Using Minecraft in Education:

A Qualitative Study on Benefits and Challenges of Game-Based Education

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A research paper submitted in conformity with the requirements
For the degree of Master of Teaching
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Abstract

This study explores the educational benefits of video games and video game based learning. Specifically, this qualitative research project investigates the effectiveness of a popular video game called Minecraft in a classroom setting. The data for this study was collected using three semi-structured interviews with educators who are already using the game in class as the main, optional or supplementary tool. The participants were asked to share their ideas of experiences with Minecraft. Findings suggest that Minecraft is mobilized as an excellent tool that decentralizes instruction, encourages students' creativity, facilitates collaboration in class, allows for cross-classroom and cross-curricular teaching, addresses some of the needs of diverse students and students who have experienced prior school struggles and may potentially even have therapeutic values for students with learning disabilities. Introduction of Minecraft to a classroom however may be a difficult task as initial financial investments, hardware requirements, technological knowledge and board regulations may unfortunately prevent certain schools from using Minecraft in class. Furthermore, teachers interested in implementing Minecraft into their schools have to maintain a student-guided and game-based learning environment in order to receive the full benefits of Minecraft based classroom.

Keywords: Minecraft, game-based learning, educational games, student-guided classroom, edutainment, digital literacy, video games

Acknowledgements

First and foremost, I would like to thank my supervisor, Dr. Rob Simon for accepting to work with me on such a short notice. His passion, humour and wisdom guided me through this study and helped me overcome the challenges associated with the initial lack of data or progress in the early stages of research. I would also like to thank Dr. Jim Hewitt who guided me toward my supervisor and whose knowledge of technology and tranquil, patient nature helped me make an important decision of switching my topic to one that I was truly passionate about. I also want to thank Katherine Bellomo for being a great moral support, guide and an amazing human being throughout my two years at University of Toronto whose brilliant approach to teaching taught me some of the most important lessons a teacher could get. Finally, I am especially grateful for being a part of an Intermediate/Senior cohort in Master of Teaching program and to all of the classmates that I laughed, cried, played and suffered with for two years. These two years have been a rollercoaster of emotions and intellectual challenges and without each other's support we would have not gotten through it.

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CHAPTER 1: INTRODUCTION

1.1 Background of the Study

Using video games in class is seen as a somewhat controversial topic today. Despite various studies that find that approximately 90% of students engage in video games outside of class (Paglia-Boak, 2012), a lot of experienced teacher have a negative opinion about adapting video games to class relating them potentially to a classroom distraction rather than an educational activity (Baek, 2008). Furthermore, despite the tremendous popularity of a game called Minecraft and the release of an educational modification called MinecraftEDU, the game has only been marginally assessed from the perspective of a teaching tool by academia with no comprehensive studies to date. There are however tremendous investments from every board in various Information and Communication Technologies (ICT) as well as a lot of controversial research on the effectiveness of ICT in class.

A lot of modern studies try to assess the potential benefits and challenges in using various ICT tools such as projectors, laptops, smart boards and so on in the classroom setting. Yet, there are quite a lot of conflicting results in many of these studies and the effects of technology in class are still not clear. For example, a 2011 meta-analysis by Tamim et al. found that “technology is helpful for students’ achievement in regular formal educational contexts” (Tamim, Bernard, Borokhovski, Abrami, & Schmid, 2011), and another meta-analysis (Cheung & Slavin, 2012) concluded that “educational technology applications generally produced a positive, though small, effect” (p. 198). Furthermore, an experimental study of the Technology Immersion Model in Texas (Shapley, Sheehan, Maloney, & Caranikas-Walker, 2011) found that “there was no

statistically significant immersion effect on students' reading and mathematics achievement" (p. 299). And another by Angrist and Lavy (2002) found a "consistently negative and marginally significant relationship between the [use of computers] and 4th grade math scores" (p. 760) concluding that "[technology in class] is no better and may be even less effective than other teaching methods" (p. 760). Interestingly, Angrist and Lavy (2002) also make a recommendation to the government of Israel, where the study was done, stating that "money spent on Computer Assisted Instruction in Israel would have been better spent on other inputs," (p. 761) which raises a question of how much money is spent in Ontario on the similar programs. On the other hand, using games in education is almost on the opposite spectrum of research with very few actual studies in existence.

Despite these conflicting results on benefits of computer based education, most school boards in Ontario continue to spend millions of dollars every year on implementing new tools and upgrading and updating current computer based technology. For example in 2012, Toronto District School Board (TDSB), spent $7 million on IT consulting services alone and additional $5 million on IT Hardware and Software upgrades, which represented 8% of total costs that year (TDSB, 2012, p. 62).

However, the previously mentioned meta-analysis by Cheung and Slavin (2012) made another interesting discovery: "innovative technology applications and integrated literacy interventions with the support of extensive professional development showed more promising evidence" (p. 198). What exactly are these innovative technology applications? A lot of them seemed to have been simple games such as *Fast ForWord, Reading Reels* and *Lightspan* that were "designed to retrain the brain to process information more effectively through a group of computer games" (Cheung & Slavin, 2012, p. 201). *Lightspan* is even specifically designed to be

used at home on *Sony PlayStation*, which a lot of the students already used for games at home. So despite other ICT technologies failing to provide a significant result, simple games seemed to show a potential benefit.

The aforementioned findings on the inadequate results of ICT integration in education, as well as the need for more engaging education in modern classrooms led me on a quest to discover various innovative technological ways that the modern teachers use in order to motivate students in their classrooms and specifically I decided to focus on one of the most popular games out right now – a video game called Minecraft that was officially released in 2011 and has been making waves in the gaming community across the world.

At the same time, it has been long known that one of the best ways to learn something is by having fun doing it. This idea is well summarized by Rogers and Sharapan (1994): "play is a very serious matter […] it is an expression of our creativity; and creativity is at the very root of our ability to learn, to cope, and to become whatever we may be" (p. 13). In other words, combining entertainment, technology and education is one of the best motivational tools at a teacher's disposal.

The modern classrooms has a potential of becoming a lot more interesting and engaging for students, based on the amount of various technological tools available to teachers on the Internet and through other sources, such as for example the Apple App Store. Unfortunately, the classes that I witnessed to date did not go beyond the use of PowerPoint slides and a projector and relied on old style lecturing techniques and labs in order to teach the concepts required by the curriculum. Therefore, investigating the ways modern teachers could employ new innovative technologies and their reasons for using or not using certain tools is worth investigating in more detail.

1.2 Purpose of the Study

The main purpose of this qualitative study is to investigate the effects of a computer game called Minecraft in an educational setting. The foundation for this study lays in my personal interest in computer and video games and my own experience in learning arts, humanities and sciences through various computer and video games. With the emergence of a trend known as "Edutainment", defined as education that has been placed within the framework of entertainment, i.e. use of various video games and social media for education (DeVary, 2008), it is a very exciting time to partake on such a project, as this may indeed be the future of education in Ontario. Specifically, I am interested in discovering what benefits and challenges occur in the usage of this particular computer game that has become a worldwide phenomenon and is already used in some classrooms. At the same time, I want to discover the reasons behind inadequate use of games in classrooms or reluctance of certain teachers to use these educational techniques for learning purposes.

Apart from my own fascination with various gadgets and tools that can be used in education, one of the reasons I decided to pursue the topic is after observing several science and math classes during my practicum at high schools in Toronto. While teaching and observing various classes I noticed a recurring trend, the majority of the students were barely engaged and rarely followed the lectures or labs, relying on their partners for help. They often used their smartphones in secret and played smartphone games while in class because the lectures did not engage them enough. They were often told to copy notes and to memorize concepts, but only few of them really appreciated or got engaged in the science or math as a subject and for the most part saw them as foreign concepts. However, once I brought simple video games into the classroom and implemented a few computer labs that required individual exploration and some

gaming skills, the students' engagement had gone up and the students who were often confused by the topic were highly engaged and participated in the lecture with a lot more enthusiasm. The experience in this practicum, along with my own personal experience of being a gamer and learning from games in high school motivated me to pursue the idea of using video and computer games in class and using edutainment and game-based learning theories in order to develop it into a qualitative study.

1.3 Research Questions

The focus of this study is to answer the question: "How is the game called Minecraft used in education?" In order to narrow down the question, the study will attempt to answer a series of sub-questions, meant to uncover specific details in regards to the use of Minecraft in class.

The first sub-question is: "What benefits does using Minecraft offer over a traditional teaching technique or other computer technologies?" This sub-question will attempt to uncover the reasons why certain private schools and teachers choose to use Minecraft as a teaching tool and why other cheaper or free computer tools are not used instead. The question will also try to uncover why some parents choose to send their kids to these specific programs and how students interact in such environment.

The second sub-question is: "What are the challenges of integrating Minecraft into the classroom?" This will help narrow down the reasons for why Minecraft is not used more widely yet and what possible challenges teachers face when trying to develop a Minecraft based curriculum.

The third sub-question is: "What are the benefits of using game-based learning in education?" The last sub-question will focus on discovering the teachers' opinion in regards to

the idea of using game theory in classrooms and whether investing into Minecraft for educational purposes is something Ontario school boards should consider as well. The recommendations that will be made at the end of this study will be based on the studies and the findings on the subject of gamification and game-based learning in relation to education and applied specifically to Minecraft.

1.4 Background of the Researcher

Even prior to my acceptance to the Master's of Teaching program at OISE, a part of the University of Toronto, I was quite fascinated with the idea of integrating various games and specifically the gaming theory used in various online games with education. Having been accepted to the Intermediate/Senior cohort of the Master's of Teaching program, I decided to dedicate my research time to discovering technological resources that could be used in improving the student motivation when learning subjects that are often seen as boring, such as sciences and math, both of which are also my teachables. One of the main reasons why I chose this topic though is due to my own experience with education and the influence video games had on me as a student.

Throughout my middle and high school days, I was plagued by uninspiring teachers who left a scar on my education. It was only in the last few years of my schooling when I was at CEGEP, the Quebec equivalent of grades 12 and 13, that I finally had teachers that filled me with a desire to succeed and gave me the guidance needed to pursue my dreams in the field of science because they employed various creative educational techniques to teach both science and math and to inspire their students. However, even in my own free time, I relied on different technological techniques in order to become a more successful student.

Looking back at my school life, I realized that even though I lacked the external pressure to study or to succeed, I still learned and did well at school simply because I found ways to entertain myself as a student. For example, when learning English as a second language, I relied more on media, movies and specifically online video games and chatting on the internet in acquiring and continuously perfecting my English skills. Within a month I could achieve what my teachers could not teach me in years.

Internet in general proved to be a very helpful tool in my education and having discovered various websites, I was able to satisfy my curiosity and thirst for knowledge in my own unique ways. I kept discovering and continuously researching various topics, on subjects such as biology, chemistry, physics and specifically my school time favorites – astronomy and astrophysics – and was continuously encouraged to keep on learning not by my teachers, peers or parents, but because certain video games were made in such way that they left various historical, scientific or even mathematical questions unanswered, so I was intrinsically encouraged to go out there and seek the answer for myself.

By the time I got into university, I realized that I spent more time perusing the internet for facts and answering historical, scientific or moral questions asked within the video games that I played than I did going through lecture notes.

Finding new interesting facts became a huge time commitment, but at the same time turned me into a more curious student and gave me initiative to go beyond the book and the lecture notes and to find new information. Not surprisingly, during my CEGEP years, my grades skyrocketed, which inspired me to apply and eventually be accepted to a science program at one of the most prestigious universities in Canada.

Apart from this, I was also always a big fan of online role-playing games (also known as MMORPG or Massive Multiplayer Online Role Playing Games), where the emphasis is put on continuous advancement through levels and storyline, while gaining various rewards, experience and discovering new areas and quests. The games of this genre are often set in either fantasy or sci-fi environments and have thousands or even millions of people interacting, co-operating, fighting or completing quests in order to improve their own characters.

My family members were always fascinated with how much time I spent playing these games and neither family nor friends could ever understand the obsession. There was even a time when I reflected upon this passion, seeing it more as a burden and an addiction, rather than time well-spent, until I realized that this was something I could use not only for entertainment, but also for my professional development. Having discovered the studies of the concept of gamification of education as well as game-based learning, I decided to study these phenomenona in more detail.

1.5 Overview

This study contains five chapters: introduction, literature review, methods, findings and discussion. The introduction provides the reasons why this topic was chosen. The literature review relates the topic to the findings from relevant studies and identifies specific ideas necessary for this study. The methods describe the data collection processes and the questions used for the interview. The findings are dedicated to showing the answers collected from all the interviewees. Finally, the last chapter, discussion, provides a thorough analysis of the data as well as the implication the data has on the question at hand. It also includes a brief description of the limitations of the study and the suggestions for the future research.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The use of any technology and specifically video games in class involves numerous benefits and limitations and identifying these known factors is crucial for this qualitative study. Due a lack of studies on educational uses of Minecraft, it is necessary to look at the field of video games in education from a broader perspective, in order to identify potential problems that may be faced in Ontario classrooms today as well as make suggestions for future implementations for game-based learning in the province.

