workforce executives report that students are graduating from college without the 21st century skills needed to work in a global society. One unique finding this study revealed is that gamers do bring skills with them into the classroom that they have learned through their gaming experiences. The researcher did not expect to find a high concentration of gamers within the

population. It was only after the Gaming Experience survey was administered that the researcher realized the high frequency. This induces a discussion on whether gamers already have these 21st century skills needed but are failing to realize their potential, and educators are failing to help gamers utilized these learned skills in the real world. Are these skills unique to gamers? McGonigal (2010) references the concept of a "generation of virtuoso gamers" that is coming of age. Gamers could be the 21st century skilled workers that workforce executives are in need of to fuel future innovation.

Conclusions

Based on the quantitative and qualitative findings, gamers who have been playing video games from an early age will bring into the classroom a certain skill set of multiliteracies unique to technology and the 21st century. It can be concluded that students today are receiving a parallel education during after school hours. This education is taking place in video game worlds where students are becoming "virtuoso" gamers. Educators might benefit from tapping these skills and encouraging students to "transfer" these skills from video game environments into the real world. Students who are exposed to gaming are more likely to seek out future careers in engineering and other technology fields (Gee, 2007). If teachers were better prepared to teach 21st century skills through gaming and digital literacies, students might be better prepared to work in the 21st century's global economy. Students would then have the necessary skills needed to meet the demand for innovation. The current education system is still operating on most of the 20th century practices of the Industrial Age. Clearly workforce executives are expressing a need for educators to better prepare students for college and careers through the teaching of 21st century skills.

There is a direct link between boys, STEM, and video gaming during the high school years. Males develop a comfort level with the technologies associated with the video game industry and therefore that familiarity encourages them to pursue the STEM fields in college. These technologies include programming, 2D digital art, 3D modeling, robotics, and engineering. The more gaming experience a student has outside of class, the more success that student will have adapting to a game-based learning assignment that utilizes game literacy and video games in the classroom. High school girls are missing out on key years to develop their programming and design skills for 21st century careers. Education is failing to tap the creative and innovated minds of over half the world's population. If high school girls are performing equally (if not better) as boys in academics and STEAM classes, we as educators need to take progressive steps to ensure that all students receive equal opportunity. Educators need to address the unfortunate mindset that video games, math, science, programming, 3D modeling, and engineering are for boys. Girls need to be encouraged to enroll in STEAM courses. While this study's population included only 9 females out of 66 subjects, it is symptomatic of the problem worldwide and supports the overall research in this area of study.

Students are reading while immersed in game worlds! What we have known as literacy in the 20th century has now changed. Gamers are indeed readers of all forms of text. Reading can take the literary forms of books, eBooks, websites, and video game narratives. Gamers enjoy the fiction reading in video games because it allows them to step into the book and be the hero of the journey. Children and adolescents today possess an altruistic nature that calls upon them to perform heroic missions in game worlds. These video game narratives are tapping into that sense of good. They enjoy the fiction, the fantasy, the magic, and the lore because, in game worlds, they can possess special powers and use them for good. To continue to dismiss video

games as "mindless entertainment" fails to recognize that students are reading. They are just choosing to read via a new literary means. Based on the case study interview responses and my observations as a researcher, video games often encourage students to read traditional forms of literacy. One can then conclude that teachers are failing to recognize the potential of video games for learning. It is reminder that you can never judge a book by its cover until you open it and experience it for yourself first-hand.

It can be concluded that video games do indeed teach 21st century skills and that video games provide students with opportunities to practice these skills. Video games, virtual environments, and game engines teach the concepts of Critical Thinking and Problem Solving, Communication, Collaboration, and Creative and Innovation. In short, *Minecraft* proved to be an effective educational tool to teach 3D modeling skills, and it can be equally as effective to teach core content areas based on the research. The combination of "gameplay" and "game design" challenged the students to be creative and innovative.

Limitations of the Study

There were limitations to this study. The overwhelming number of male to female participants was a limitation. The researcher could only record data from the students assigned to the courses. The researcher had no control over the gender or other demographic make-up of the subjects for the quantitative model of this sequential mixed model study. Individual students select courses to meet their high school degree plan requirements. The ratio of male to female reflects the interest in the courses and available seats in the class. Selective purposeful selection could be viewed as a limitation to the qualitative model of this study. However, the quantitative survey helped provide more equality. It should also be noted that the two graders for the *Minecraft* Project were different educators from those who actually vetted the rubrics. This was

due to the limitation of time at the end of the school year. Grades were due and the researcher had to locate graders in order to meet the district's grade entry deadline. The researcher only recorded what the subjects and participants shared and revealed through the survey responses and the four case study interviews.

Implications for Practice

This study was conducted because there was a need for more studies researching the practice of video game integration in a classroom. The study contributes to the growing body of research within game studies that targets a secondary (9-12) population. It is a contribution to help facilitate a "mind shift" in how we prepare students for the 21st century. The advancements in technologies have changed the literacies and skills that are needed to be successful in today's global society. The need to prepare children for the future's careers has not changed. While this study's population was small due to limitations, it provides a snapshot of video game integration with a high concentration of gamers in a South Texas area high school.

The findings from this study could be used to improve the teaching of 21st century skills, and better prepare students for college and future careers. It could inform the pedagogical theory and professional practices of educators to help them understand this new generation of the 21st century learner. It raises awareness for teachers to acknowledge a new type of learner in their classrooms that can be described as "The Gamer". It provides insight on a parallel education that most teachers are unaware their students have as a result of their experiences playing video games during after school hours. Educators should not be afraid of this type of technology. As teachers, we are life-long learners. This study suggests that video games serve as powerful engagement and educational tools in the classroom. The teacher is the facilitator of the learning

experience. It is my hope that this study adds to the current body of research that encourages teachers to teach 21st century skills through video games and virtual environments.

Recommendations for Future Research

A longitudinal study with the four participants of this study would provide a better understanding of applied 21st century skills over time. I recommend a follow-up study once all four participants have reached the age of 21. At that time, all four should have reached the 10,000 hours of gaming that McGonigal and Prensky discuss is typical of the average American gamer. A study researching the students' college gaming experiences and career readiness would provide greater perspective. It would attempt to again measure the predictors of academic success and the 21st century skills gamers are learning through video game experiences.

