BUILDING BLOCKS:

CHILDREN'S OPEN-ENDED PLAY IN MINECRAFT

by

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ABSTRACT

Building Blocks: Children's Open-Ended Play in Minecraft
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This qualitative research study tracks the evolution of the video game *Minecraft* as a tool for education and connects it with constructionist theories of learning. It highlights an emerging model of pedagogy that severs these constructionist connections in favour of heteronomous, teacher-directed lessons that limit children's autonomy and negate their affinity with cultures surrounding *Minecraft*. To explore alternatives to this teaching model, eight children, aged 6 to 8 years, engaged in open-ended, self-directed play in *Minecraft* over four 20-minute sessions and shared their experiences through focus group discussions. The results highlight the importance for educators to create a constructionist culture around *Minecraft* by allowing children to autonomously pursue their intrinsic interests and respecting their affinity with practices not traditionally welcomed in the classroom, including playing with in-game explosives. The paper concludes with guidelines for teachers to implement these practices and create a constructionist culture in their own classrooms.

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Thank you also to all the students with whom I've had the honour to teach using Minecraft. Their TNT-filled explorations showed me the power of intrinsically-motivated, inquiry-based learning and sent me on this journey to explore my own learning.

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And finally, thanks to my GamingEdus colleagues who joined me in the Minecraft fun way back when it was a weird game few teachers had heard about. Your camaraderie and friendship over the last few years has made teaching with Minecraft more fun than a barrel of creepers.

DEDICATION

To the students and teachers who play with TNT.

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CHAPTER 1: INTRODUCTION TO MINECRAFT

Messy Learning with Minecraft

I first knew I was on to something when my students destroyed their brand new island. It was my first time teaching with *Minecraft,* and it was chaotic, messy and full of learning (O'Donnell, 2011). And not just for the students. I quickly abandoned my carefully-planned lesson as the Grade 5s and 6s charged through the well-stocked starting area I had created and snatched everything in sight. They ignored the posted signs telling them to share, instead hoarding the food, tools and weapons like a pack of raiding pirates. They smashed the signs and took them, too. They whooped with delight at each new discovery and ran amok for a full twenty minutes, falling in lava, getting lost in the woods and attacking each other with pork chops. This chaos was followed by the longest stretch of quiet writing I had ever seen from them. For fifteen minutes, these students who regularly resist putting pencil to paper wrote in silence about their adventures in the game. That's when I realized *Minecraft* was a powerful tool for teaching.

What is Minecraft?

First released in 2009, *Minecraft* is described by its makers, Mojang AB, as "a game about placing blocks" (Mojang AB, 2016a). Created by Markus "Notch" Persson, a computer programmer from Sweden, *Minecraft* is a video game with no plot, no quests and no end goal (Nebel, Schneider, & Rey, 2016). With more than with more than 24 million copies of the desktop computer version sold, *Minecraft* is very much a global success (Mojang AB, 2016c). *Minecraft* is part of the sandbox genre of video games where players focus on modifying their virtual environment, rather than progressing through levels by defeating monsters or solving puzzles (Techopedia, 2016). In *Minecraft*, players break and place blocks to build just about

anything they can imagine, from shelters to roller coasters and beyond. Players also harvest resources like wood, coal and more and combine these resources to 'craft' everything from tools and machines to weapons and cake and much, much more. It's blocky look and focus on building has drawn many comparisons to Lego (Collins, 2014). There are now versions of *Minecraft* for multiple digital platforms, including desktop computers, video game consoles, smartphones and tablets (Mojang AB, 2016a).

The game's popularity with young people (Thompson, 2016) and its potential for creativity has led a growing number of Kindergarten to Grade 12 (K-12) educators to use *Minecraft* as a tool for teaching in their classrooms (Lorence, 2015). This interest has been followed by the release of educational versions of *Minecraft* (Mojang AB, 2016b), which help educators shoehorn its limitless creative potential into their very limited curriculum targets. *Minecraft*'s use by teachers in classrooms is the focus of this study. The changes to the game will be explored further, but first some personal context is needed.