Three specific bigger themes will be looked at in this literature review. First, it is important to look at how the students today differ from the previous generation of students and what that means for the teachers today. The second theme will touch on the various limitations that teachers are faced with today when dealing with the technological tools used in class. Finally, the last theme will assess the idea of using various gaming theories and computer games in class with the main emphasis on a game called Minecraft. The so-called gamification of education or edutainment, as well as a similar idea of games-based learning will be looked at from the perspective of teachers using it in class. As there was very limited academic literature about Minecraft when this project began, this literature review will focus on analyzing relevant studies on both educational games and using game-based learning in order to draw parallels with the game like Minecraft.

2.2 New Generation of Students

The majority of students today are capable of using technology in ways that are seen as mysterious and incomprehensible to a lot adults and specifically teachers. The modern student is

capable of adapting to and using various classroom technologies at a much faster rate than it takes a teacher to figure it out and implement in class (Besnoy, Housand, & Clarke, 2008). Prensky (2001) goes even as far as calling the modern students "digital natives", in the sense that they are a completely different breed of students capable of adapting to new technological environment with ease and can "process information fundamentally different from their predecessors" (p. 2).

Due to the sudden advancements in technology and an increasing inter-connectedness of the world through various Internet social media such as Facebook and Twitter, the students today are used to having access to a wide variety of information right at their fingertips. Communicating with peers from other countries or using a variety of software is second nature to the majority of students in class today, so using various means of technology in a modern class may be highly beneficial not only for the learning benefits that come with it, but also because the students today rely on technology in daily life.

And although it is hard to believe that many of these tools, such as tablets, smartphones, and MP3 players did not even exist a decade ago, they have now become a "fixture of youth culture" (Ito, et al., 2008, p. 1). Therefore, encouraging teachers to design various activities using the technological tools may foster not only interest in learning, but also a genuine understanding of where all this technology came from and how certain fields, such as for example science and math played an important role in shaping every student's life today. Giving teachers more opportunities to use these technologies in class in order for students to develop these new literacy skills, often referred to as "digital literacy" (Leu, Kinzer, Coiro, & Cammack, 2004), i.e. skills to use technology for research, analysis, integration and sharing of resources via technological

means, is imperative for the development of not only students' skills, but also in order to keep the teachers abreast with current education techniques.

At the same time, while student do use a lot of the modern technology in their daily lives, they rarely get to experience any educational benefits from it or participate in meaningful school-related activities using technological tools (Ito, et al., 2008). Some schools go as far as banning these tools from schools (e.g. blocking access to Facebook and Twitter) and thus create an imaginary barrier between modern technology and any potential educational benefits that they may bring. Ito et al. (2008) adds that "erecting barriers to participation deprives teens of access to these forms of learning … youth could benefit from educators being more open to forms of experimentation and social exploration that are generally not characteristic of educational institutions" (p. 2). Therefore, in order for modern classes to be effective in educating youth, the teachers and education boards have to become more open to various technologies available today and learn to adopt, as well as integrate, various technological tools into their classrooms.

2.3 Teachers' Limitations

When it comes to implementing various technological tools into the classrooms, a lot of teachers feel inadequately prepared for the task and thus avoid using any tools, relying instead of the traditional approach. Some of the well-known and studied limitations in implementing technological tools to classrooms will be discussed below. Ertmer (1999) organizes these limitations into two categories: first-order barriers, i.e. external factors that do not depend on teachers, such as for example the lack of computers at schools and second-order barriers that are internal in nature and are usually based on teachers' established beliefs.

One of the more well-known problems that teachers often face is the lack of computers at school or at home and a lack of sufficient access to other types of technology (Smerdon, et al.,

2000). Although this problem can be averted by supplying teachers with the necessary technology (e.g. purchasing laptops or desktop computers), certain types of technology will still remain unavailable to them due to higher costs (e.g. tablets and smartphones) or the difficulty in keeping up to date with the advancements in technology.

Another more common problem is the lack of time to plan classes using these new technological tools or to explore new tools in your own free time in order to understand their functionality (Wood, et al., 2005). Although time management is always an issue when it comes to planning or learning new things, understanding these technological tools and most importantly being able to use them may help the teachers facilitate their own classroom management and class preparation later on. In other words, the initial time investment required to become sufficient at using new technological tools will pay dividends in time and will potentially save a lot more time in the future.

Third problem that often arises with teachers trying to learn new technology is the lack of technical support or knowledgeable experts that can guide them through the learning experience (Smerdon, et al., 2000). However teachers need to be taught too, so it is school's duty to implement necessary professional development sessions in order to help teachers get acquainted with the new technology and to learn to apply these new tools to class.

On top of that, teachers often receive insufficient training and feel like they have inadequate skills in using technology (Smerdon, et al., 2000). This lack of confidence in personal technological abilities however can be resolved through the use of extensive professional development and also experimentation with technological tools in one's free time. For the most part, teachers should already be aware that the best way to learn is by doing and that practice makes perfect.

Furthermore, Ertmer (1999) discovered that certain teachers are innately resistant to change and are passive toward various technological changes that are constantly happening around them. Although stubbornness to change is difficult to overcome, it is school's responsibility to ensure that all of the teachers get adequate training in using all the necessary tools and that the teachers are at least willing to try a new approach.

On the other hand, Ertmer (1999) also found that certain schools contain a conservative culture that does not offer support and may even contain several incompatible teaching traditions. In other words, schools may become complacent in using a traditional teaching style or may contain several teaching styles, not supporting any one of them specifically.

Finally, curricular constraints may also limit the teachers' abilities to use technology. So, for example, certain classes may only be taught in a traditional way, or at least it may seem so at first (Egbert, Paulus, & Nakamichi, 2002). However, with the amount of various technological tools available today, it is quite likely that a brief search on the Internet will uncover at least one way of adapting technological tools for any sort of a classroom. So, finding the right technological tool for a class is only a click away.

2.4 Video Games in Education

The much more specific technological concept that is directly related to this research project and will now be discussed in more detail is using video games in education. Using games in education is an old concept as even Vygotsky (1967) and Piaget (1962) had emphasized the idea of games in preschool and beyond in fostering the development of social cognition. But despite tremendous advances in video game industry, the teachers have "limited experience designing or implementing effective educational computer games" (Ma, Williams, Prejean, & Richard, 2007, p. 517). So, even despite sudden advances in computer game and online

technology and the tremendous popularity of these games, most teachers are not aware of their existence or their popularity amongst students.

2.4.1 Unclear Findings

There are several studies that indicate that modern video games are effective at developing certain cognitive skills, such as for example high levels of visual and selective attention as well as concentration (Rosas, et al., 2003). According to Green and Bavelier (2007), young gamers are often able to pay attention to a greater number of objects at the same time than non-gamers and exhibit much faster reaction times, increase eye-hand coordination and manual dexterity. Video games also enhance spatial skills and gamers often get better scores on Mental Rotation Test (Green & Bevalier, 2007).

At the same time, a series of medical articles that were published starting with the late 90s suggested that playing video games may also be similar to taking cocaine, by increasing sharp spikes in the levels of dopamine (Koepp, et al., 1998) and may produce dependence-like behavior that may lead to other types of addictions later in life (American Medical Association, 2007). However, video game usefulness in the classroom setting has been questionable to date and with the overabundance of various educational games that are not so successful it may seem like the field of education is not meant for the realm of video games. For example, a literature review by Mitchell and Savill-Smith (2004) found mixed results on the usefulness of video games in education, varying from teaching students up to 36 important learning principles such as decision-maker and experimenter (Prensky, 2001) to more negative findings such as adverse impact on schoolwork (Griffiths, 1997). Furthermore, in the qualitative meta-analysis of various computer game based learning tool studies, Ke (2009) discovered that out of 65 comprehensive studies to date, 34 had significant positive results, i.e. the computer game based environment was

beneficial to learning. However, the study also found that 17 of the studies had mixed results, with only certain outcomes being positive, while other outcomes not being affected at all. Additionally, it was also found that one study (Christensen & Gerber, 1990) had a surprising negative effect of game-based education and found that a conventional learning environment was more beneficial to students' learning. This study however, focused on students with learning disabilities in a math class and the conclusion indicated that due to the nature of the game (a fast paced arcade game that involved math addition), the students were at a disadvantage and had trouble focusing while playing the game. So, using a more modern computer simulation and changing the difficulty settings might have had a potentially beneficial effect on these students as well.

Finally, the most recent article on the effects of video games on youth and adolescents discovered that not only do most games have a generally positive cognitive, developmental and social effect on kids, but even identified that video games that are often perceived as violent or aggressive had a surprisingly positive effects on pro-social rather than aggressive behaviors (Granic, Lobel, & Engels, 2014). The mixed results in the studies mentioned above indicate that it is not entirely clear whether video games improve learning outcomes and may also indicate that a much more structured approach is required when studying various types of video games. Just as there are many different genres of video games out there, not all of these genres would appeal to all students. Instead, the researchers in aforementioned studies may have tried to use "educational games" that were meant to satisfy everyone, thus ignoring the fact that not all students may enjoy them.

2.4.2 Online Video Games and Education

One of the main differences between the modern video games and the games from a decade ago is their almost ubiquitous social nature. The vast majority of modern video games include a multiplayer component and over 70% of all gamers today regularly play video games online (Entertainment Software Association, 2012). The social and cognitive benefits of these games in studies to date are quite positive and vary from a general increase in helping behavior and students becoming more supportive in class (Ewoldsen et al., 2012) to increased engagement with social and civic activities in everyday lives, such as raising money for charities, volunteering, and etc. (Lenhart et al., 2008). In the last few years, researchers outside of Canada have also looked at benefits of massive multiplayer online games in education and explored potential applications of online games in classrooms (Gros, 2007; Childress & Braswell, 2006; Hou, 2012). These researchers tried to apply various gaming strategies to the classroom and experienced quite a lot of success in motivating students to study and to continuously learn while playing specially developed online games.

For example, one type of massive online games that has been studied in some detail is so-called Massive Online Role-Playing Games (MMORPG). In these games, players simultaneously interact with each other, solve problems and advance in levels in various fantasy, sci-fi or other settings in a persistent, online virtual world. According to Campello, de Lima and Roazzi (2010), "MMORPGs could be used not only as a viable teaching tool, but also as a parallel activity that could function as a significant "catalyst" for education" (p. 1572). These games are able to not only motivate students to study at school, but even help them pursue the class-related knowledge outside of class during their free time, as a lot of these games have a persistent server that can be accessed at any time. This important feature allows the students to continue their education

outside of school at their own leisure time, so developing activities that will be motivating and interesting within these games is essential in creating students that are self-driven to study and succeed even outside of school hours.

Also, apart from learning class materials, students may develop other useful skills. Jang and Ryu (2011) found that "MMORPGs offer a useful place where people can grow their leadership skills and potentially transfer them into the real world" (p. 616). In another study, it was found that "there are elements within the design of MMORPGs which foster intrinsic motivation while requiring players to think, plan, and act critically and strategically" (Dickey, 2007, p. 269). Also, in a yearlong study by Hou (2012), where a specific MMORPG was designed to test students' learning, the researcher found that turning a learning process into an online competition reinforced mastery learning and increased student performance. Furthermore, according to Suh, Kim and Kim (2010), "students studying English utilizing online role-playing games showed higher scores in areas of listening, reading, and writing than those who attended face-to-face instruction classes" (p. 370). Finally, although traditionally, online games were mostly played by male players, in the last few years there had been a large influx of female players as well (ESA, 2004; ESA, 2012; Yee, 2001). In other words, both male and female players seem to have intrinsic interest in these online games and playing these games creates an opportunity to develop various skills that can be used in daily life as well.

Unfortunately, neither MMORPGs nor other online games have ever been explored as educational tools in Canada or specifically in Ontario, despite indications that the video game industry in Canada is steadily growing (SECOR Consulting Inc., 2011) and approximately 90% of all Ontario students grades 7-12 reporting to play video games (Paglia-Boak, et al., 2012).

Consequently, the growing number of teenagers engaged in online gaming, along with the indications that online game theory can be successfully used in education serves as a good reason for investigating the effects of online gaming in Ontario, as well as helping modern teachers get acquainted with the phenomenon and helping them introduce it into their own classrooms.

2.4.3 Educational Games VS. Game-Based Learning

However many of these studies forget to make a distinction between educational games and video-game based learning. Game-based learning is an emerging phenomenon that a lot of the gaming community is really excited about as it retains the authenticity and the fun that is inherent to video games. It is broadly defined in a publication by Perrotta, Featherstone, Aston and Houghton (2013) as including five important principles. The first is *intrinsic motivation*, referring to the intrinsically fun and motivating nature of video games. The second is *learning through intense enjoyment and fun,* which refers to games being able to create a state of consciousness known as "flow", during which an individual is completely absorbed by the task. The third is *authenticity* meaning that the type of learning that occurs is directly reflected in the game and applied contextual skills rather than more abstract notions that are often seen in traditional instruction. The fourth is *self-reliance and autonomy* that implies independence within the game, inquiry and exploration-based learning and alternative passions that could arise by playing the game. Lastly, the fifth principle is *experiential learning* that may also be referred to as the principle of "learning by doing", a concept that is a lot easier and more cost-effective to implement within a game rather than in a traditional classroom environment.

The paper also mentioned several mechanisms that are often included in effective game-based learning techniques and they are: simple set of rules, clear but challenging goals, fictional

setting, progressive difficulty levels, high degree of student control, immediate and constructive feedback and a social element that allowed for shared experience and building of bonds (Perrotta, et al., 2013).