From a literacy viewpoint, a content analysis of various video games and their narratives would lend some perspective into the reading practices of young gamers. Coding and evaluating the narrative texts, quests, and graphic art of the games would provide multiple data sources for triangulation. Analyzing the texts would assess the reading levels of video games. This qualitative data could then be converted and quantified. Furthermore, I recommend exploring the reading habits, literacy skills, and genre interests of gamers through the use of survey and case studies.

While student interest in video game integration is high, there is an overall need for more studies into the actual practice and effectiveness of video game integration with younger populations. Studies into MUVEs, MMOs, MMORPGs, RPGs, and Sandbox games will add to the field of knowledge in this area. Game engines should also be studied for their effectiveness in education and included with game studies. There is a need for studies that take into

consideration the effective combination of "gameplay" and "game design" as two parts of a whole and the learning that occurs via these two pathways. The game of Minecraft uniquely provided a space where students could learn skills by combining gameplay and game design. Simply stated, it is a video game that can engage students in gameplay and game design at the same time. More studies into the effective use of Minecraft in schools are needed. I also recommend studies into the sexism present in video games, the lack of females in STEAM courses, and how gender impacts identity in game worlds. These perceptions and biases need to be further researched to understand why girls are receiving the message from society that certain areas of study and video games are for males only.

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Appendix A

CCISD External Research Review Committee Document

Office of Assessment and Accountability

CORPUS CHRISTI INDEPENDENT SCHOOL DISTRICT

P. O. Box 110 Corpus Christi, Texas 78403-0110
3130 Highland Avenue Corpus Christi, Texas 78405
Office: 361-844-0396 Fax: 361-886-9371
Website: www.ccisd.us

December 18, 2014

Ms. Katherine Hewett
Technology Faculty Member
Richard King High School
Corpus Christi ISD
5225 Gollihar Road
Corpus Christi, TX 78412

Dear Ms. Hewett:

The CCISD External Research Review Committee members granted you **Approval with Conditions** to conduct your research entitled "*Minecraft Project: A Mixed Model Study of the Acquisition of Literacy Skills through Gaming Experiences and Game-Based Learning*" at Richard King High School in the Corpus Christi Independent School District.

The conditions outlined below must be met in order to grant **Approval** prior to your conducting research in CCISD:

- Prior to conducting research in your six, technology classrooms at King HS to begin February 1, 2015, you must have written consent from each parent/guardian whose child will be asked to participate in the research. Our parents want to be engaged in the learning of their children, and your request to conduct research at King HS provides a meaningful avenue for them to be involved. Our parents want choice in what their children are being asked to do at school as well. Your research on behalf of our students through gaming experiences and game-based learning at King HS provides them the option.
- Prior to conducting research in your six, technology classrooms at King HS to begin February 1, 2015, you must have written assent from each student who will be asked to participate in the research. Like their parents, our students want to be engaged learners who feel they have a choice in the matter. Your research request makes that possible.
- Additionally, please locate the CCISD External Research Parent Consent Form and Student Assent Form in both English and Spanish on our Office of Assessment and Accountability web page at our CCISD web site, www.ccisd.us . Those forms must be completed, signed and dated, then submitted to this office **prior** to your conducting your research at King HS. We have converted those forms into Word fillable so that they will be simpler to navigate. Tomorrow Dr. Moynihan-McCoy will establish a Google Chrome Cloud shared drive for you to submit those forms to her via the Internet making it possible for you to have unlimited data space to upload those forms.

Finally, this **Approval with Conditions** indicates that your request meets all research/evaluation and FERPA standards.

It is a pleasure to formally welcome you to the District as a researcher as you begin the study in your technology classes at King HS, Ms. Hewett. We look forward to your meeting the conditions of this approval by sending us the pertinent documents soon. We also need a copy of the approved IRB proposal from TAMU—CC once that occurs.

At the conclusion of your work, please provide us with a copy of the final study. We want to share your findings with the educators across CCISD.

Should you need additional assistance during your research, please feel free to contact Dr. Toni Moynihan-McCoy at 361-844-0396, ext. 44256 and/or via e-mail at Toni.Moynihan-McCoy@ccisd.us .

Sincerely,

Dr. Elda E. Garcia
Interim Executive Director
Office of Assessment and Accountability

EG/tmm

Enclosures

cc: Roland Hernandez, Ph.D., Superintendent of Schools
Maria Luisa Guerra, Ed.D., Deputy Superintendent
Bernadine Cervantes, Ed.D., Assistant Superintendent for School Leadership Services
Janis Jordan, Ed.D., Assistant Superintendent for Curriculum and Instruction
Toni Moynihan-McCoy, PhD, Accountability Research;
External Research Committee Member
Debbie Seeger, Director, Office of Strategic Initiatives;
External Research Committee Member
Ric Allen, Systems Programmer/Analyst;
External Research Committee Member
Erin Sherman, MA, Research Compliance Officer, TAMU-CC
Dan Pearce, Ed.D., Department Chair, TAMU-CC

Appendix B

CCISD External Researcher Document

Office of Assessment and Accountability

CORPUS CHRISTI INDEPENDENT SCHOOL DISTRICT
P. O. Box 110 • Corpus Christi, Texas 78403-0110
3130 Highland Avenue • Corpus Christi, Texas 78405
Office: 361-844-0396 • Fax: 361-886-9371
Website: www.ccisd.us

EXTERNAL RESEARCH
OUTSIDE RESEARCHER/INVESTIGATOR
STATEMENT OF CONFIDENTIALITY

I, the undersigned, hereby agree not to divulge any information or records concerning any Corpus Christi Independent School District student without proper authorization in accordance with board policies, state and federal law.

During the performance of my duties as the principal researcher/investigator for this approved research study, I will have access to student information as well as to school data containing confidential information. This information is protected by the Family Educational Rights and Privacy Act [FERPA]. I recognize that improper discussion or release of information concerning a student and/or parent is forbidden and may be grounds for legal and/or disciplinary action. I agree that all discussion, deliberations, records, and information generated or maintained in connection with these activities will not be disclosed to any unauthorized person.

Further, I recognize that the unauthorized release of confidential information constitutes grounds for discipline, termination of my research project, and/or civil/criminal liabilities and penalties.