Bringing the Blocks to School

I am one of those educators using *Minecraft* in the classroom. The scene described above is from the first time I introduced the game to a group of students who came to me for extra support with reading and writing. The students' explorations beginning that day fuelled our collective learning for the rest of the school year and sent me on a journey to share the power of learning in *Minecraft* with my fellow educators.

This was in 2011, and in the months that followed, I wrote blog posts, spoke at education technology conferences and talked to the media about *Minecraft* and learning (Chung, 2013; ECOO, 2012; O'Donnell, 2011). I also partnered with the EDGE Lab at Ryerson University

(EDGE Lab, 2015) to create the GamingEdus Project (GamingEdus, 2016), a series of *Minecraft* worlds designed for teachers to play the game and learn how to use it in their classrooms. Along with my teacher colleagues, I created the Multi-School Minecraft Server to provide an online space for teachers to play the game with their students during school (O'Donnell, 2013b). In less than a year, there were nearly a dozen teachers and their students from schools around the globe playing together in this digital commons (O'Donnell, 2013a).

By the middle of 2011, *Minecraft* had become a global phenomenon, but its use in schools was limited to early adopters and tech-savvy teachers (Thompson, 2016). *Minecraft* was weird, had no rules and graphics that belonged in the 1980s. It did not come from an educational company, and it was not yet endorsed by school boards or leading educators. It did not have the traditional features commonly seen in educational software like curriculum-specific games with built-in assessment tools (Ito, 2008). *Minecraft* was about as far from school as you could get, and for educators like me that's what made it perfect for engaging our most reluctant learners. The Grades 5 and 6 students I was working with at the time were already fed up with school. They knew they were not reading or writing at grade level and were quick to reject anything that smelled too much like school work. For these students, the fact that *Minecraft* was weird and unlike anything they had experienced in class was in itself a reason to engage with it. *Minecraft* did not remain completely free from the scent of school for long.

Schooling Minecraft

In early 2012, TeacherGaming LLC, an independent game company, launched *MinecraftEdu*, an authorized education version of *Minecraft* with features that made it easier for teachers to use the game in their classrooms (Waxman,2012). *MinecraftEdu* was a modified

version of *Minecraft* with an added set of tools designed specifically for teachers. In addition to making the game simpler to set up on school computers, *MinecraftEdu* came with a set of classroom management tools that allowed teachers to freeze the students' characters while in game, prohibit students' access to specific materials and mute students, so they could not type messages into the game's chat system (MinecraftEdu, 2014a). With these new tools that controlled students' movements, limited their choices and silenced their voices, *Minecraft* had officially picked up the telltale aroma of school.

In 2014, Microsoft purchased Mojang AB, the makers of *Minecraft* (Perez, 2016). In 2016, Microsoft also bought *MinecraftEdu* from TeacherGaming LLC and discontinued its development (Barack, 2016). They went on to launch their own educational version of the game, *Minecraft: Education Edition*, with similar classroom management tools for teachers in the summer of 2016 (Perez, 2016). With the resources of Microsoft now behind it, *Minecraft* as a tool for learning had hit the mainstream. How *Minecraft* (and other video games yet to be developed) will be used in the classrooms of the future is being defined today. At this critical stage in *Minecraft's* evolution as teaching tool, a dominant pedagogical paradigm is emerging from educators that further pushes the students to the sidelines and misses out on the true learning potential *Minecraft* offers.

Teacher, Leave Those Blocks Alone

On the way from being weirdo to teacher's pet, *Minecraft* has retained its power for creativity and problem solving, but the race to cover the curriculum and increase test scores has led to much of this creating and problem solving not being done by the students, but by the teachers (Gallagher, 2014).

This learning model involves a top-down, teacher-centric approach with pre-built structures and activities in *Minecraft* that focus on efficient delivery of the curriculum. These prescribed, curriculum-based activities are often designed and built by teachers with the goal of leading children through step-by-step procedures to learn a specific topic, such as geometry or ancient history (Dikkers, 2015; Gallagher, 2014). When used in this way, teachers turn *Minecraft* into little more than a digital worksheet. They remove the potential for constructivist learning (Kamii & DeVries, 1993) by not allowing children to build their knowledge through autonomous interaction with the game environment.