In contrast, educational games take a different approach and try to adapt educational principles and educational techniques and create video games based on those principles in order to encourage students to learn. In the words of Granic, et al. (2014), educational games are "chocolate-covered broccoli" (p. 74), they look great and are good for students, but are simply not fun to play. Nevertheless, as part of the academic based reforms in the US, the MacArthur Foundation and several technology companies have launched a competition to develop video games for teaching science and math (Steinkuehler, 2010) as well as other subjects in order to improve students' performance in Science, Technology, Engineering and Math (STEM) curriculum classrooms. Unfortunately, as Shaffer, Squire, Halverson and Gee (2005) put it, "most educational games to date have been produced in the absence of any coherent theory of learning or underlying body of research" (p. 18). As a result, today we are flooded with a variety of "edutainment" games that take pieces of video games and try to staple them into curriculum expectations, resulting in something of a hybrid of video games and education. Games like Math Blaster or other Blaster series of games that have been around for decades are a good example of this phenomenon and also demonstrate that despite marginal success of the game in the mid-90s, the overall fun effect is not there and the game is more focused on practicing the arcade gaming skills than math concepts, while being totally devoid of any higher level thinking (DeVoss, 1997).

2.4.4 Minecraft

This particular qualitative study takes a more game-based learning approach in order to assess if a commercial release of a video game can be successfully used as a teaching tool in a classroom. Minecraft is a commercial release and was not intended to be used in education originally, but has been created in such a way that a huge learning component was necessary to be successful in the game with various new modifications that changed the game dramatically released on daily bases. One of such releases was MinecraftEDU, which is described below, changed the game into a teacher-friendly tool and allowed for easy integration into the classroom

Minecraft is an open world, exploration and building game, written in Java and released in 2011 for PC by a Swedish company Mojang. The entire world of Minecraft is built out of $1m^3$ textured blocks that can be either mined or used in construction of anything from a new pickaxe to a full scale model of a city. The randomly generated world contains several different biomes that simulate climate conditions on Earth and also has a day/night cycle, with night being populated by various aggressive monsters. The game features two modes, one called “survival” where a player has to try to live for as long as possible by feeding, clothing and taking care of their character and the other being the “creative” mode that allows the player to build anything they desire using all of the available blocks. Minecraft also contains the use of electrical circuits and logic gates, which allow for elaborate engineering projects, for example a player could create a simple computer or a calculator, given enough time. Just like massive multiplayer online games, Minecraft can also be played with other players if a multiplayer server is setup and thus allows for collaborative or competitive group experience. However, the most significant advantage of the game is the active “modding” community that has been consistently releasing

various modifications and enhancements for the game, making it even more unique and diverse in every way.

One of the main advantages that Minecraft has over other modern video games is that it blends entertainment, creativity, social media skills, communication and engineering in an easy to use and understand package. For instance, the use of virtual blocks within the game is a great way for students to develop spatial skills (Garskof, 2014).

Minecraft is also one of the most popular and most sold games ever made. As of February, 2014, Minecraft has sold over 14 million copies (Hillier, 2014) has over 100 million registered users (Reilly, 2014) and was on top of the Apple App Store in 2013 (Dredge, 2013). Its popularity with kids and adults is undeniable and its success has been attributed to the game appealing to basic human activities of exploration and collaborative co-construction (Edwards, 2011).

What is even more interesting from the perspective of education is that in 2011, a version of Minecraft called MinecraftEDU was released by an independent team in cooperation with Mojang. This version of Minecraft is meant to be used at schools and made in agreement with Mojang to make it more affordable for educational establishments. This particular version was created by an elementary school teacher from New York who was asked to build a version that would be easy to use by teachers who are not familiar with the game. As of September, 2012, over 250 thousand students already had access to this version of Minecraft around the world (Waxman, 2012). Some of the ways that this version of the game has been used to teach students are:

- Building various ancient civilizations or geographical locations (*Figure 1)*
- Physics, chemistry and biology demonstrations using the materials and the game physics that are already in the game
- Learning the principles of electronics and computing
- Recreating particular parts of various novels while exploring them in the game.

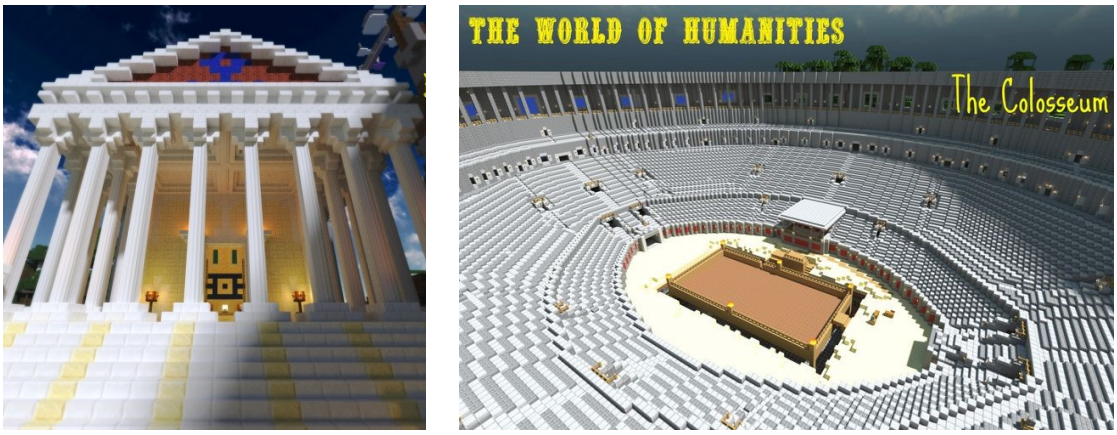

Figure 1. An ancient Greek temple and The Colosseum from World of Humanities modification. Retrieved with permission from http://minecraftedu.com

Even language teachers have successfully used it to introduce various grammar and vocabulary lessons since Minecraft has a neat feature that allows for easy addition of information via various wooden signs in the game (Walton, 2012)

Furthermore, even the students in higher grades can benefit from the game, as various types of maps are already in development such as for example (Short, 2012):

- Maps of human body for a biology class
- Models of a cell that can be explored from within
- Anatomical models
- Climate simulation by using various biomes and climate conditions

- Farming and tree-planting activities
- Resource depletion and unsustainable environment simulation
- Learning lunar phases
- Exploring physical states of matter (e.g. ice melts into water, water evaporates)
- Chemical reactions, especially using a specific mod called MineChem (*Figure 2*)

Figure 2. Examples from MineChem, various chemical elements and a fusion reactor in action. Retrieved with permission from http://www.minecraftforum.net

Apart from the diverse types of classes and age groups where the game can be used, what is really interesting to note is that Minecraft appeals to many various types of kids and is gender-neutral as well. As a matter of fact, young girls age picked it as the number one game over other girl favorites such as NintendoDogs (Girls Decide, 2012). Also, according to Zedda-Sampson (2013), approximately 40% of kids ages 8 to 10 play Minecraft already, which is a large number, considering only about 14-17% of them use popular sites like Facebook and only 8-16% play online at all. The incredible popularity of Minecraft and the amount of various tools that could be used in educational setting that were made specifically for the game make Minecraft an excellent candidate for game-based education model.

2.4.5 Video Game Effectiveness in Education

So why do some games seem to have so much effectiveness in teaching students, while others seem to produce more negative effects and most importantly, can Minecraft become one of the more effective games in education or will it follow the opposite trend? In order to attempt to answer that question, it is worth looking at what makes an educational technique effective.

Previous papers by Malone and Lepper (1987) and more recently Ciampa (2013) established six important factors of effective learning systems: challenge, control, curiosity, recognition, cooperation and competition. In other words, a learning system has to be challenging enough, providing the student with a feeling of control and making them intrigued and curious. It also has to present the student with a sense of pride and recognition, allowing for cooperation with other students and giving a chance to distinguish him or herself through competition.

Creating challenging activities that would be enjoyable and fun without being frustrating is an important feature of most video games today and is essential to keeping the students in the right learning mindset. This is an essential feature that keeps video gamers interested in playing the games and according to Biles (2012), presents an opportunity for "scaffolding of gameplay to keep players in their optimal zone for learning by providing just the right amount of challenge and difficulty to maintain the balance between fun and frustrating" (p. 906). This is often seen as the increase in number of enemies depending on the player character's level in games such as Fallout 3 and Left 4 Dead (Biles, 2012) or in case of Minecraft, in a progressively higher and more difficult types of enemies that spawn in the area depending on the amount of time spent in the region (referred to as Regional Difficulty) and also depending on the phase of the moon, with full-moon spawning the most difficult enemies. This constantly adjusting difficulty level is

necessary to keep the players engaged and on-task in games and is essential for successful learning experience as well. Furthermore, keeping the students at the right level of challenge, gives them an important feeling of control, often referred to as the locus of control that is necessary for their continual progress.

On top of that, Minecraft provides the extrinsic satisfaction of pride in own work by being able to showcase personal creations to others and keeping the personal projects on a persistent server that a school can create for students' personal recognition. Also, the ability to engage in self-directed learning and access the Minecraft server even outside of class hours along with the actual exploration feature that is a big part of the game create an environment that stimulates students' curiosity. This is further compounded by the addition of thousands of free modifications available for the game and easily installable on any server that change anything from the game's texture to adding new exciting areas of explorations or even turning the game into a massive chemistry lab.

The ability to setup and run a massive multiplayer server that allows for a very large number of accounts to join and play together is one of the main features of Minecraft. This presents an opportunity for teachers, schools and school boards to create a massive server that can be used by various students online all at the same time and in the same virtual universe, in a sense turning the game into a type of an MMORPG mentioned above. Using the online server creates an excellent opportunity for cooperative learning, which in turn produces higher self-efficacy, confidence and motivation to complete tasks by providing assistance from their peers (Cheng & Ku, 2009). Furthermore, students using the server are more likely to be more acceptant of other students and have better intergroup relations and be acceptant of academically

challenged peers or peers with learning disabilities, similar to the findings on mobile technology and learning by Cheng and Ku (2009).

The online version of the game also allows for various types of competition, however as Ciampa (2013) notes, teachers must be careful from turning it into direct competition and instead focus on creating a master-oriented competition where a student strives to beat their own performance or score rather than competing with the students in class.

Therefore in theory, Minecraft meets all of the requirements for an effective learning system (Malone & Lepper, 1987; Ciampa, 2013), however further research is needed in order to address the game's effectiveness in class. These six factors are further investigated in more detail in the discussion chapter and are based on the specific findings of this qualitative study.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This qualitative study investigates the usage of a computer game called Minecraft in education by interviewing three educators that have already started using the game in their classrooms. The previous chapter explored the known effects and benefits of video games in class and hinted on the potential benefits of Minecraft as a game and a teaching tool, but no study to date has investigated the effects that the game has on students and their parents or how the teachers perceive their Minecraft based classrooms. In order to establish certain themes and to investigate the topic in more detail, this study included three interviews with the educators that have adapted Minecraft to their classroom and have used the game for several years. Phenomenological analysis (Creswell, 2007) was used to process the data and to relate it to the literature review with the intention of getting several main themes that could then be used in relation to the research question and relevant sub-question. The final conclusions are drawn based on the combination of interview data, and the literature review.

3.2 Procedure and Data Collection

The data for this qualitative study was collected through semi-structured interviews of three very distinct types of teachers, in order to get as many different answers as possible. The interviews were conducted both in person and via Skype since two of the participants preferred Skype to a face-to-face meeting and focused on several main themes related to the topic. The themes were formed as the interviews progressed and were finalized during the data analysis phase. Although all of the questions were quite open ended, due to the specificity of the topic the answers led me to the same recurrent themes that are mentioned later on.

The main purpose of the interviews was to discover the benefits of using Minecraft as a teaching tool, the challenges associated with it, the students' and parents' opinions about the game and its educational benefits and to discover any other themes that may be uncovered as the interviews progressed. The overarching goal of this study is, depending on the findings, to recommend Minecraft, specifically the version that was made for teachers by an organization called MinecraftEDU, to be used in Ontario classrooms as part of the curriculum.

The actual interview consisted of 12 open-ended questions with a few follow-up questions each . The interviews were recorded using Smart Voice Recorder application on an Android phone and a Camtasia Recorder for the Skype interviews with the recording then edited and played for transcription with a PC program called Audacity.

Following each interview, the specific findings were organized into themes and compared to the current literature and to other interviews that were performed in order to establish re-emerging ideas and to relate these findings to the research question for this MTRP. The data was thoroughly analyzed by both me and my research supervisor and was then organized into findings that are discussed in chapters four and five.

3.3 Participants

In order to find the participants for this research project, I had to do an extensive search online, looking for teachers that are already using Minecraft in classrooms or are integrating Minecraft in other educational environments. To my surprise, I was able to find exactly three people in Toronto and two more teachers outside of Canada, all of whom I wanted to interview for this project. Having contacted all of them, I got an almost instant reply from three of the potential participants and decided that it would be best to interview various types of individuals

in order to get a separate set of responses, which would then lead to the discovery of common themes.