KEEP THIS PAGE FOR YOUR RECORDS

Executed this 10th day of December, 2014

Katherine Hewett

Outside Researcher/Investigator Signature

Katherine Hewett

Type or Print Name of Outside Researcher/Investigator

Richard King High School - Museum

Campus and Principal Signature

Every student a learner...every learner a graduate...every graduate a success!

Appendix C

Principal Statement of Consent Document

Office of Assessment and Accountability

CORPUS CHRISTI INDEPENDENT SCHOOL DISTRICT
P. O. Box 110 • Corpus Christi, Texas 78403-0110
3130 Highland Avenue • Corpus Christi, Texas 78405
Office: 361-844-0396 • Fax: 361-886-9371
Website: www.ccisd.us

KEEP THIS PAGE FOR YOUR RECORDS

As a campus principal, you are making a decision about participating in this study. Your signature on this page indicates that you have read the information provided above on previous pages and have decided to participate in the study. If you later decide that you wish to withdraw consent to participate in the study, simply tell me. You may discontinue your participation at any time.

Contact: Katherine Hewett
5225 Gollihar Road
361-906-3400, Ext. 22214

STATEMENT OF CONSENT

[signature]	12/4/14
Campus Principal Signature	Date
Katherine Hewett	12/4/14
Signature of Person Obtaining Consent	Date
Katherine Hewett	12/4/14
Researcher/Investigator Signature	Date

Every student a learner...every learner a graduate...every graduate a success!

OAA 9/20/2014

Appendix D

Institutional Review Board Document

OFFICE OF RESEARCH COMPLIANCE
Division of Research, Commercialization and Outreach

6300 Ocean Drive, Unit 5844
Corpus Christi, Texas 78412
O 361.825.2497 • F 361.825.2755

Human Subjects Protection Program — Institutional Review Board

APPROVAL DATE:	February 12, 2015
TO:	Ms. Katherine Hewett
CC:	Dr. Dan Pearce; Dr. Bethanie Pletcher
FROM:	Office of Research Compliance Institutional Review Board
SUBJECT:	Initial Approval
Protocol Number:	11-14
Title:	The Minecraft Project: Predictors for Success and Acquired Literacy Skills via a Game Based Learning Environment
Review Category:	Expedited
Expiration Date:	February 12, 2016

Approval determination was based on the following Code of Federal Regulations:

Eligible for Expedited Approval (45 CFR 46.110): Identification of the subjects or their responses (or the remaining procedures involving identification of subjects or their responses) will NOT reasonably place them at risk of criminal or civil liability or be damaging to the their financial standing, employability, insurability, reputation, or be stigmatizing, unless reasonable and appropriate protections will be implemented so that risks related to invasion of privacy and breach of confidentiality are no greater than minimal.

Criteria for Approval has been met (45 CFR 46.111) - The criteria for approval listed in 45 CFR 46.111 have been met (or if previously met, have not changed).

(7) Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies. (NOTE: Some research in this category may be exempt from the HHS regulations for the protection of human subjects. 45 CFR 46.101(b)(2) and (b)(3). This listing refers only to research that is not exempt.)

Provisions:

Comments: The TAMUCC Human Subjects Protections Program has implemented a post-approval monitoring program. All protocols are subject to selection for post-approval monitoring.

This research project has been approved. As principal investigator, you assume the following responsibilities:

1. Informed Consent: Information must be presented to enable persons to voluntarily decide whether or not to participate in the research project unless otherwise waived.
2. Amendments: Changes to the protocol must be requested by submitting an Amendment Application to the Research Compliance Office for review. The Amendment must be approved by the IRB before being implemented.

3. Continuing Review: The protocol must be renewed each year in order to continue with the research project. A Continuing Review Application, along with required documents must be submitted 45 days before the end of the approval period, to the Research Compliance Office. Failure to do so may result in processing delays and/or non-renewal.
4. Completion Report: Upon completion of the research project (including data analysis and final written papers), a Completion Report must be submitted to the Research Compliance Office.
5. Records Retention: All research related records must be retained for three years beyond the completion date of the study in a secure location. At a minimum these documents include: the research protocol, all questionnaires, survey instruments, interview questions and/or data collection instruments associated with this research protocol, recruiting or advertising materials, any consent forms or information sheets given to participants, all correspondence to or from the IRB or Office of Research Compliance, and any other pertinent documents.
6. Adverse Events: Adverse events must be reported to the Research Compliance Office immediately.
7. Post-approval monitoring: Requested materials for post-approval monitoring must be provided by dates requested.

Appendix E

Institutional Parent Consent Forms

PARENTAL CONSENT FORM - Surveys

The Minecraft Project: Predictors for Success and Acquired Literacy Skills via a Game Based Learning Environment

Introduction

The purpose of this form is to provide you (as the parent of a prospective research study participant) information that may affect your decision as to whether or not to let your child participate in this research study. This form will also be used to record your consent if you decide to let your child be involved in this study.

If you agree, your child will be asked to participate in a research study on game based learning. The purpose of this study is to measure how students can learn using a video game as an instructional tool and what real world skills they have learned through gaming. He/she was selected to be a possible participant because your child is enrolled in a 3D Modeling and Animation course that will be using MinecraftEdu to complete a modeling project.

What will my child be asked to do?

If you allow your child to participate in this study, he/she will be asked to complete a 20 question survey at the beginning of the study that will ask your child questions about their gaming experience and history. A second 20 question survey will be given at the end of the class project to ask them for their perspectives on games based learning and what skills they feel they learned. Both surveys will take no more than 15 minutes to complete.

What are the risks involved in this study?

The risks associated in this study are minimal, and are not greater than risks your child ordinarily encounters in daily life.

What are the possible benefits of this study?

The possible benefits of participation are the contributions your child will make to the growing research in the area of game based learning.

Does my child have to participate?

No, your child doesn't have to be in this research study. You can agree to allow your child to be in the study now and change your mind later without any penalty.

This research study will take place during regular classroom activities. The project in MinecraftEdu is part of the core curriculum for the course. Your child will already be working on this project to fulfill the grade requirements in the class. The research part is separate from the class work. Your child's grade will NOT be penalized if they do not participate in the research component of the project.