Purpose of this Study

This qualitative research study explores the opportunities for Digital Games-Based Learning (DGBL) through self-directed, open-ended play in *Minecraft* with children in aged 6 to 8 years in Toronto, Canada. By focusing on student autonomy and connecting *Minecraft* with the rich history of computers in the classroom, alternative teaching models become clear and the power of learning in *Minecraft* can be harnessed equitably and to its full potential.

CHAPTER 2: LITERATURE REVIEW

Computers Arrive in the Classroom

The late 1990s saw a marked increase in school spending across the United States and Canada on new technologies like desktop computers and network infrastructure as school boards worked to update their capabilities to prepare students for the new millennium (Cuban, 2009). As personal computers arrived in classrooms, Armstrong and Casement (1998) raised concerns about the cost to schools' limited budgets to acquire technology, like desktop computers, while questioning the educational benefits they offer children. Additionally, they expressed concern over the growing influence of private interests in the public education system as schools opened their doors to Microsoft, Dell, Apple and a host of software companies promising student success through educational software. Just because computers *can* be used in schools, they argued, does not mean they *should* be in schools. Armstrong and Casement (1998) warn that without identifying specific education goals, bringing technology into the classroom can become merely an excuse for purchasing expensive new toys.

Before adopting a new technology, Postman (1999) challenges us to ask what is the problem that a particular piece of technology is designed to solve. He sees this as a crucial question because the problems technology claims to answer are often insignificant to the average person, or their significance is an illusion created through marketing with the end goal of selling products. Postman (1999) reminds us that we, the users of technology, are ultimately in charge and that we do not have to go in the direction technology leads us. We have, he argues, a responsibility to ask questions of the technology with which we engage.

While we have the advantage of nearly twenty years of hindsight to counter many of Armstrong and Casement's (1998) and Postman's (1999) dire predictions, their concerns around the absence of criticality from society in general and educators in particular when bringing new technology into the classroom are as valid today as they were in the 1990s.

In today's Wi-Fi enabled classroom where iPads and laptops are as common as lunch bags and late slips, few educators are critically examining their approaches to new technology. This is evident in the growing number of K-12 educators who are unquestioningly branding themselves as a Google Certified Educator, Microsoft Innovative Educator Expert or Apple Distinguished Educator (Apple in Education, 2016; Google for Education 2016; Microsoft, 2016). For these educators, and the many more they influence, teaching with technology in the 21st century means education philosophy and teaching practices are shaped by the same company who sold the school the class set of shiny new tablets and that software-as-service plan with low, monthly payments. Postman (1999), Armstrong and Casement (1998) might have issued their warnings in the previous century when computers belonged on desktops and software came on CD-ROMs, but as we will see with *Minecraft*, a little critical thinking can go a long way to helping the children escape the eduscape of branded teachers and platform-dependent schools.

Papert's Turtle

When it comes to thinking about thinking and technology, Papert (1980) and his view of computers as "objects-to-think-with" (p. 11) lays out the route for this escape. Papert (1980) argued that computers could get young people thinking, building and innovating. A student of Jean Piaget, Papert expanded Piaget's concept of constructivism, that children build knowledge