The first participant was a business owner in downtown Toronto who runs an afterschool program for kids to how to do various arts and science projects using Minecraft. This participant was recruited via email and agreed to be interviewed almost right away. Following the interview, the participant recommended that I contact a professor that runs the EDGE lab at Ryerson University, which is known for various innovative discovering in technology. To my surprise, this led me to my next participant who was a TDSB teacher that already used Minecraft to teach grade 3-6 classes in technology and library studies and was actively promoting the use of Minecraft in class. Finally, the third teacher I interviewed was a colleague of the second participant in TDSB and used Minecraft as one of her other games and activities in class.

All three participants were very eager to answer my questions and were extremely helpful in helping develop this project or providing me with extra resources and information regarding various conferences that I later attended to become more knowledgeable on the topic.

3.4 Data Analysis

Each of the interviews were digitally recorded and then later transcribed by me in a verbatim format, omitting certain colloquialisms, voice fillers and interfering sounds such as coughing or laughter. Several cycles of revision were used to read and discover various themes within the interviews. A colour-coded system was used in order to create a visual map using PowerPoint for various ideas that were then chunked into specific themes and related to the main research question or one of the sub-questions. The phenomenological analysis (Creswell, 2007) was then used to generate codes based on the interview data from the interviews and to chunk them into several major themes. This was accomplished in several cycles of analysis.

The first cycle established specific ideas within the interview and identified recurring themes. The second cycle combined the ideas into specific themes, relevant to the main question. The third and consequent cycles of reading were used to relate the themes from each of the interviews and to identify relevant data.

Throughout the interviews, several specific themes emerged. The seven most common themes were:

- Specific benefits of using Minecraft
- Unique challenges associated with the game
- The diverse types of students interested in it
- The learning styles and the class dynamics that this game established
- The financial costs involved
- The parental opinion and involvement
- The need for the right teacher mentality in using the game

These themes will be later discussed in more detail in chapters four and five.

3.5 Ethical Review Procedures

Each of the participants was provided with two copies of the letter of consent (see Appendix A), which was then signed and one of which was kept by the participant. In case of the Skype participants, an online copy was given to them to sign and was then returned to me signed digitally.

All of the interviews followed the procedures outlined in the consent letter and were based on the ethical review procedures for the Master of Teaching program at OISE, University of Toronto and all of the guidelines were followed by me as directed by my supervisor.

The participants were made aware that they could withdraw from the study at any time and could decline answering any of the questions. They were also informed that their identities or their work place identity will remain anonymous and that pseudonyms will be used instead of the actual names. This was to ensure privacy and to protect their names from any harassment or inquiry by persons other than me once the MTRP was publically released and available to everyone.

Any and all data collected that revealed student work or student private information during the interview of one of the teachers was not used for this research. Only some specific answers regarding student performance were used to conceptually formulate one of the themes for the research question and were then permanently destroyed in order to protect the students' privacy.

3.6 Limitations

One of the major limitations of this study was the timeframe in which the study was conducted. Due to the late start of this particular research project, I did not have enough time to conduct a much more thorough review of the findings and conduct even more interviews. My previous topic was an attempt to study the effects of technology on science education and was unfortunately unsuccessful. So although my initial interest has always been using video games in education, I found it hard to find a specific area to focus on. It was through sheer luck that this particular area of study became available to me as a topic as one of the professors, who later became my supervisor, was quite interested in investigating Minecraft in education as well. Had I started on this path from my first year as a graduate student, the research project would have had a much more extensive and elaborate results.

Furthermore, due to the ethics board constraints, initially only adults in education were available for the interview and no student could be used for any of the observations, interviews or other research techniques that I wanted to use. The larger research project that I am a part of received the ethics for interviewing students, and that is something that I intend of pursuing as part of the research team in the future in order to use some of the student work to demonstrate the effectiveness of Minecraft. In this study however, all of the results are based on the opinions and the classroom results of three participants.

Furthermore, two of the participants were males with a computer-oriented background, so this could have also created a certain bias in their response. In other words, the participants did not represent a diverse body of teachers that is inherent to Ontario teaching boards or other places in Canada.

Finally, due to qualitative nature of the study, most of the findings are also open to interpretation and are, in a sense, a subjective idea of what I as a researcher reconstructed them to be. Since I was familiar with Minecraft for over three years prior to the start of the study and had myself played it extensively, there could have been some innate bias in me trying to find as many positive results as I could, while unconsciously disregarding the negative aspects of what another less biased researcher could detect. I did however invite my research supervisor and my colleagues to review my findings in order to detect potential biases. Furthermore, all three participants were also highly biased toward Minecraft as they were already using it in their school and so their responses were, in a sense, a reinforcement of believes that I already had. Using a less biased sample of teachers that just started using Minecraft or have used Minecraft unsuccessfully, could provide a much more reliable data for the future studies.

CHAPTER 4: FINDINGS

4.1 Introduction

The findings presented in this chapter are based on one face-to-face and two Skype based interviews that explored Minecraft as an educational tool and addressed various advantages and disadvantages of this game-based learning technique. The chapter is organized into several main themes with related subthemes: 1 - Various uses of Minecraft, 2 - Benefits of Minecraft Based Learning, 3 - Issues and Concerns in Implementation of Minecraft Program, 4 - Unexpected Findings, 5 - Future Directions of Minecraft. The first part of the chapter describes the participants in more detail. Each theme is then explored from the perspective of interviewees and their opinions are presented or cited directly.

4.2 Participants

4.2.1 Arnold

Arnold was the first participant interviewed. He is a self-starter of a web developing company that he owned for 18 years. He is a hands-on learner and taught himself how to code from early age. He is very competent with computers and is also a video editor and a part-time programmer. He also educated himself a lot about electronics, mechanical systems and loves to tinker and learn by doing. The company that he owns is located in the western part of Toronto and offers an afterschool program for kids of all ages that teaches them how to tinker with various mechanical and electronic tools and offers various computer based programs and even a 3D-printer for learning and afterschool education. His afterschool program started out of his garage 5 years ago and became so popular that he decided to relocate it to a new place, moving it to the basement of his web developing company. Arnold started using Minecraft as part of the

afterschool program in the last 3 years and became interested in it after seeing that his two teenage children, a boy and a girl, were obsessed with the game. According to Arnold, he saw the creative and problem solving potentials of the game and decided to try it. In the last 3 years Minecraft became one of the more popular afterschool programs at his school and is often integrated with other tools, including the 3D printer in order to make the program more interactive and creative for students attending. Due to the success of his afterschool program, Arnold is planning to expand it to other areas of the city.

4.2.2 Larry

Larry is a public elementary school teacher with Toronto District School Board and has been teaching for the past 5 years. Teaching is his second career and prior to graduating from University of Toronto, he also worked as a successful children's writer. Writing children books and graphic novels is still a big part of his life and as an artist he loves creating things for kids. He also considers himself a gamer and has been playing video games since childhood. He used various video games in his classroom in the past, specifically games that the students were already interested in, such as the Pokémon series on Nintendo DS. He began using Minecraft in his class 3 years ago and has since developed the program into a multi-school project based on a server that was graciously provided to him by Ryerson University. He has since presented at several EdTech conferences and is a co-founder of a games based learning teacher community in Ontario. He considers himself a technologically savvy individual and is responsible for running and organizing the Minecraft server, as well as assisting other teachers using the server and Minecraft in their class.

4.2.3 Deb

Deb is a teacher-librarian with Toronto District School Board and has been teaching for the past 17 years. She is not a gamer herself, but has been observing the gaming culture peripherally through her games-obsessed husband and their teenage children. She first became a Minecraft player, but was already using a game based concept in her class, using a toy called Webkinz. She first decided to try using Minecraft with her grade 3 class while teaching them math and language using the single player version of the game as part of a multi-station assignment. Following the initial success, she implemented the game further, eventually joining the multi-school server managed by Larry. In her class, she uses a strictly student-based approach and encourages students to create and explore while using personal diaries and journals to keep track of their progress that she then uses in assessment.

4.3 Various Uses of Minecraft

4.3.1 Minecraft as an optional activity

Both Larry and Deb actively use Minecraft in their elementary classes and both report having great success in motivating their students to do work and in reaching curriculum expectations using the video game. One major difference in their approach is in the extent to which Minecraft is used in class. As a teacher-librarian, Deb uses Minecraft as a support tool and often relies on single player version of the game as one of the activities or stations that students have to attend during their class time. She encourages her students to keep a journal that verbalizes their thinking process in the game and helps them with writing as well as adds a verbal component to other tasks she requires of them. One example that she provided was when she taught a grade three math class and asked them to keep a math journal:

> I used it with my grade threes once, teaching language and math and I like students leading the way. You need a math-Minecraft journal and keep math language. At first it was hard for them, but when you point out like how many bricks do you need to build the house? How big is the inside? Is rectangle house bigger than square house? How many blocks did you need? How many blocks does one tree get you? I find those are a bit more authentic because you need to know those things in the game.

Her students were quite quickly able to adapt to the idea of using math concepts within the game, which helped them practice the concepts she was trying to teach and at the same time gave them a tangible way of measuring what they were trying to learn. The students that Deb taught were not only actively constructing objects that required a practical use of math, but were able to get a visual feedback on what they were doing and then verbally explain it in their journals, adding an element of literacy to the math subject she taught them. This multi-faceted approach is often lost in a traditional math classroom where students have to deal with imaginary problems in word forms, translate them into numbers and then back into words.

4.3.2 Minecraft as the main tool

Larry's class is based primarily on games, although he does use various other games such as Pokémon and Skylanders in his classes. His focus with video games and specifically Minecraft is in using the games with students who are struggling with reading and writing and who are often sent to various behavior programs or do not do well at school. He uses Minecraft as an encouragement tool and helps the students acquire the necessary confidence needed in changing their personal mindset and consequently succeeding at school. He also primarily uses Minecraft as an online tool and his students often use the multi-school server to play and interact with students from other schools. He mentioned that developing social skills and also learning to

do work at school is the main focus of his class and Minecraft helped him achieve these goals with ease. His students are always very enthusiastic about keeping an “adventure journal”, where they are encouraged to keep track of what they do on the server. According to Larry, they are always exceptionally motivated to tell their stories and have never tried to give him any excuses for not doing the writing that is required of them. He believes that because Minecraft became so meaningful to them, it helps them connect the school work that he requires with the fun that they have in the game.

4.3.3 Minecraft as a supplemental tool

As a business owner, Arnold uses Minecraft differently from Larry and Deb. His afterschool program integrates Minecraft as part of the class that was based on tinkering and construction. Using various computer tools, a scanner and a 3D printer, Arnold’s students are able to construct real life objects that were built in Minecraft or scan and transfer real objects into the game. The introduction of Minecraft in his program was to help students create virtual objects in order to then create a tangible physical object using the 3D printer. This multi-tool approach creates a deeper, more meaningful interaction and adds a dimension of interest, allowing the students to connect real life with the virtual reality that they are used to in the game. His classes also teach the students collaborative skills and assist in social interaction. In Arnold’s opinion, it is much better for the students to come and play Minecraft together rather than sit and play it alone at home. He mentioned that all of the projects are organized as a team with a discussion before the class and are then executed and completed as a social unit. A theme or a topic is often voted on before the start of the class and the students then work separately or in small groups on each part of the project on the Minecraft server that he runs at his academy.

During the class, he maintains minimal presence and describes his role as “teaching them how to play with other people…encouraging them to be good to each other”.

4.3.4 Common approach

Despite the slightly different approach that the three educators take in using Minecraft, there is one major similarity in each of the programs. All three use a student-guided or student-driven approach, with students using the game the way they want to use it, and teachers only interfering to keep the social aspects of the game in check, making sure that no conflicts arise. When the conflicts did arise, all three were able to resolve them masterfully because of the ease with which it is possible to supervise and moderate all of the in-game activity and each of the interviewees had an example of using Minecraft to either resolve conflict or to teach conflict resolution.

Deb’s story was about one of her summer classes where Minecraft was used:

> For example we had this one student from another teacher’s class who wanted to share a house with one of my students and my student said ok sure. And that other student broke my student’s house and attacked my student in the game. My students were furious, wanted to kill that person, but the great thing is that I was there, their teacher was there and secondly, we used it as a teaching moment. For my student, who was a girl, she told me that she felt bad saying no, so that was a good opportunity that sometimes you have to be rude and be able to say no. So this was a good lesson to introduce before it turns into a relationship abuse. So you have to say no and don’t feel bad offending them if you feel uncomfortable about something. So we talked about something important in a very safe way.

Arnold had the following experience:

> We had one incident where some kids were having a conflict online. Kids were building something together at first and then they disagreed on what should be built and they started wrecking each other's stuff and so they got quite upset about it, but I look at those kinds of situations as opportunity to learn and you have to learn how to deal with those kind of situations when they come up.

Finally Larry talked about a program where Minecraft is used to teach students to resolve conflicts:

> But right now I'm running a [Minecraft] club at lunch at my school for older kids and the purpose is to teach them social skills. They get into a lot of trouble at recess and fights and that sort of thing. So conflict resolution and all that.