What if my child does not want to participate?

In addition to your permission, your child must agree to participate in the study. If your child does not want to participate he/she will not be included in the study without penalty.

If your child initially agrees to be in the study he/she can withdraw at any point during the study without penalty.

Who will know about my child's participation in this research study?
This study is confidential and all survey results will be kept private. No identifiers linking you or your child to this study will be included in any sort of report that might be published. Research records will be stored securely and only the teacher and researcher, Katherine Hewett, will have access to the records.

Whom do I contact with questions about the research?
If you have questions regarding this study, you may contact Katherine Hewett, 906-3400, Ext. 2214, Katherine.Hewett@ccisd.us or Dr. Daniel Pearce, 825-5881, danpearce@tamucc.edu.

Whom do I contact about my child's rights as a research participant?
This research study has been reviewed by the Research Compliance Office and/or the Institutional Review Board at Texas A&M University – Corpus Christi. For research-related problems or questions regarding your rights as a research participant, you can contact Erin Sherman, Research Compliance Officer, at (361)825-2497 or erin.sherman@tamucc.edu.

Signature
Please be sure you have read the above information, asked questions and received answers to your satisfaction. You will be given a copy of the consent form for your records. By signing this document, you consent to allow your child to participate in this study.

Signature of Parent/Guardian: _____ **Date:** _____

Printed Name: _____

Printed Name of Child: _____

PARENTAL CONSENT FORM – Case Study

The Minecraft Project: Predictors for Success and Acquired Literacy Skills via a Game Based Learning Environment

Introduction

The purpose of this form is to provide you (as the parent of a prospective research study participant) information that may affect your decision as to whether or not to let your child participate in this research study. This form will also be used to record your consent if you decide to let your child be involved in this study.

If you agree, your child will be asked to participate in a research study on game based learning. The purpose of this study is to measure how students can learn using a video game as an instructional tool and what real world skills they have learned through gaming. He/she was selected to be a possible participant because your child is enrolled in a 3D Modeling and Animation course that will be using MinecraftEdu to complete a modeling project. Your child has also been chosen for their level of gaming experience and can provide some expertise about games.

What will my child be asked to do?

If you allow your child to participate in this study, he/she will be asked to give a one hour interview directly after school in his/her classroom. The teacher/researcher will ask your child about their gaming history and experience. Questions will also concern what type of games they like to play and what they have learned from gaming.

Your child will be audio recorded during the interview. Interviews will be audio recorded using a voice recorder and a password protected iPad belonging to the researcher. All recordings will remain confidential and locked in a cabinet in the researcher's home. Recordings will be destroyed after three years. Your child will be given a false name for the interview. Your child will not use their real name for the interviews which will protect their identity and ensure confidentiality.

What are the risks involved in this study?

The risks associated in this study are minimal, and are not greater than risks your child ordinarily encounters in daily life.

What are the possible benefits of this study?

The possible benefits of participation are the contributions your child will make to the growing research in the area of game based learning.

Does my child have to participate?

No, your child doesn't have to be in this research study. You can agree to allow your child to be in the study now and change your mind later without any penalty.

This research study will take place during regular classroom activities. The project in MinecraftEdu is part of the core curriculum for the course. Your child will already be working on this project to fulfill the grade requirements in the class. The research part is separate from

the class work. Your child's grade will NOT be penalized if they do not participate in the research component of the project.

What if my child does not want to participate?
In addition to your permission, your child must agree to participate in the study. If your child does not want to participate he/she will not be included in the study without penalty. If your child initially agrees to be in the study he/she can withdraw at any point during the study without penalty.

Who will know about my child's participation in this research study?
This study is confidential and all survey results will be kept private. No identifiers linking you or your child to this study will be included in any sort of report that might be published. All information data collected will be kept secret from everyone except the researcher, Katherine Hewett, her dissertation chairs, Dr. Daniel Pearce, Dr. Bethanie Pletcher, and Dr. Quang Zeng, her methodologist. Research records will be stored securely in a locked cabinet at the researcher's (Katherine Hewett) home.

If you choose to allow your child to participate in this study, he/she will audio recorded. Any audio recordings will be stored securely and Katherine Hewett will have access to the recordings. Any recordings will be kept for three years and then erased.

Whom do I contact with questions about the research?
If you have questions regarding this study, you may contact Katherine Hewett, 906-3400, Ext. 2214, Katherine.Hewett@ccisd.us or Dr. Daniel Pearce, 825-5881, danpearce@tamucc.edu.

Whom do I contact about my child's rights as a research participant?
This research study has been reviewed by the Research Compliance Office and/or the Institutional Review Board at Texas A&M University – Corpus Christi. For research-related problems or questions regarding your rights as a research participant, you can contact Erin Sherman, Research Compliance Officer, at (361)825-2497 or erin.sherman@tamucc.edu.

Signature
Please be sure you have read the above information, asked questions and received answers to your satisfaction. You will be given a copy of the consent form for your records. By signing this document, you consent to allow your child to participate in this study.

_____ My child MAY be audio recorded.

_____ My child MAY NOT be audio recorded.

Signature of Parent/Guardian: _____ **Date:** _____

Printed Name: _____

Printed Name of Child: _____

Appendix F

Institutional Student Assent Forms

ASSENT FORM - Surveys

The Minecraft Project: Predictors for Success and Acquired Literacy Skills via a Game Based Learning Environment

Introduction
My name is Katherine Hewett and I am a doctoral candidate at Texas A&M University – Corpus Christi. I am doing a research project about video games in the classroom. Research is a way to test new ideas. Research helps us learn new things.

I would like you to help with my study because you are enrolled in a 3D Modeling and Animation class that is going to be building models in MinecraftEdu.

What will I be asked to do?
If you want to help with my study, I will ask you to take two 20 question surveys in class at the beginning and end of the project. One survey will ask you about your gaming history and the other will ask for your thoughts on the Minecraft project you complete in class. It will take only 15 minutes to complete each survey.

What are the risks to me?
The risks to you are no bigger than the risks you have each day. You are only asked to complete two surveys.

What good can happen?
The good things that could happen to you are the fact you will be able to share your perspectives on gaming. By sharing your experiences you may encourage other teachers to use video games in the classroom to help other children learn.