through engagement with their environment, to introduce the idea of constructionism (Harel & Papert, 1991). Constructionism adds that this knowledge building is especially successful when a child is consciously constructing something that exists outside of themselves, which Harel and Papert (1991) called a "public entity" (p. 1). The authors use the image of a child building a sand castle on the beach as constructionism at work. Papert developed Logo, a computer programming environment that put into action his constructionist theories by allowing children to communicate with computers rather than simply consume information from the machine, as had been the practice in the past (Papert, 1980). With Logo, Papert sought to counter the power dynamic between child and computer. Instead of the computer-aided instruction model, where computers taught children through educational software, children taught the computer through programming. The object of Logo is to move a cartoon turtle, known simply as Turtle, around the computer screen by inputting commands telling it how many steps to take, which direction to turn and more. In this way, Turtle transformed the computer into an 'object-to-think-with' where children constructed their mathematical knowledge through interaction with the machine in the Logo programming environment. Papert (1980) recognized that moving a cartoon turtle across a screen is only one element of the learning happening with Logo. The most powerful constructionist learning, he argued, occurs with educational objects "in which there is an intersection of cultural presence, embedded knowledge and the possibility of personal identification" (p 11). Logo captured this cultural presence by connecting children's learning to the growing popularity of a new technology, the personal computer, while using elements that children could identify with, a cartoon Turtle. In this way, playing with Logo became more than just an activity to be completed in school. The Logo programming environment provided

children a space to explore, experiment, fail and persevere with their own thinking at their own pace. Papert also hoped these educational objects would serve as a model for other objects, yet to be invented. Nearly 30 years later, Markus "Notch" Persson, who learned to program computers by copying code from the back of technology magazines, would create just such an educational object with the video game *Minecraft* (Parkin, 2013).

Bruckman's MOOSE

Before *Minecraft* landed in schools, Bruckman (1997) explored children's constructionist learning in digital environments with MOOSE Crossing, a text-based virtual world. Created by Bruckman, MOOSE Crossing was used to explore the ways in which community and constructionist activities mutually support each other. Bruckman (1997) argued that the diverse knowledge of a community can help its members learn through constructionist practices of creation and collaboration. Conversely, these constructionist practices create a strong and supportive community.

Bruckman's (1997) focus on collaboration and community clarified Papert's ideas to underscore that the success of constructionist ethos relies equally on the people doing the building and supporting as much as the tools they use to create. Tools or communities, Bruckman (1997) argues, can only be effectively constructionist when they are embedded in what the author calls a "constructionist culture" (p. 17), the educational philosophy that drove the creation of a learning tool or activity around which the community is formed. Bruckman's (1997) observations from twenty years ago on the role of the community to support constructionist learning will be useful when we look at how teachers are using *Minecraft* today.

Education Meets Entertainment

As personal computers continued to appear in homes and schools in the 1980s through to the 2000s, a steady flow of educational games, often referred to as edutainment software, also appeared. Ito's (2008) overview of children's software charts the innovations in this media from the early instruction systems like PLATO and Wicat up to the popular *SimCity* series of games. Ito (2008) places children's software into three genres: academic, entertainment and construction. Academic games, like the successful *Math Blaster* series, focused behaviourist approaches to gameplay, rewarding players for completing academic-focused mini-games (smaller challenges within the overall story-based adventure of the game) with points, badges or special effects. Games in the entertainment genre, like *Where in the World is Carmen Sandiego?,* downplayed academics in favour of family-friendly fun, appropriate for young children. The construction genre has the closest ties to Papert's (1980) vision of technology enabling children to be builders of knowledge. Early examples include graphics programs like *KidPix* and world-building games like the *SimCity* series. This final group of games all placed the tools of creation in the hands of the young player, giving them powers to make or break their worlds to fit their vision. Ito (2008) sees the construction genre as having the greatest potential for transforming the conditions of childhood learning in the future. With the global success of *Minecraft* (Mojang AB, 2016c), a game that is all about construction, one could say it was an accurate prediction.

Commercial Video Games as Teachers

Gee (2003) delves into video game worlds designed exclusively for the commercial market, often not specifically for children, to seek out games that hold potential benefits for children's literacy learning. Gee (2003) sees in these games evidence of young players

participating in communities of practice, groups connected by a shared interest, that often leave non-gamers (e.g. parents and teachers) on the outside unable to comprehend what exactly the children are up to. Gee's (2003) biggest contributions to the games in education movement were to validate the use of commercial, Off The Shelf (OTS) video games as opportunities for learning and introduce the term Digital Games Based Learning to teachers and administrators around the globe. His work in this regard set the stage *Minecraft*'s acceptance in schools a decade later.