As a social and an online game, Minecraft is bound to have the inevitable conflict, but what is interesting to note is how effective the educators were at resolving the conflicts that occurred either during class time (Arnold) or in between classes (Deb). This in effect suggests that the online feature in Minecraft can be used as an excellent platform for social skill development and for mediating and resolving various classroom and inter-student conflicts. Also, the fact that Larry's program was created to use Minecraft to develop students' social skills and prevent further interpersonal conflict during recess suggests that the game may have features that enable it to create a pro-social environment that can be used to effectively mediate conflict and teach students the necessary social skills even more effectively than in a traditional classroom. The advantage of having a persistent Minecraft world means that the learning process does not stop at break time. This adds an important benefit of having a constant support to social skill development and the ability to intervene when and if something goes wrong.

4.4 Benefits of a Minecraft Based Program

4.4.1 Differentiated approach and creative expression

During her interview Deb referred to Minecraft as the ultimate differentiated learning experience. She added, "if you want to fight or just build, you can…if you want to explore, you could do that too…and it's fun, they really like it". Allowing the students this type of freedom may go against the modern idea of an organized curriculum, but all 3 educators agreed that it was the main strength of the program and why Minecraft based classroom worked so well. Deb believes that "kids have better more cool plans than we do and they have all these amazing ideas" that limiting them in their expression or setting strict guidelines for what they could and could not do would limit the effectiveness of the program. "One of my students even made a video about Minecraft…recorded everything about rocks and minerals in the game", and although the video by itself was great, Deb went further and used it in her other classes to teach about other environmental topics:

> The grade 8 student made this video and I played it in my grade 4 and they shared knowledge and we went looking for these minerals and we talked about what these rocks do and we talk about environmental stewardship and you can bring it in Minecraft and you can teach students about how you create holes and relate it to real life and mining and destruction of environment. So that's the teacher's role.

This suggests that using a cross-curricular approach and using student-guided curriculum by allowing the students the freedom to choose how to reach certain curriculum objectives is essential for the success of Minecraft based classroom and in essence creates a classroom based on differentiated instruction that so many teachers strive for today.

Larry also referred to Minecraft as a great tool for creativity and self-expression. He mentioned that video games in general are a great connection point for students today and that "kids are often disengaged and can't connect what they're learning in the classroom with the real life". He provided a hypothetical example of inner city students who are often required to read books and do assignments on areas they are not familiar with or have no interest in whatsoever. "Imagine [immigrant students] and they have to read a book about Wayne Gretsky". Larry adds that unlike other video games though, the greatest thing about Minecraft in particular is that "there's a way into it for everyone". It is easy to pick up and start using and even the basic version of the game offers a tremendous amount of things that can be done.

Finally, in Arnold's opinion the game allows students to "follow their own interests". It encourages them to learn things in the way they want to learn them and to acquire skills in an exciting way. Minecraft also helps "students become self-organized and plan things better" and adds a creative component to any task. Actively using Minecraft for various tasks helped his students get involved in the learning process and according to Arnold, could hypothetically be used in any subject. He added that in one of his classes his students played around with the idea of eco-systems that are already built into the game. "It could be incorporated into Minecraft, so you could have the students build an eco-system and use it in the science class." The ease with which eco systems can be discussed and analyzed in Minecraft as well as the instant, visual representation of eco-system change can create an excellent model that can then be used to explain real-life phenomena. This miniaturized design is prevalent throughout Minecraft and allows teachers to examine various complex topics on a smaller scale, but adds an excellent visual and interactive element that is often absent from classroom discussions or role-plays in a traditional classroom.

4.4.2 Digital literacy, social skills and online safety

One of the more important features that the game allows to explore in more detail is the ability to combine the class on literacy and any other curriculum expectations with an excellent learning tool on digital literacy. All three educators agreed that this is an essential skill that needs to be addressed and developed in a modern day classroom and that it is often ignored by most teachers and is only mentioned in passing. Arnold goes as far as saying "I think it's one of the most necessary skills in the world […] it's a different social interaction from face-to-face interaction. [Students] need to learn about it, not to be protected from it." He also emphasized that most of his work related interactions were exclusively online and that digital literacy formed the most essential skill that his afterschool program addressed. According to him, his current program "teaches them to play online together…how to play with other people…[not to] ruin the stuff they make." Making in this case refers to various types of constructions that players often create in the game, such as their own houses for example, which can also be destroyed by other players without their consent. The teacher's role in Arnold's program is to make sure that any problematic behavior is addressed and discussed with students. The educator in his program "helps kids work things out and try to err on the side of forgiving, try to work things out". Arnold also tries to teach the students about various online tools that are at their disposal when dealing with any potential harassment and help the students learn how to resolve these issues before they escalate. So the main purpose of this online interaction, according to him is "learning the concept of collaboration and dealing with issues and conflicts earlier…learning the team dynamics".

Furthermore, Deb provided several examples where an online misbehavior or problematic interaction was used as a learning moment in helping the students acquire the

necessary social skills. In her words, “a wonderful thing about making mistakes in Minecraft is that you can turn it into a learning opportunity”. For example, when her students were overheard talking about “killing each other” online she used this to talk to them about understanding different social situation and that in some situations audience may not understand or may be offended by what is being said. “In schools we don’t tolerate this [language], we had to make sure they understand it”. She also described a potentially abusive situation with one student indirectly harassing the other in the game. But because it was addressed promptly and with both students understanding how to react to this type of a situation in the future, the game provided an opportunity to “talk about something important in a very safe way…before it turns into a relationship abuse”. The other advantage of this occurring in the game was that nobody got suspended and the only punishment was a loss of Minecraft privileges for some time. Furthermore, she also mentioned that when her students admitted to using illegally downloaded Minecraft accounts, she used this opportunity to talk to her students about copyrights and why it was not okay to use an illegal account on a school server. According to her “teachers can help the students make these connections…teachers can help them reflect on the game and connect it to real life”.

Finally, the foundation of Larry’s class is in using digital literacy as the basis for the development of essential study skills and learning appropriate social behavior. He provided an example of using the game during the lunch-time program that allowed the students who are often seen as trouble makers to channel their energy into the creative medium that Minecraft provides. This assisted them in developing real-life social skills by interacting with other kids online using the multi-school server and under Larry’s supervision.

The other important feature that Larry mentioned was in regards to the server safety and online privacy settings that he uses. Unlike other multiplayer games that often have servers open to a wide audience, Minecraft has several important features that make it very safe for online use. Both Larry and Arnold use strict server settings that only allow for whitelisted accounts to connect. In other words, in order to connect to the multi-school server that Larry and Deb use or to the private server that Arnold uses in his afterschool program, they have to add the person's credentials to the server list and enable their access. As previously mentioned, the illegal accounts or any outside users will not be able to connect without appropriate permissions from the server administrator.

4.4.3 Multidimensional appeal

One of the more interesting findings during these three interviews was the fact that Minecraft seems to appeal to a large variety of students and not just a stereotypical gamer. Diane's class that used Minecraft extensively was run in the summer and unlike other remediation classes was actually organized specifically to target Science, Technology, Engineering and Math (STEM) fields. The students that she had were all quite diverse in their interests and came from different backgrounds. They all enjoyed using the game in class and unanimously said they wanted more of it at the end of the program. She also mentioned that almost all of her grade 1 students today know and love the game, regardless of how well they do in school, what culture they are from or what gender they are. Interestingly, she even gets occasional high school students coming to her class and asking to volunteer in her Minecraft program.

Larry mentioned when he worked as a Long Term Occasional teacher, he got to experience students from various socio-economic statuses and cultures and all of the elementary

and middle school students that he taught greatly enjoyed the game. As an occasional teacher, he was required to teach in different places around TDSB and having bought the Minecraft accounts, he was able to bring the game with him every time he moved to a new teaching position. All of his students were very enthusiastic about using the game in the last 3 years, however he did mention that because the new generation of students may be familiar with Minecraft already, some of them may come in with a negative preconception. For example, he mentioned a female student whose brother was a great fan of the game, which meant that she thought that she would not like it.

> [Today], when we introduce the game, almost everyone has either heard of or tried it. This is good because they're ready to learn and know the game already, but creates a challenge of pre-conceived notions about the game. So, new students that I have now may have some resistance because they might not like it for one reason or another […] And the thing about Minecraft in particular is that there's a way into it for everyone. Some people love going in and fighting, and beating up their friends, other people love exploring new lands and some people love growing vegetables. And for this student, what she discovered, what really got her interested is the chat feature in the game. She found that she could send messages to her friends who were in another classroom and she could send them message and once she discovered that, she was in. She was chatting, she then became like the chat expert for the little group where she was in.

So having tried the game, even the student who was initially resistant to the idea of playing Minecraft ended up finding a feature in the game that would get her engaged and interested in playing and thus participating in class.

Arnold's students come from a variety of backgrounds as well, although all of them have to pay for the afterschool program. Nevertheless, he too mentioned that high school students often come to volunteer and he lets them assist with the activities as long as they perform the work that he requires of them. Interestingly, Arnold also mentioned several interesting cases of students with mental or learning disabilities, specifically several students with ADHD and even severe cases of Autism that not only like the game, but flourished in it. According to him, the students that are usually seen as problematic and disruptive in class transform into regular "Minecrafters" when they get into the game, acting and performing on the level of other students in his class.

4.5 Issues and Concerns in Implementation of Minecraft at Schools

In order to implement a program in game-based learning, specifically a program using Minecraft in education, several factors, such as financial investment, tech support and teacher training need to be considered and planned out.

4.5.1 Financial investments

According to Arnold and also the public school teachers that were interviewed, the initial financial investments are quite minimal. The current price per account of the commercial version of the game that allows unlimited use including online access to various servers is $26.95 US (Mojang, 2014). The EDU version of the game differs in price from $18.00 US per account to $41 per classroom (MinecraftEDU, 2014). The $18 dollar version offers an unlimited account with the possibilities of using various EDU modification that have been created by other teachers as well using the game in the same way that the commercial version is used. The $41 version is more limiting and is connected to the teacher's account, but allows for an unlimited number of student accounts which can then access the specialized school server or can use the single player

version of the game with unlimited features. In other words, it is now possible to purchase an account for $41 that can be used by the entire school and will only have minor limitations that are often not essential for classroom based gaming. However, in order to use the game effectively, the school also needs to have somewhat up-to-date computers, preferably with a newer integrated graphics card. Specific hardware requirements are available on the game company website (Mojang Support, 2014) and do mention that a Chromebook or a Netbook may not be enough to run the game. If the school has access to iPads or any other tablets, it is possible to use a handheld version of the game (Kaplan, 2011) which only costs $6.99 US, but unfortunately no EDU version exists for the tablets yet. Finally, proponents of Bring Your Own Device may want to encourage the students to bring their own devices capable of playing the game, especially since a lot of the modern smartphones can easily run the pocket edition of the game.

4.5.2 Technical support

Despite the low initial costs, the technical support that is needed to run a successful server may unfortunately prevent some schools from trying the game in class. Although the single player version of the game, especially the EDU version is relatively easy to setup and run, the multiplayer version may require a school or a teacher to setup school specific servers for privacy and security reasons. Both Arnold and Larry admitted during their interviews to being computer tech specialists and mentioned that the initial setup did take quite a while. In Larry's words: "there's a lot of technical issues, huge technical issues…I'm a bit of a computer geek, I don't mind lifting the hood on the computer and having things setup, some teachers might not like that". Some of the initial technical problems according to Larry and Arnold who often setup their own Minecraft servers are:

- Successfully setting up a school server and granting access only to students and not other individuals
- Installing specific modifications, updating them as needed
- Ensuring the security and privacy of the server is maintained at all times
- Troubleshooting individual accounts and ensuring that all of the accounts are up-to-date and can run the modifications

However, a single teacher knowledgeable in the area is enough to guarantee the success of the program. According to Deb whose students use the server that is ran and maintained by Larry, "once I bought the accounts, there really is nothing else [to setup]…someone else does the tech support". So, using the servers that are maintained and managed by someone else is relatively easy and problem-free.

4.5.3 Opportunities for teacher gaming

The final issue in implementing game-based learning is making sure that the teachers are knowledgeable enough to use the game and are comfortable enough to play it. Calling this Professional Development is not enough as according to all three interviewers, teachers need to play the game or to at least be comfortable within the game environment in order for the program to work. According to Deb, "if teachers don't understand games, do you really want teachers to jump on that bandwagon?...It's like trying to teach French without really speaking it…using books and videos to teach French…are you going to respect that kind of a teacher?" A school that decides to implement a program using Minecraft cannot simply assign a Professional Development day and try to teach its educator how to be gamers. This type of a mentality has to come from within. Deb also warns against teachers that may have a lot of ideas and passion for gaming, but have not tried Minecraft itself. She spoke of a teacher that she met during her

summer school who wanted to adapt the Minecraft program for her own class and had "grandiose ideas she wanted to use in class", but was not at all familiar with Minecraft and how it worked. When Deb's students explained that it was a lot of work, the teacher did not understand that. "This teacher, she was going to give this assignment to them, but what if they don't like it? What if it doesn't float their boat?" So in Deb's opinion, trying the game, playing it yourself and getting lost in it is essential for Minecraft based learning to work. She went as far as saying that a teacher does not have to be a good at it or be a gaming expert. She shared her personal experience about being lost in Minecraft:

> I play Minecraft, although my classic Minecraft story is, I fell in a hole and was stuck in that damned hole for 2 weeks and someone had to come and save me. This helped me understand the Chilean miners a lot more. Although I play games, I'm not that good at it. Playing it myself and seeing my family play helped me realize that it might be kind of cool for class.