Do I have to be part of the study?
No. You do not have to be part of the study. Your parents said you can be in the study, and you do not have to because they said you can. You should only be part of this study because you want to. Your grade in this class will not be penalized if you chose not to participate.

Who will know I am part of the study?
All your classmates will be taking the two surveys in class but you will not know which other students have agreed to be part of the research study. By signing this form you agree to allow the researcher to collect your data. Your survey results and any information that you contribute will be kept secret from everyone except the researcher, Katherine Hewett, her dissertation chairs, Dr. Daniel Pearce, Dr. Bethanie Pletcher, and Dr. Quang Zeng, her methodologist. All data will be kept locked in a file cabinet at the researcher's (Katherine Hewett) home and will be destroyed after three years. You can stop being part of the study whenever you want to. You can tell your parents, your teacher, or any adult that you would like to stop, and it is OK.

Signature
You have been told about the research study. You had a chance to ask questions. You can ask questions at any time. You can stop being in the study at any time.

If you sign your name below, it means that you want to be in this research study.

_____ ___ _____

Your Name (Printed) Age Date

_____
Your Signature

ASSENT FORM – Case Study

The Minecraft Project: Predictors for Success and Acquired Literacy Skills via a Game Based Learning Environment

Introduction
My name is Katherine Hewett and I am a doctoral candidate at Texas A&M University – Corpus Christi. I am doing a research project about video games in the classroom. Research is a way to test new ideas. Research helps us learn new things.

I would like you to help with my study because you are enrolled in a 3D Modeling and Animation class that is going to be building models in MinecraftEdu.

What will I be asked to do?
If you want to help with my study, I will ask you to take part in an interview directly after school to ask you questions about your gaming experiences. One interview will take an hour and it will be conducted in the 3D Modeling and Animation classroom.

What are the risks to me?
The risks to you are no bigger than the risks you have each day. You will only be asked about your gaming experiences and perspectives about game based learning.

What good can happen?
The good things that could happen to you are the fact you will be able to share your perspectives on gaming. By sharing your experiences you may encourage other teachers to use video games in the classroom to help other children learn.

Do I have to be part of the study?
No. You do not have to be part of the study. Your parents said you can be in the study, and you do not have to because they said you can. You should only be part of this study because you want to. Your grade in this class will not be penalized if you chose not to participate.

Who will know I am part of the study?
Your involvement in this study will be kept confidential. By signing this form you agree to allow the researcher to collect your data. All information that you contribute will be kept secret from everyone except the researcher, Katherine Hewett, her dissertation chairs, Dr. Daniel Pearce, Dr. Bethanie Pletcher, and Dr. Quang Zeng, her methodologist. You can stop being part of the study whenever you want to. You can tell your parents, your teacher, or any adult that you would like to stop, and it is OK.

Will I be audio recorded?
Yes, interviews will be audio recorded using a voice recorder and a password protected iPad belonging to the researcher. All recordings will remain confidential and locked in a cabinet in the researcher's (Katherine Hewett) home. Recordings will be destroyed after three years. You will be given a false name for the interview. You will not use your real name for the interviews which will protect your identity and ensure confidentiality.

Signature
You have been told about the research study. You had a chance to ask questions. You can ask questions at any time. You can stop being in the study at any time.

If you sign your name below, it means that you want to be in this research study.

_____ ___ _____

Your Name (Printed) Age Date

_____

Your Signature

Appendix G

Parent Recruitment Statement Document

Parent Recruitment Statement

The Minecraft Project: Predictors for Success and Acquired Literacy Skills via a Game Based Learning Environment

(NOTE: There are two parts to this project. The class project itself is mandatory for grading purposes as part of the curriculum for the 3D Modeling and Animation course. The research part of this project is separate and completely voluntary. Your child does NOT have to participate in the research study attached to this project and he/she will not be penalized.)

Welcome to the Minecraft Project! Over the next several weeks your child will embark on an educational journey like no other. The Minecraft Project is an educational 3D modeling experience that will test the limits of their creativity and critical thinking skills. The goal of this project is to engage in a massive build project employing the skills of a whole classroom of builders. Together they will create an interactive learning environment based on a historic place or city. They will replicate historic landmarks and immerse themselves into the time period assuming the roles of the people who once lived there.

There are six phases to this project:

- Phase 1 – Research
- Phase 2 – Planning/Map Preparation
- Phase 3 – Construction/Landscaping
- Phase 4 – Educational Content/Role-play
- Phase 5 – Economy/Role-play
- Phase 6 – Machinema

Learning Objectives:

- The student will build and design a 3D model utilizing a 3D virtual space environment.
- The student will utilize critical thinking skills to problem solve programming and modeling issues within a 3D virtual space.
- The student will research a building design and character based on a historical period.

- The student will engage in developing an economy system based on currency and trade that is appropriate for the time period.
- The student will build an educational interactive space within the virtual environment to exhibit what is learned and educate others within the community.
- The student will create a script, film, and edit a ten minute Machinema based in their world

Things you should know if you agree to participate in the research part of this project:

- I am conducting a study related to the 3D Modeling and Animation course in which your child is enrolled.
- The purpose of this study is to research how video games can be used in a classroom to help students learn.
- The study will take approximately eight weeks depending on the completion of the project.
- First, your child will be asked to take a 20 question survey on their gaming experiences that will not take more than 15 minutes to complete.
- Second, their gender, ethnicity, and grade point average will be collected by the researcher for demographic purposes.
- Third, on completion of the project your child will take a second survey on their experiences, what they learned, and their thoughts about using Minecraft in school.
- Four students will be selected by the researcher based on gaming experience and enrollment in the 3D Modeling and Animation course to participate in an after school interview. Each participant will be interviewed for one hour about their gaming experiences and what they have learned from the project.
- Participation in the study is NOT mandatory. Again your child's grade will not be impacted if they chose not to be part of the study. Students are free to leave the study at any time if they wish. They will complete the class project for a grade but they will not be part of the study and not data will be collected from them.
- All data will be kept confidential. Pseudonyms will be used and all data will be de-identified.
- After parent consent is attained. Students must also assent to be a part of the study.
- Their grade on the project will be part of the data collection if they chose to be part of the research study.
- All data collected will remain confidential.
- If you have any questions regarding this study you may talk to your child's teacher by email at Katherine.Hewett@ccisd.us or at 906-3400, Ext. 22214.