So, even a teacher who may not be familiar with games needs to only have the curiosity to try and explore in order to successfully implement Minecraft into their curriculum.

4.5.4 Student guided learning

On top of that, teachers interested in the game-based program have to be comfortable with a student-based classroom and should avoid using a teacher-centered approach. In Arnold's opinion, for a Minecraft program to be successful in class, "teachers have to be first of all comfortable not being experts…the kids are going to know more about the game than the teachers and that's not the place where the teachers are usually comfortable". In other words, being able to keep open mind and letting the students take lead or even teach the teacher is one of the more essential requirements for this program to work. Larry has a simple ideology: "I

don't organize any of the stuff, the kids organize themselves" and this ideology provides a good summary for the foundation of a game-based learning program. However, a teacher who is not familiar with games or has not played the game before and wants to introduce Minecraft in order to improve student learning or in Larry's words "dropping the game into their pre-existing program and thinking that it's going to save it" will not receive the full benefits of game-based learning.

Larry also mentioned that the teachers should avoid "spending their time doing the building and the creating, while the students are just going to be led through for example a model village or a cell or something…who's having more fun, the teachers or the students?" He added that Minecraft is an excellent platform for self-expression and being creative and lets the students create fascinating things that they are genuinely proud of and want to share with the world. A teacher who takes away the essential part of Minecraft, i.e. building and creating, and instead decides to create a theme park on a topic that has to be covered according to the curriculum is going to miss out on the incredible learning opportunity that Minecraft offers by giving the students the freedom to explore the topic by constructing everything themselves.

Therefore, in order for the Minecraft based program to have a beneficial effect on students, the teachers have to let the students guide the learning process and voice their opinions on what and how the class should proceed. The students should also be given autonomy to reach the learning goals within the game using any of the multitudes of creative ways at their disposal, avoiding specific limitations or concrete guidelines in order to preserve the essence of fun that games like Minecraft offer naturally. And most importantly, the teacher should be familiar with the game or at the least, be positive about exploring the game in their own time and occasionally playing it themselves. Interesting, Larry also mentioned that he also runs a specific teacher-only

server of Minecraft where teachers are encouraged to explore, build, create and make mistakes in order to learn Minecraft better. He added “it’s more important for teachers to play the game themselves first…to get lost in it, to explore it, to find out why it’s so engaging to students, why their kids love it”. Having such a server, which would only take minimal extra resources to setup, would allow for a multi-teacher collaborative space where teachers who are not as familiar with the game could try new things and find out if their ideas worked, as well as use the in-game chat feature to communicate with other experts who may guide them through the game and show them the strengths of Minecraft as an educational tool.

4.5.5 Education board regulations

Finally, according to Larry and Deb, there was one major problem in trying to use Minecraft server for education in Ontario and that came from trying to get the necessary permissions from the education board to run the server across several schools. Their server runs a program across five different schools in Toronto District School Board and because of the schools involved, they are required to apply for the Open Port Access permission with the board. According to Deb, the process involves the principal sending a special request to the IT department at TDSB, which took anywhere between 3 to 6 months to process. This does not stop the teachers from using the single player version of the game meanwhile, but would definitely create an organizational problem for certain schools wanting to either join a Minecraft server or create a multi-school server of their own.

4.6 Unexpected Findings

4.6.1 Parental opinion

Although one of the interview questions was in regards to the parental opinion on using the video games in education, as well as potential difficulties dealing with parents, I was quite surprised to find out such an overwhelming parental support of game-based learning, specifically when it came to Minecraft. For example Arnold mentioned a parent of two boys with Asperger's syndrome who was ecstatic when she found her two boys playing with the other kids and responding positively to the teacher figure in class.

> We actually have some kids with mental health issues that just thrive here! So, for example, a parent came in here with two sons, both with Asperger's and they came in and used Minecraft together. And the parents, she stayed and watched and she was almost in tears because she said this was the first time that she saw an interaction with a teacher figure that was so positive that it was just letting them explore their interests and kind of learn as they go. It just worked so well for them, so she just wanted to bring them here constantly, as often as possible

What this suggests is that using a virtual world and adding an online component may have created a safe place for the students to become new individuals and thus allowed them to overcome the barriers of their learning disability. In effect, this raises an interesting question of whether Asperger's syndrome and Autism labels may be detrimental to students' performance in class and why these labels seemed to have disappeared or did not affect the students' performance and interaction in Minecraft. This could be of particular benefit to students that are often forced into seclusion or isolation by traditional classroom dynamics and Minecraft could even be used to create an excellent virtual safe space to explore other difficult topics.

Diane had a similar response from the parents of her grade 3 class during the summer program that she ran. She mentioned that "parents were really happy and even got us gifts and such nice notes," adding that the program was such a great hit with kids that the parents could not be more happy.

Finally, Larry spoke of several types of parents that he had to interact with and for the most part the parents were more than happy to not only enroll the kids into the program, but would even purchase the game for in-home use. He mentioned a mom of one of his students that sent him a note asking Larry for reasons on why her child should get Minecraft for his birthday and was more than happy to support the student when the reasons were provided. He added that most parents he spoke to are "happy to see that teacher or schools are getting connected with kids and their lives and that the kids are coming back home excited about their school experience", adding that he has "yet to have a negative feedback about their child using the games in class".

4.6.2 What to avoid

I was also surprised to hear about specific things that all three interviewees mentioned that should be avoided in a game-based learning program. In Arnold's opinion, trying to integrate Minecraft into a regimented and structured classroom may become a problem and create a lot of discontent among teachers. The question of "how can we fit this game into our structure?" that some teachers pose according to Arnold may have no answer in certain situations.

Likewise, Larry mentioned that using Minecraft in a teacher led classroom with a specific goal in mind may be problematic and "suck some of the fun and authenticity of the game out of

the experience". A more open and student guided approach is what Larry suggests and uses in his own classes as well.

Deb went even further and added that trying to combine the gaming culture and the classroom culture as suggested by gamification theories today creates a "Frankenstein monster where neither culture is respected". Taking the pieces of the game without the context and trying to introduce them into your classroom is not as powerful as using the game as the foundation. She mentioned a teacher who tried to introduce math formulas on the wooden signs that are used in Minecraft as part of her math classroom and expected the students to learn them. In Deb's opinion, "this was like saying I teach outdoor education by taking kids outside and having them do worksheets on the bench". But most importantly, she mentioned that she was afraid that Minecraft might follow the same direction as comic books with publishers trying to appropriate the game and make "garbage comics that were [intended to be] educational". She disagrees with the idea of appropriating students' childhood and wants us to avoid doing the same with video games and specifically Minecraft.

4.7 Future directions of Minecraft

Deb believes that due to the game's success, it may eventually become appropriated by educational companies that may misuse and shape it into the directions that will not be enjoyable to students as she mentioned in the quote above. She is however quite positive about the future where we empower our students to speak up about what they want to learn and how. Giving the students control of their learning with teachers dictating as little as possible is what Deb hopes her Minecraft education will eventually be able to achieve.

Larry hopes that the teachers that decide to use the program come with the right mindset and introduce the program in such a way that gives it a lot of longevity. He is however concerned

that the novelty of video games may wear off in the same way that SMART boards or watching TV in class did. Nevertheless, he hopes to see a lot more sandbox games similar to Minecraft in the future that will give his students more opportunities to explore and discover. He also hopes that the education community finally takes an "intelligent, critical look at using games in classrooms" and that issues such as gender bias and equity become address in future video games as well.

Likewise, Arnold believes that now that Minecraft has established the need for creative sandbox video games, this niche is going to be around for quite some time. According to him, "Minecraft may go away, but something else will take its crown using the same creativity pieces".

CHAPTER 5: DISCUSSION

5.1 Introduction

The purpose of this study was to investigate the effects of Minecraft in an educational setting and to establish potential benefits and challenges associated with using the game in class. The interviews that were conducted over the period of this study and the analysis that followed resulted in overwhelmingly positive results that were surprising even to me. Though despite several major benefits that were discovered, some major challenges and issues also became evident.

In this chapter, I further analyze these benefits and challenges using the literature review from chapter two and relevant conclusions and recommendations are made based on the existent research and the findings from the previous chapter. This section begins with the analysis of various benefits of Minecraft in a classroom setting. It then touches on the specific issues and concerns, followed by a section on implications and recommendations that use the guidelines of successful educational systems established by Malone and Lepper (1987) and Ciampa (2013). This section ends with limitations of this study and recommendations for future research in order to establish unanswered questions and makes proposals for future studies.

5.2 Benefits of Minecraft Based Education

5.2.1 Multi-Dimensional Approach – A Tool for Every Class

One of the more interesting benefits to teachers that want to explore using Minecraft in class is that there are various ways of successfully using the game in a classroom setting. No previous studies to date have ever looked at how video games or Minecraft specifically could be used as supplemental, optional or main tools in classrooms and the only comprehensive study to

date only mentioned the potential to use Minecraft in various subjects such as chemistry, biology, geography and so on (Short, 2012). However the findings from this study indicate that Minecraft can be successfully adapted to different types of teaching styles and classroom designs. When using it as main instructional tool, similar to Larry's approach, other additional tools can be used such as adventure journals or personal diaries. As an optional tool, similar to Deb's class, a teacher may use Minecraft as one of the station's activities or give the students a choice of completing something in Minecraft rather than on paper or in another medium. As a supplementary tool, Minecraft could be connected to other technological devices or media (such as a 3D printer in Arnold's academy) and used to supplement student learning either via a 3D virtual world component or by helping the students visualize and create something that may be difficult to do without the game.

Deb referred to Minecraft as the "ultimate differentiated learning experience", suggesting that even by default, the game offers a huge variety of activities that can be done by students or used for learning. Even though this is what Short (2012) implies in his paper as well, Deb goes even further adding that Minecraft allows for cross-curricular and cross-grade approaches. In her experience, the Minecraft creations from her older students, specifically a detailed video describing minerals in Minecraft, were an excellent source of learning to be used in a completely different younger classes. This then led to new projects and resulted in students learning a relevant, but somewhat different topic of environmental stewardship that was part of that grade's curriculum. This example also indicates that it is possible to lead a successful multi-grade Minecraft program with very minimal teacher involvement and also justifies the initial investments in teacher training that may at first be a problem for some teachers (Wood, et al., 2005).

5.2.2 Multifaceted Appeal – Everyone Likes Minecraft

One of the more surprising findings was how much different types of students enjoyed playing the game. According to Arnold, "there's no specific type of a kid. It's pretty broad" and in Deb's words "we had a mix of really good and bad students and different gender as well". This suggests that Minecraft does not only appeal to gamers and students who would strive in a virtual world environment, but even to students who may normally be seen as non-gamers. A lot of these findings are congruent with the reports that listed Minecraft as the number one game amongst girls ages ten and over (Girls Decide, 2012) and the most popular computer-related activity among kids 8-10 (Zedda-Sampson, 2013).

In terms of online games, the literature suggests that both male and female players are interested in playing online with the number of females growing closer to the number of males in the last few years (ESA, 2004; ESA, 2012; Yee, 2001). This is also supported by the interviews with all three participants mentioning that both boys and girls love playing on the online server and with various types of students being interested in the game.

Only one of the students that Larry mentioned did not initially like the game because of the preconception she had about it. "So there was resistance, but she gave it a try and was into it after that," Larry stated, elaborating that the girl then found a niche she was very interested in, eventually becoming an expert and teaching other students.

Lastly, it is worth mentioning that even the parents had a very positive response to using Minecraft with some parents being exceptionally receptive, even purchasing the game for their children or sending thank you notes and presents to the instructors. Although there is no clear indication for why the parents had such a positive response, Larry suggested that parents are happy to see that the schools are connecting to their children's personal lives and that students

are finally excited about their school experience. Further studies may need to interview parents and assess their views of gaming, game-based education and Minecraft specifically.

5.2.3 Mental Health Benefits – Dr. Minecraft

Larry's use of Minecraft to assist students with anti-social tendencies and the autistic students that Arnold mentioned whose performance and behavior within the game changed to those of other students both hint on a potential use of Minecraft as a therapeutic tool or a support in mental health rehabilitation. Although there are no detailed studies to date that would indicate any therapeutic values of video games, the recent article by Granic, et al., (2014) made recommendations for further studies in using video game-based learning as cognitive behavioral therapy for various mental disorders and learning disabilities. There are however several interesting websites that talk about autistic children and their love of Minecraft, including some that were able to self-teach various subjects or skills within the game. For example, a mother from Sweden wrote a blog post about her son with Asperger's Syndrome who successfully used Minecraft to learn various essential skills such as writing and reading with some support from the mother (Stam, 2014). Another post suggests that Minecraft may appeal to people with autism because of the order and control that they crave in real life and thus assists the players in becoming at ease with each other (Stuart, 2013). Finally, an entire server dedicated to meeting and playing with other students with autism and autism-spectrum disorders was created by a Canadian father whose son was diagnosed with Autism (Porter, 2013). The server skyrocketed in popularity since its release in 2013 and as of 2014, had several hundred registered users and up to fifty people online at any time of the day (Duncan, 2014). Finding these essential human interactions is something that students with Autism find particular difficult, so these articles and

the findings from this study may suggest that Minecraft may even have some therapeutic value that needs to be investigated in more detail.

5.2.4 Social Benefits of Minecraft in Multiplayer

Minecraft is also a great tool for combining several social and technological lessons into one using the online multiplayer server. Despite the somewhat unclear findings on video games in education that were discussed in the literature review, most findings on the use of online games had a lot of positive results (e.g. Campello, et al., 2010; Ewoldsen, et al., 2012; Jang & Ryu, 2011; Lenhart, et al., 2008). For example, all three educators mentioned that using the multiplayer server allowed them to address various online safety and digital literacy issues and teach students on how to behave online and resolve conflicts. These digital skills that Arnold described as "most necessary skills in the world" can be effectively addressed by using the multi-player server and allowing the students to explore, make mistakes and learn from them with the teacher's presence and support.

For example, Arnold mentioned that he "helps kids work things out and try to err on the side of forgiving" using the Minecraft server and Deb specifically talked about an example of a potential online abuse that was turned into a teaching moment on social abuse and online safety. Furthermore, Larry's lunchtime Minecraft activity is specifically designed to teach students social skills that can be transferred to real-life situations or in other words using virtual world interaction to teach real-world skills. These conflict resolution and online safety skills are often ignored in traditional classrooms and are imperative in modern society.

Another interesting example that both Deb and Arnold provided was the increased number of high school students that wanted to assist the younger students in their Minecraft programs. Although it is possible that their reasons for volunteering were more selfish and they

just wanted to play the game, Arnold mentioned that when they come to volunteer "we give them jobs" and talked about how supportive students become. This finding goes hand in hand with the study by Ewoldsen, et al. (2012) that established a significant increase in supportive student behavior after playing online games. Also, since the high school students in these programs were in leadership role and were often responsible for helping younger students while guiding them with any game-related questions, this finding suggests that similar to a study by Jang & Ryu (2011), the students using Minecraft may "grow their leadership skills and potentially transfer them into the real world" (p. 616).

Finally, although violence in video games may be a controversial topic and is often shunned in school settings, Deb also allows her students to participate in Player-Vs-Player (PVP) battles in her class. Although some teachers may disagree with adding that feature to the multiplayer server, the article by Granic, et al., (2014) showed that violent video games may actually have various pro-social effects and decrease aggressive behaviors, which implies that even the feature that traditionally may be seen as "bad" by parents, teachers and administrators, may in effect be very beneficial to students learning if used correctly. Deb, in this case, ensures that her students understand the difference between "game-culture" and "school-culture" and mentions that she used this experience to teach them about two important life skills: knowing who the audience is and making sure to use the right vocabulary depending on the situation.

5.3 Technological Limitations and Teacher Comfort with Video Games

The limitations that teachers may face in integrating Minecraft into their school or school curriculum are quite varied and will be described using Ertmer's (1999) guidelines and barriers on technology integration at school. These two types of barriers are broadly defined as first-order barriers and second-order barriers. The first-order barriers that Ertmer (1999) defines as external

factors that do not depend on teachers include: computer availability, the technical knowledge to setup and use Minecraft server and education board approval. The second-order barriers can be defined under the umbrella term teacher comfort with video games.

5.3.1 First-Order Barriers

As mentioned in the literature review, teachers often face the lack of computers at school (Smerdon, et al., 2000) and due to the demanding nature of modern video games, not all schools will be able to afford to use Minecraft or other video game based education in their classroom. Although Minecraft computer requirements are relatively low (Mojang Support, 2014) the game still requires installation, Java support and preferably more than one computer, ultimately one per student in class. This creates a major barrier for schools in lower socio-economic-status areas and in effects may exclude those schools from partaking in the game-based learning or using the Minecraft server that is currently available in Toronto District School Board.

The technical knowledge necessary to use and play the game are quite minimal, but successfully setting up and using a Minecraft server, requires a solid understanding of various game, computer and network components. According to Larry,

> There's a lot of technical issues, huge technical issues. I mentioned I setup the server in the library and that's because I'm a bit of a computer geek, I don't mind lifting the hood on the computer and having things setup. Some teachers might not like that.

This suggests the difficulties associated with starting a new Minecraft server, which can become an even bigger problem as according to Smerdon, et al. (2000) there is often a lack of technical support or knowledgeable experts to guide teachers through the learning experience. Luckily however, only a single such expert is needed for a successful Minecraft server as according to Deb

who uses the same Minecraft server as Larry, “all the technical stuff is done by another teacher and we’re lucky in that sense.” In other words, a single knowledgeable teacher who is willing to setup, run and manage the server is enough to initiate a Minecraft based multiplayer server, which other teachers can join and use after. On top of that, partnering with universities that might be interested in supporting Minecraft based learning by providing server space or even technical support may alleviate challenges associated with the lack of technical knowledge or experience in setting up private servers.

Finally, the education board approval may add another first-order barrier as according to Deb, “there’s a lot of logistical bureaucratic stuff you have to deal with if you want to be able to use Minecraft in a multiplayer world.” In TDSB, this involved getting a written request from three principals to the board’s IT department that then took up to six months to go through. This could create a problem for some teachers as their requests in Ontario could lead to a period of time when the game could only be used in single-player mode and would thus lose the benefits associated with the multiplayer version of the game, described in the literature review and further down in the discussion section.

5.3.2 Second-Order Barriers

However despite these first-order barriers that could hypothetically be overcome with time and financial investment, the second-order barriers that will now be discussed may create a much bigger problem.

One problem that Deb identified in her interview is “If teachers don’t understand games, do you really want teachers to jump on that bandwagon?” adding that “It’s like trying to teach French without really speaking it.” Not understanding what makes Minecraft fun and trying to implement it into the curriculum just to improve student participation is unfortunately not a good strategy and may end up in a huge loss of time and money. Nevertheless, recent government funding in the US increased

the creation of so-called “educational games” (Steinkuehler, 2010) and some teachers were even encouraged to participate in summer long professional development programs that tried to help them understand how games could be used in education (Garcia, 2011). This however is unlikely to change the teacher mentality regarding video games or other technology (Ertmer, 1999). On top of that, Minecraft would also fall in the realm of game-based learning which is defined by the five principles of intrinsic motivation, learning through intense enjoyment and fun, authenticity, self-reliance and autonomy and experiential learning (Perrotta, et al., 2013) and would thus not be affected by the professional development programs or the funding as the US government is focused on educational games and not game-based learning.

Another problem that was voiced by both Arnold and Larry is with classrooms that are often teacher-led. A teacher who is used to being an expert and to a teacher-guided approach may, according to Arnold, may be stuck with a question:

> How can we fit this game into our structure? [Teachers] have to first of all be comfortable not being the experts. The kids are going to know more about the game than the teachers and that’s not the place where the teachers are usually comfortable.

Larry also added that, “If it’s teacher-led learning, this might be a problem. In a student-led classroom, [Minecraft] works great though.”

This suggests that a student-guided approach is necessary for a successful integration of Minecraft into curriculum and that being able to give students the power of being experts is necessary for the game-based learning to work. This is further reinforced by the literature review as not only are the students often able to adapt and figure out technology faster than teachers (Besnoy, et al., 2008), but may even process information differently and adapt to technological environment with a lot more

ease than their teachers (Prensky, 2001). Yet unfortunately, modern classrooms rarely allow the students to experience meaningful school-related activities using technological tools (Ito, et al., 2008), so giving the students an opportunity to use various tools, including but not limited to Minecraft is essential in helping them develop digital literacy skills necessary to function in modern day society.

Finally, since according to research, teachers often do not have enough time to explore new tools and understand their functionality (Wood, et al., 2005), it would be very difficult for non-gamer teachers to get into Minecraft in their own free time and understand what makes the game so unique and interesting to students. Since according to Ertmer (1999), certain teachers may be reluctant and refuse to adapt to new changes, using Minecraft as a school wide program or applying video games-based education to classes where teachers may feel uncomfortable using video games is also not a good idea as the teachers are unlikely to change their mindset regarding video games.

5.4 Implications and Recommendations – Effectiveness of Minecraft

Despite the quite positive findings that hint on Minecraft's success in education settings, it is necessary to go back to the study by Malone & Lepper (1987) on effective learning systems and a more recent study by Ciampa (2013) on educational systems using mobile devices. The six factors that were established to be imperative to a successful learning system are: challenge, control, curiosity, recognition, cooperation and competition. In order to answer the question om the effectiveness of Minecraft in class it is thus necessary to try to find parallels between the findings, the literature review and the six factors presented here.

5.4.1 Minecraft – Challenge and Control

Challenge was defined by Malone and Lepper (1987) as the right balance between easy and difficult whereas control was described as "a sense of personal control over meaningful outcomes" (Malone & Lepper, 1987, p. 258).

Providing the right amount of challenge in order to motivate students to continue using Minecraft and keeping the students in the optimal performance zone while balancing the difficulty levels within the game did not seem present a problem during this study. None of the participants in the study used the survival mode that is available in Minecraft where the in-game difficulty actually changes with time. All three participants instead used the creative mode within the game and relied on the creativity of students to construct various structures that ranged in difficulty from simple figures and statues to more advanced towers and pyramids that were showcased to me by Larry on the Minecraft server. This student-centered approach however resulted in the students choosing their own challenges and building various contraptions depending on how comfortable they felt in completing the project. For example, Arnold spoke of his students in the summer camp that had a choice of what they wanted to build.

> So this one girl wanted to make a rollercoaster so here was her rollercoaster. So we went into the game and started to mark off the plots and just, it was so much fun seeing them self-organize. They were building this whole week.

This self-regulation in choosing the appropriate challenge is interesting in that it gives the students the feeling of control over their own actions and choices and presents them with a set of self-defined goals. This important feature of Minecraft creates a teaching tool with an innate ability to give the students a choice to interact with their own creation in real time and work at their own pace. Whether this creation is then used as a presentation or for assessment, it gives the

students the locus of control over their own work empowering them to succeed and to learn more (Ciampa, 2013). Larry mentioned,

> When the teachers are spending their time doing the building and the creating and the students are just being led through it. For example a model of a cell or a village or something […] I'm always wary of who's having more fun, the students or the teacher. So who's really getting engaged here?

While Deb added, "Kids have better more cool plans that we do and they have these amazing ideas. Get the kids to help create the path to your curriculum expectations." Suggesting that trying to appropriate the control of the creativity that is innate to Minecraft and instead create a "theme park" that the students can explore and visit, similar to what Short (2012) did in his study on using Minecraft in science may not be as beneficial as giving the students the ability to create a particular topic themselves. Furthermore, Deb's comment suggests that Minecraft could be an excellent tool to use in organizing a curriculum that the students could be interested in by giving them the control over their own learning and letting them create the unit plan that they will enjoy being active participants in. So although Short (2012) did have positive results and reported general satisfaction and improved engagement with his students, the longevity of his "theme park" Minecraft education may be questionable. Most new technology that is introduced to class is often accompanied by the novelty effect (Krendl & Clark, 1994) and becomes less interesting with time. This may imply that due to the relatively recent release of Minecraft, students may eventually lose interest in it if it is used in a teacher-guided classroom. However identifying the successful elements in the student-guided classroom and studying them in more detail may be indispensable in developing a successful game-based classroom.

5.4.2 Minecraft – Curiosity

When assessing the curiosity component in Minecraft, it is useful to look at several facts that were mentioned in the literature review in chapter two and also looking at it from two perspectives mentioned by Ciampa (2013): sensory curiosity and cognitive curiosity.

Firstly, educational games have already been compared to "chocolate-covered broccoli" (Granic, et al., 2014, p. 74) in that they might have an educational component and be good for students, but lack the intrinsic interest and fun factor associated with the video games. This can also be compared to a game that offers a lot of sensory curiosity and looks great on the outside, but lacks the cognitive curiosity and may become boring quick.

By itself, Minecraft is very fun as demonstrated by the statistics mentioned in the literature and its popularity amongst the youth (e.g. Hilier, 2014; Dredge, 2013; Reilly, 2014), but turning it into an educational tool may, according to Larry "suck some of the fun of authenticity of the game out of the experience", implying that preserving the authentic game elements is necessary for keeping the students curious and engaged in the game.

Video games already offer a variety of sensory curiosity elements that the students may find interesting and engaging. The multimedia environment afforded by Minecraft's design offers video, audio, music, animation and interactive elements that have been previously found to evoke sensory curiosity in students (Liu, Toprac, & Yuen, 2009). During his interview, Larry mentioned that "using video games is a very big connection point" for students in his class and that they instantly arouse students' curiosity. The combination of visual, auditory and even touch (if played on a tablet) components, also create a "multidimensional learning environments which cater to multiple learning styles" (Ciampa, 2013).

On top of that, Minecraft also stimulates the students' cognitive curiosity in various ways. For one, according to Larry, "The thing about Minecraft in particular is that there's a way into it for everyone," in other words, Minecraft includes all kinds of features that guarantee that any child will like it. Even the students that have never heard of Minecraft in Larry's class enjoyed the game right away, "When I first showed it to the kids, they had no idea what it was but were interested and dove right in," which suggests that it does not take much convincing on the teacher's part to have the students use the game in class. Arnold had a similar experience and added that "It just encourages them to learn things they are really excited about and they learn all kinds of things too," implying that Minecraft genuinely encourages students to explore topics and makes them more interesting.