Appendix H

Qualtrics Survey Instruments

Gaming Experience Survey

Q1 What is your name? (First and Last Name)

Q2 How long have you been playing video games?
- ❍ Less than 1 Year (1)
- ❍ 2-5 Years (2)
- ❍ 5-10 Years (3)
- ❍ Over 10 Years (4)

Q3 How often do you play video games in a week now?
- ❍ Never (1)
- ❍ Less than an hour a day (2)
- ❍ 1-5 hours a week (3)
- ❍ 5-10 hours a week (4)
- ❍ 10-15 hours a week (5)
- ❍ 20 or more hours a week (6)

Q4 Pick your favorite video game genre. Choose only ONE.
- ❍ Action Oriented (1)
- ❍ First Person Shooter (2)
- ❍ Role-Play Game (RPG) (3)
- ❍ Educational (4)
- ❍ Strategy (5)
- ❍ Puzzles (6)
- ❍ Horror (7)
- ❍ Simulation (8)
- ❍ Sandbox (9)
- ❍ Sports (10)
- ❍ Massively Multiplayer Online Games (11)
- ❍ Massively Multiplayer Online Role-Play Games (12)
- ❍ I don't play video games. (13)
- ❍ I have no favorites. (14)
- ❍ Platforming (15)
- ❍ Survival (16)

Q6 I play most of my games on mobile devices (phones, 3DS, PSVITA and tablets).
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q7 I play both action oriented games (PVP) and sandbox games.
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q8 I prefer action oriented games (PVP) over sandbox games.
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q9 One or both my parents are video gamers. (If your parents play mobile app games they are considered gamers.)
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q10 I consider myself an expert and experienced gamer in at least one game I play.
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q11 I have played educational games at school designed specifically for Math, Science, Social Studies, and other core content areas.
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q12 I have competed in organized gaming leagues.
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q13 I have created content for video game engines.
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q14 I have participated in a role-play economy system by selling and trading gear for game characters.
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q15 I belong to community forums, consult websites, or watch YouTube to learn how to play specific games.
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q16 I am proficient at customizing my game/role-play character to fit my personal tastes and identity.
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q17 I have modified or programmed code for a game.
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q18 The games I play have a back story and require a good deal of reading in order to complete missions and level up through the game.

- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q19 I use my gaming expertise to create video tutorials to teach other players how to play a game.

- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q20 I have multiple game/role-play characters that I can choose to play for different missions and tasks within ONE single game.

- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q21 I have created a Machinema film.

- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q22 I have used a skill in real life that I learned in a game.

- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Minecraft Assessment Survey

Q22 What is your name? (First and Last Name)

Q2 I liked having my teacher's avatar inside the Minecraft game with me.
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q3 I like playing Minecraft at home and not at school.
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q4 I prefer building in Survival Mode rather than Creative Mode.
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q5 I learned how to model a building or improved my building skills in class.
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q6 I was able to spatially reason (imagine) how I wanted my model to look in Minecraft.
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q7 I collaborated well with my building group (classmates).
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q8 I researched online how to create the models I wanted to build.
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q9 I was able to navigate the 3D environment quickly.
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q10 I was able to use the chat commands to talk with my group.
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q11 I was engaged in this project.
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q12 Researching and then building my model helped me to learn historical content better than a lecture..
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q13 I was able to use the screen capturing software on my computer to take pictures and film.
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q14 I have gained modeling and design skills I may use in the future.
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q15 This project challenged me to be creative and innovative.
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q16 Modeling in creative mode with its unlimited resources was easier for me than survival mode.
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q17 My group was able to establish a role-play community based on our building theme.
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q18 I was able to learn how to mine and craft items in the game.
- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q19 I was able to figure out how to use red stone to power a circuit or irrigation system.

- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q20 I felt my group was productive.

- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Q21 I prefer to work alone.

- ❍ Strongly Agree (1)
- ❍ Agree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Disagree (4)
- ❍ Strongly Disagree (5)

Appendix I

Minecraft Project Rubrics

Minecraft Project Rubric - Group

Evaluation:	10 point scale 1←---------5---------→10 (Unsatisfactory------Exemplary)	Points Earned:
Originality & Creativity – • The 3D model reflects creative visualization and understanding of the design theme. • The 3D model exhibits original thought through the complexity of the design.	1 2 3 4 5 6 7 8 9 10 Notes:	
Composition & Design – • The 3-D *forms* were constructed with attention to space (interior and exterior) as well as scale. • Textures and colors used fit desired mood of the theme. • The 3D model has a sense of *unity,* in that all elements come together into an overall successful composition.	1 2 3 4 5 6 7 8 9 10 Notes:	
Technical Application – • The 3D model reflects an applied basic understanding of gaming and modeling technology. • The 3D model reflects evidence of problem solving judged by the difficulty or detail of design, layout, scale, or complexity of the build. • The 3D model exhibits good application of a video game as a digital art medium.	1 2 3 4 5 6 7 8 9 10 Notes:	
Craftsmanship – Verification and Validation • The 3D model is built correctly and consistent to the theme. • The correct steps were taken in designing the model in regards to research first then technical application (modeling). • The right product was developed and built to fit the theme. • The 3D model satisfies the intended audience and theme. • The 3D model meets the requirements for the assigned project.	1 2 3 4 5 6 7 8 9 10 Notes:	
Research – • The use of research is reflected in the design of the model.	1 2 3 4 5 6 7 8 9 10 Notes:	
	(Subtotal X 2 = Grade) **Final Grade =**	

Minecraft Project Rubric - Student

Evaluation:	10 point scale 1←---------5---------→10 (Unsatisfactory------Exemplary)	Points Earned:
Originality & Creativity – • Model reflects creative visualization and understanding of the design theme. • The 3D model exhibits original thought through the complexity of the design.	1 2 3 4 5 6 7 8 9 10 Notes:	
Composition & Design – • The 3-D *forms* were constructed with attention to space (interior and exterior) as well as scale. • Textures and colors used fit desired mood of period. • Model has a sense of *unity,* in that all elements come together into an overall successful composition.	1 2 3 4 5 6 7 8 9 10 Notes:	
Technical Application – • Model reflects an understanding of game mechanics and building/modeling technology. • Model reflects evidence of technical problem solving. • Model exhibits proficient technical skills in (spatial reasoning) navigating and using the interface of the 3D space. • Displays exceptional range or mastery of the technical medium.	1 2 3 4 5 6 7 8 9 10 Notes:	
Craftsmanship – Verification and Validation • Model is built correctly and consistent to the theme. • The correct steps were taken in designing the model in regards to research first then technical application (modeling). • The right product was developed and built to fit the theme. • The 3D Model satisfies the intended audience and theme. • The 3D Model meets the requirements for the assigned project.	1 2 3 4 5 6 7 8 9 10 Notes:	
Research – • The use of research is reflected in the design of the model.	1 2 3 4 5 6 7 8 9 10 Notes:	

(Subtotal X 2 = Grade)

Final Grade =

Appendix J

Case Study Interview Questions

Katherine Hewett

Case Study - Interview Questions

1. Describe your first experience with a game. (age)
2. Talk about a typical time you played a game and whether you played with friends, family, or alone?
3. Tell me about any online multiplayer games you have played.
4. Tell me about your online friends in these worlds.
5. Talk about a time when you taught or were taught by another player.
6. Talk to me about your game avatars and how you identify with them.
7. Talk about how games make you feel about yourself.
8. Describe your favorite video game genres and their design mechanics or aspects.
9. Talk about the reading experiences you have experienced through gaming.
10. Describe your expertise and skills in game worlds.
11. Talk about what gaming has taught you.
12. Talk about what you are able to do in game worlds that you are unable to do in real life.
13. Talk about a time you traded, earned money, or purchased game items for specific games.
14. Discuss the creative projects or content you create for gaming and graphic design.
15. Describe your preferences towards building in Survival or Creative modes.
16. Talk about what you built and how you planned out the process of building it.
17. Discuss any skills you felt you learned that may help you in college and possibly a future career.
18. Talk about how your gaming experiences impacted your ability to adapt to a game based assignment in your class.

Appendix K

Gaming Experience Survey Results

Gaming Experience Survey, n = 66

Question	Response	f	%
How long have you been playing video games?	Less than a Year	1	1.5
	2-5 Years	5	7.6
	5-10 Years	24	36.4
	Over 10 Years	36	54.5
How often do you play video games in a week now?	Never	3	4.5
	Less than an hour a day	4	6.1
	1-5 hours a week	10	15.2
	5-10 hours a week	19	28.8
	10-15 hours a week	18	27.3
	20 or more hours a week	12	18.2
Pick your favorite video game genre. Choose only ONE.	Action Oriented	6	9.1
	First Person Shooter	18	27.3
	Role-Play Game (RPG)	13	19.7
	Strategy	7	10.6
	Puzzles	2	3.0
	Sandbox	1	1.5
	Sports	5	7.6
	MMO Games	2	3.0
	MMORPG	4	6.1
	I have no favorites.	6	9.1
	Survival	2	3.0
I play most of my games on mobile devices (phones, 3DS, PSVITA and tablets).	Strongly Agree	5	7.6
	Agree	17	25.8
	Neither Agree or Disagree	16	24.2
	Disagree	18	27.3
	Strongly Disagree	10	15.2
I PLAY both action oriented games	Strongly Agree	22	33.3

(PVP) and sandbox games.	Agree	26	39.4
	Neither Agree or Disagree	10	15.2
	Disagree	7	10.6
	Strongly Disagree	1	1.5
I PREFER action oriented games (PVP) over sandbox games.	Strongly Agree	13	19.7
	Agree	24	36.4
	Neither Agree or Disagree	22	33.3
	Disagree	6	9.1
	Strongly Disagree	1	1.5
One or both my parents are video gamers. (If your parents play mobile app games they are consider gamers.)	Strongly Agree	8	12.1
	Agree	26	39.4
	Neither Agree or Disagree	4	6.1
	Disagree	17	25.8
	Strongly Disagree	11	16.7
I consider myself an expert and experienced gamer in at least one game I play.	Strongly Agree	35	53.0
	Agree	27	40.9
	Neither Agree or Disagree	2	3.0
	Disagree	2	3.0
	Strongly Disagree	0	0
I have played educational games at school designed specifically for Math, Science, Social Studies, and other core content areas.	Strongly Agree	11	16.7
	Agree	35	53.0
	Neither Agree or Disagree	11	16.7
	Disagree	7	10.6
	Strongly Disagree	2	3.0
I have competed in organized gaming leagues.	Strongly Agree	9	13.6
	Agree	17	25.8
	Neither Agree or Disagree	9	13.6
	Disagree	20	30.3
	Strongly Disagree	11	16.7
I have created content for video game engines.	Strongly Agree	4	6.1
	Agree	19	28.8
	Neither Agree or Disagree	13	19.7
	Disagree	17	25.8
	Strongly Disagree	13	19.7

I have participated in a role-play economy system by selling and trading gear for game characters.	Strongly Agree	17	25.8
	Agree	19	28.8
	Neither Agree or Disagree	6	9.1
	Disagree	18	27.3
	Strongly Disagree	6	9.1
I belong to community forums, consult websites, or watch YouTube to learn how to play specific games.	Strongly Agree	15	22.7
	Agree	30	45.5
	Neither Agree or Disagree	5	7.6
	Disagree	11	16.7
	Strongly Disagree	5	7.6
I am proficient at customizing my game/role-play character to fit my personal tastes and identity.	Strongly Agree	21	31.8
	Agree	30	45.5
	Neither Agree or Disagree	8	12.1
	Disagree	5	7.6
	Strongly Disagree	2	3.0
I have modified or programmed code for a game.	Strongly Agree	3	4.5
	Agree	23	34.8
	Neither Agree or Disagree	8	12.1
	Disagree	22	33.3
	Strongly Disagree	10	15.2
The games I play have a back story and require a good deal of reading in order to complete missions and level up through the game.	Strongly Agree	13	19.7
	Agree	29	43.9
	Neither Agree or Disagree	19	28.8
	Disagree	3	4.5
	Strongly Disagree	2	3.0
I use my gaming expertise to create video tutorials to teach other players how to play a game.	Strongly Agree	4	6.1
	Agree	8	12.1
	Neither Agree or Disagree	13	19.7
	Disagree	23	34.8
	Strongly Disagree	18	27.3
I have multiple game/role-play characters that I can choose to play for	Strongly Agree	17	25.8
	Agree	27	40.9

different missions and tasks within ONE game.	Neither Agree or Disagree	11	16.7
	Disagree	9	13.6
	Strongly Disagree	2	3.0
I have created a Machinema film.	Strongly Agree	1	1.5
	Agree	8	12.1
	Neither Agree or Disagree	3	4.5
	Disagree	32	48.5
	Strongly Disagree	22	33.3
I have used a skill in real life that I learned in a game.	Strongly Agree	15	22.7
	Agree	39	59.1
	Neither Agree or Disagree	5	7.6
	Disagree	4	6.1
	Strongly Disagree	3	4.5