Cognitive curiosity is further aroused by the exploration of the game world that the students can do at any time and the introduction of various modifications to the game that add a novelty effect. In terms of size, a single randomly generated Minecraft world has been compared to the total area of planet Neptune or about 15 times larger than the area of planet Earth (Peel, 2014), which means that exploring and discovering everything in the game is nearly impossible and students who are curious adventurers would find quite a lot of area to cover. Also, allowing the students to engage in self-directed learning outside of class by accessing the Minecraft server outside of school hours (Sharples, et al., 2007) further encourages the students to explore and learn within Minecraft. Finally, the game modifications that can change the game from something as simple as a visual look to something more dramatic such as an entirely new world and a universe to explore add another level of novelty and interest. As of early 2014, there were over 6000 various modifications and over 26000 various textures available for free (Planet Minecraft, 2014) with the number growing on daily bases due to the game's popularity.

So both sensory and cognitive curiosity can be easily aroused by the game if used in a game-based learning environment and as long as Minecraft is not used as an educational game by introducing various teacher-guided activities. Using a teacher-guided approach in Minecraft may unfortunately lead to the arousal of sensory, but not necessarily cognitive curiosities. In other words, a teacher may excite students with the visual, auditory and interactive elements inherent to Minecraft, but not provide the students with enough mental stimulation to continue playing beyond the class time or stimulate their intrinsic desire to explore.

5.4.3 Multiplayer Server - Recognition

Despite the innate intrinsic interests the students might have in Minecraft, one cannot ignore the power of extrinsic motivators that provide positive feelings and a continued motivation to learn (Maehr, 1976). Recognition is defined by Ciampa (2013) as "enjoying having efforts and accomplishments recognized and appreciated by others". The students' genuine pride in their work that all three participants discussed and the gratification of being able to present your work to others that Minecraft facilitates with a persistent online server allow the teachers to create an engaging environment where students' work is visible to others (Malone & Lepper, 1987).

For example Larry talked about using journals as the way for students to express their in-game exploration while using this as a written component in his language class,

> [Students] were always so full of stories and so eager to tell that I've never had a problem with them avoiding work or coming up with excuses that they don't want to do things. It's something that's meaningful to them and connects to them.

The desire to showcase their work and the pride that the students had in their in-game accomplishments were an excellent driving force for them to continue submitting their work and in effect practice the writing and language skills that were required of them by the school board. He also added,

> My focus with video games in schools is with kids who are struggling with reading and writing, […] they don't see themselves as writers or readers. So before, having them do any work was like pulling their teeth. But with Minecraft in particular, there's such an avenue for discovery that after they've played a bit, there's always something they want to share their knowledge about, so it's this engagement piece that gets them writing.

As teachers, this is exactly what we often want the students to do and having a tool that engages their expression without the need for remediation or threats of detention could potentially change the approach that a lot of traditional classrooms take. Having the students produce work that can then be used to address their spelling, grammar, subject understanding or any other curriculum expectation is essentially one of the more powerful features of using Minecraft in education.

5.4.4 Multiplayer Server - Cooperation and Competition

The use of cooperation and competition is essential to make a more effective educational technique as mentioned by Ciampa (2013) and Malone and Lepper (1987). Cooperation, according to Ciampa (2013) is "a group of individuals working together to attain a common goal" and competition is defined as "two or more people or groups having directly opposing goals." However without direct observation of students at work in Minecraft, it is quite difficult to ascertain whether these two components are well addressed within the game.

Nevertheless, since many students spend a lot more time using various mobile and internet technology outside of school than inside their classroom (Walker & Shepard, 2011), the use of an online server would create an opportunity for students to continue learning even outside of class. The ability to access the multiplayer server even outside of school hours enables the students to learn at their own pace and engage in self-guided informal learning at home or anywhere else they have access to the internet (Sharples, et al., 2007). On top of this, the ability to setup secure, whitelisted server that can only be used by pre-approved students with log files that are saved on the server to keep track of all user actions allows for the creation of a very safe learning environment. Added to this is the ability to use internet search tools or other mobile devices to cultivate students' curiosity related to the game-based learning and "[providing] easier access to a wealth of new information" (Ciampa, 2013, p. 91). This in effect calls for a critical review of various social aspects of the game that could become internalized in students playing on the Minecraft server.

On the one hand using the multiplayer feature in Minecraft allowed for the creation of a very inclusive learning environment that engaged all students regardless of age, gender or disability. Deb mentioned that the schools that are currently participating in the multi-school Minecraft server differ in both students' ages and socio-economic status, but that all of the students worked together well and none of the participants mentioned any kind of discrimination in the game. This is congruent with other research on technology in education (Wellings & Levine, 2009) and presents the possibility of creating a virtual classroom that could engage diverse learners of various skills and abilities, removing various barriers to learning (Ciampa, 2013). On the other hand however, Larry also mentioned,

> I'm hoping we'll see an intelligent and critical look in general at using games in classrooms, cause games are great but are hugely problematic in their representation of gender, ethnicity, basically inclusivity that we're not talking about right now [….] For example, the fact that when you play Minecraft, your default character is a white guy named Steve. When I show it to my students at school, they're not white dudes named Steve. That's not voiced, but can be internalized and we have to try to break down these barriers.

Despite there being no apparent discrimination within the game, and the use of online server created equal grounds for all of the students that used it, the game design itself presented a somewhat discriminatory view of white male dominance as the character named "Steve" is the default choice for a new player entering the game. This could be exacerbated by the fact that certain students may be privileged to have an advantage to accessing Minecraft-based education compared to students from schools that cannot afford to introduce the program. This virtual diversity barrier could then become internalized, creating new grounds for discrimination. Alternatively, it could present an opportunity for a safe dialogue on issues such as race, ethnicity, language, gender and class distinction, identity markers and other diversity topics. This discussion needs to be further addressed in future studies in regards to possible recommendations for the educational version of the game MinecraftEDU.

When it comes to competition however, the findings were not as clear. Previous research on competition using mobile tools found that using visual multimedia technology in class often supported mastery-oriented evaluation rather than performance-oriented evaluation. In other words, the students strived to be masters at their tasks rather than competing with others and trying to be better than them (Ciampa, 2013). On top of that, Hou (2012) found that using a

specifically designed online game to test students where competition was a big factor, reinforced mastery learning and increase student performance. This is also congruent with one of the six factors mentioned by Ciampa (2013) and Malone and Lepper (1987) for the creation of an effective educational technique and thus warrants a closer look in the future. Therefore, it would be interesting to find out if Minecraft too encourages a similar environment that helps students to increase their own competence rather than outperform peers and if the competition in the game improves intrinsically motivated learning by providing the right level of difficulty and direct feedback (Malone & Lepper, 1987).

5.5 Limitations and Future Research

5.5.1 Video Game Addiction

One of the areas that has not been addressed by this study and could potentially be of interest to future researchers is whether addiction could become an issue if the game is overused in class. Arnold cautioned during his interview "It's easy to get addicted to video games, addicted to Minecraft in that it starts to shut out other areas that are important in your life" which could also indicate that as the game becomes more popular in a classroom setting, a lot more resistance may be met from the parents and the administration as the students start to ignore other work or commitments in life. As previously mentioned in the literature review, there are medical indications that video games could produce dependence-like behavior (American Medical Association, 2007) by producing large amounts of dopamine (Koepp et al., 1998), which suggests that specific guidelines may need to become available in the future for teachers that want to adapt the use of Minecraft or other popular video games in their classroom.

5.5.2 Violence and PVP Servers

Due to recent studies on the benefits of online games (e.g. Campello, et al., 2010; Ewoldsen et al., 2012; Lenhart et al., 2008) along with the study that suggests violent video games may be beneficial to social development (Granic, et al., 2014), more studies are needed on the potential benefits of using Player-Vs-Player (PVP) servers in Minecraft and their effects on students. These studies could also focus on specific features of PVP and violence that seem to add pro-social elements to education despite the negative perception these games receive in the press.

5.5.3 Sandbox Games in Education

Other studies could also assess other sandbox games and their use in education in order to establish parallels between the findings in this study and similar literature and come up with specific features of sandbox games that may be responsible for the apparent success of games like Minecraft in video game-based learning. Games like Civilization, Kerbal Space Program, Universe Sandbox and Crayon Physics have already started to be noticed in education (Silverman, 2011), with Kerbal Space Program getting an EDU upgrade as of early 2014 (KerbalEDU, 2014). Further investigation of this sandbox phenomenon might be required in order to establish specific features of these games that are responsible for their success in education.

5.6 Conclusion

Prior to this study, it was unclear whether any teachers in Ontario would be interested in being interviewed about Minecraft or if any of the public school educators were familiar with the game. To my surprise, I was able to find several teachers that were quite passionate about the game and already used it in class with a lot of success stories to tell. There has also been a major

news coverage about the introduction of the game as part of the mandatory curriculum in a school in Sweden (Dunn, 2013) and more recently, a news segment from the Canadian news agency that talked about the use of Minecraft by a math teacher in the Peel region in Ontario (Parness, 2014). This helped drive my excitement about the project and encouraged me to persevere despite the initial setbacks in finding the participants.

The positive findings in this study suggest that Minecraft could be an excellent tool to use in any classroom environment. The game's strength lies in its appeal to a wide range of users, its already established popularity, its versatility and multifaceted use and various supports that are already available, such as the teacher specific modification from MinecraftEDU. The game also seems to show promise as a therapeutic tool and could be used to assist students with learning disabilities in developing real-life skills. It also creates an excellent environment in helping students develop social, digital literacy and online safety skills.

Despite all this, there are certainly a lot of barriers to overcome, such as the initial cost of software and most importantly, the hardware necessary to run the game. Without the computers or other means of playing the game, it would be quite impossible to use this technique, suggesting that schools with financial constraints are unlikely to benefit from Minecraft based education. On top of that, teacher mentality and preconceptions about video games may further limit the introduction of Minecraft to various classroom environments. The teachers that are interested in introducing Minecraft into their classroom have to maintain a student-guided approach and let the students become the experts. It is thus important for a teacher to have the necessary curiosity and an open mind to let the students try new things and have fun while learning. As this qualitative study showed, Minecraft is a very powerful tool in education, but it

can only work if teachers relinquish control that traditional classrooms require and let the students immerse themselves in the game and guide their own learning.

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APPENDICES

Appendix A: Letter of Consent for the Interview

Letter of Consent for the Interview

My name is Anton Petrov and I am a graduate student at University of Toronto, enrolled in a Master of Teaching program at OISE. My research project is focused on learning about the usage of computer games in education with the specific focus on a game called Minecraft. One of my goals is to discover the educational benefits and limitations of this teaching technique and other issues facing modern teachers that are trying to integrate gaming technology into the classrooms. I believe your knowledge and expertise on the subject will benefit me greatly and will provide a lot of insight on the topic.

The data collection for this project involves a 30-45 minute audio-recorded interview at a time convenient for you. The contents of this interview will remain anonymous and a pseudonym will be used if necessary. Your specific responses will be used for my research project and will only be accessible to my supervisor and me. All of your information will remain confidential.

All of the raw data collected will be destroyed within five years after the interview, but you may have a copy of all notes and the transcript upon request. Please be assured that your participation is completely voluntary and you may withdraw from the study at any time, up to the time of submission of the paper. If you choose to withdraw, all of the notes and transcripts will be destroyed immediately.

The results of this research project will shed more light on the usage of Minecraft as an educational tool and will contribute to a longer study about educational affordances of Minecraft.

A summary of my research as well as the full report will be sent to you upon request. Please feel free to contact either myself or my supervisor, Rob Simon, if you have any further questions.

Please sign below if you agree with this consent letter and if you would like to participate and either return it by email to anton.petrov@mail.utoronto.ca or hand it to me on our first meeting. Thanks you in advance for your help on this project.

Yours sincerely,

Anton Petrov
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Dr. Rob Simon
Research Supervisor
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Consent Form

I acknowledge that the topic of this interview has been explained to me and that any questions that I have asked have been answered to my satisfaction. I understand that I can withdraw at any time without penalty.

I have read the letter provided to me by Anton Petrov and agree to participate in an interview for the purposes described.

Signature: _____

Name (printed): _____

Date: _____

Appendix B: Interview Questions

The teacher and the school

1) What is your professional background?
2) Could you tell me more about the school you work for?
3) How do you run your classes? (provide an example of how you use Minecraft)

Students

1) Who are your students?
   - What are their interests?
   - How do they respond to this educational technique?

Reasons for using it

1) Could you tell me about your discovery of Minecraft?
   - What is your interest in gaming?
   - Were there critical decisions in your life that led you to choose this educational tool?
2) Why did you choose to use it in education? (Professional trajectory)
   - How and why did your school decide to use Minecraft?

PROs/CONs

1) What are some of the affordances/challenges of using this particular game in education?
   - Are there any shortcomings or challenges to using this education strategy?
   - What can be improved?
2) What are some of the initial investments necessary to implement this program at a school?

Parents

1) What do parents think? What is their position on gaming in education?
2) Do you get to interact with parents and if so what is their opinion?

Future/Way forward

1) What is the future of using Minecraft in the classroom?
2) How can using Minecraft benefit the future generation of students?
   - How about teachers?