Appendix L

Minecraft Survey Results

Minecraft Survey, n = 66

Question	Response	f	%
I liked having my teacher's avatar inside the *Minecraft* game with me.	Strongly Agree	16	24.2
	Agree	37	56.1
	Neither Agree or Disagree	12	12
	Disagree	0	0
	Strongly Disagree	1	1
I like playing *Minecraft* at home and not at school.	Strongly Agree	5	7.6
	Agree	8	12.1
	Neither Agree or Disagree	26	39.4
	Disagree	22	33.3
	Strongly Disagree	5	7.6
I prefer building in Survival Mode rather than Creative Mode.	Strongly Agree	14	21.2
	Agree	17	25.8
	Neither Agree or Disagree	20	30.3
	Disagree	12	18.2
	Strongly Disagree	3	4.5
I learned how to model a building or improved my building skills in class.	Strongly Agree	24	36.4
	Agree	31	47.0
	Neither Agree or Disagree	7	10.6
	Disagree	4	6.1
	Strongly Disagree	0	0
I was able to spatially reason (imagine) how I wanted my model to look in *Minecraft*.	Strongly Agree	17	25.8
	Agree	39	59.1
	Neither Agree or Disagree	8	12.1
	Disagree	2	3.0
	Strongly Disagree	0	0

I collaborated well with my building group (classmates).	Strongly Agree	28	42.4
	Agree	29	43.9
	Neither Agree or Disagree	5	7.6
	Disagree	2	3.0
	Strongly Disagree	2	3.0
I researched online how to create the models I wanted to build.	Strongly Agree	24	36.4
	Agree	28	42.4
	Neither Agree or Disagree	5	7.6
	Disagree	9	13.6
	Strongly Disagree	0	0
I was able to navigate the 3D environment quickly.	Strongly Agree	34	51.5
	Agree	23	34.8
	Neither Agree or Disagree	7	10.6
	Disagree	2	3.0
	Strongly Disagree	0	0
I was able to use the chat commands to talk with my group.	Strongly Agree	19	28.8
	Agree	19	28.8
	Neither Agree or Disagree	20	30.3
	Disagree	7	10.6
	Strongly Disagree	1	1.5
I was engaged in this project.	Strongly Agree	32	48.5
	Agree	31	47.0
	Neither Agree or Disagree	3	4.5
	Disagree	0	0
	Strongly Disagree	0	0
Researching and then building my model helped me to learn historical content better than a lecture.	Strongly Agree	20	30.3
	Agree	26	39.4
	Neither Agree or Disagree	18	27.3
	Disagree	2	3.0
	Strongly Disagree	0	0
I was able to use screen capturing software on my computer to take pictures and film.	Strongly Agree	8	12.1
	Agree	28	42.4
	Neither Agree or Disagree	25	37.9
	Disagree	3	4.5

	Strongly Disagree	2	3.0
I have gained modeling and design skills I may use in the future.	Strongly Agree	10	15.2
	Agree	42	63.6
	Neither Agree or Disagree	8	12.1
	Disagree	5	7.6
	Strongly Disagree	1	1.5
This project challenged me to be creative and innovative.	Strongly Agree	26	39.4
	Agree	38	57.6
	Neither Agree or Disagree	2	3.0
	Disagree	0	0
	Strongly Disagree	0	0
Modeling in creative mode with its unlimited resources was easier for me than survival mode.	Strongly Agree	30	45.5
	Agree	28	42.4
	Neither Agree or Disagree	5	7.6
	Disagree	3	4.5
	Strongly Disagree	0	0
My group was able to establish a role-play community based on our building theme.	Strongly Agree	10	15.2
	Agree	25	37.9
	Neither Agree or Disagree	21	31.8
	Disagree	9	13.6
	Strongly Disagree	1	1.5
I was able to learn how to mine and craft items in the game.	Strongly Agree	15	22.7
	Agree	20	30.3
	Neither Agree or Disagree	22	33.3
	Disagree	8	12.1
	Strongly Disagree	1	1.5
I was able to figure out how to use red stone to power a circuit or irrigation system.	Strongly Agree	14	21.2
	Agree	16	24.2
	Neither Agree or Disagree	20	30.3
	Disagree	14	21.2
	Strongly Disagree	2	3.0
I felt my group was productive.	Strongly Agree	24	36.4

	Agree	33	50.0
	Neither Agree or Disagree	5	7.6
	Disagree	4	6.1
	Strongly Disagree	0	0
I prefer to work alone.	Strongly Agree	8	12.1
	Agree	8	12.1
	Neither Agree or Disagree	26	39.4
	Disagree	20	30.3
	Strongly Disagree	4	6.1

Appendix M

Screenshots in Scholarly Publications

All screenshots published within this dissertation are included for the purpose of academic scholarship and in accordance with fair use.

> In the majority of cases, including video game screenshots within a work of academic scholarship is deemed a "fair use" under Section 107 of Title 17 of the United States Code as long as the content is not be used for commercial and non-educational purposes (Lastowka & Ogino, 2014, p. 2).

The researcher captured screenshots within the video games, *World of Warcraft*, *The Elders Scrolls Online*, *Second Life*, *Guild Wars 2*, *Final Fantasy XIV: A Realm Reborn*, *Final Fantasy XIV: Heavensward*, *Minecraft*, *Pirates 101*, *and Wizard101*. These screenshots were included as dissertation artifacts for case study and autoethnography research purposes.