Shaffer (2006) investigated *how* these OTS games can be used in classrooms. He suggested educators bringing games into the classroom consider the epistemic frames used by professionals when their jobs require them to think in innovative ways. Shaffer defines epistemic frames as the collections of skills, knowledge, identities, values and epistemology that professionals, like engineers, designers and artists bring to their work when thinking about problems and justifying their solutions (Shaffer, 2006). The examples he cites have students putting on these epistemic frames like eye-glasses to view the world (and their school task) as engineers, scientists and other highly skilled professions. This idea can be seen in many of the teacher-created DGBL lesson plans, particularly for *Minecraft*, that have students role play civil engineers in charge of a city, scientists in the race for a cure and other scenarios.

Steinkuehler (2004, 2006 and 2007) found many literacy learning opportunities for teenagers playing online video games like *World of Warcraft*, but also revealed how the role of the teacher in these lessons is just as important as the game being played. In DMLResearchHub (2011), she talks of her experience organizing a video game club for teenagers at her research lab. Steinkuehler recalls how the enthusiasm from the video game-loving participants fizzled as she laid out her plans for them to create websites, blogs and other literacy activities based around

their gaming experiences. Her solution was to step back, let the teenagers play the game in their own way and let the opportunities for literacy learning appear organically from the teenager's interests. As this happened, Steinkuehler and her team provided resources to support these interests, such as acquiring graphic novels based on *World of Warcraft* when the teenagers expressed an interest in learning more about the game world. For adults seeking to use video games to teach children, knowing when to step back is perhaps their most important job. Unfortunately, it is a concept many teachers find difficult to grasp as recent research around *Minecraft* is beginning to demonstrate.

Academic Research of Minecraft in the Classroom

There is a growing body of academic research looking at how educators are using *Minecraft* in the classroom. Schifter and Cipollone (2015) draw a connection between *Minecraft* and Papert's constructionist theories in their study that observed how one high school teacher used *Minecraft* with his students to create movies, known as machinima, to display their knowledge of plot and characterization for their English literature course. The authors make the connection that *Minecraft* is the modern equivalent of Papert's Turtle, which provides children a digital space in which they can relate to their environment and intellectual structures of knowing (Schifter & Cipollone, 2015). They note that while *Minecraft* is a constructionist tool, the style of teaching required to allow this type of learning is not commonly found in schools today. The teacher in their study relates how his colleagues thought he was wasting his time using *Minecraft* and suggested that he just give the students a short presentation on the topic and be done with it. The authors credit the teacher for being willing to take the chance by giving his students the freedom to explore *Minecraft* to meet the learning goals of the assignment. This focus on the

teacher's practice shows that simply bringing a video game like *Minecraft* into a school is not enough to create rich, constructionist learning. As Bruckman (1997), noted the constructionist ethos comes from the culture around the tool and not the tool itself.

Bos, Wilder, Cook and O'Donnell (2014) look at one educator who used in *Minecraft* to teach a specific strand of the mathematics curriculum to Grade 3 students. The authors offer a good example of how teachers often design scenarios in the game to provide a purpose for students to use the skills they have learned in class. In this case, the teacher used DGBL to deepen his students' understandings of area and perimeter by challenging them to build a coastal town that contained buildings and piers with specific dimensions. Each block represented one square meter, so students were challenged to create structures like a bait shop with a perimeter of 12 meters and a pier with the area of 12 square meters. The children's constructions led to class discussions around the structures' shapes and their relationship to perimeter and area. Here we see the teacher fostering a constructionist culture with his use of *Minecraft*. He presented his students a bare-bones scenario with an academic challenge and then stepped back to allow the students the cognitive space to construct their knowledge through the process of constructing their buildings.

Burnett and Bailey (2014) observed 10 and 11-year-old children playing *Minecraft* during a lunchtime Minecraft Club in a primary classroom in the United Kingdom. The authors focused their research on children's collaboration as they switched their attention from the computers screens showing the virtual world of *Minecraft* to the real world of their in-school club. With no set curricular goals, the children had the freedom to play and explore *Minecraft* as they liked. Through the children's self-directed, open-ended play, the authors witnessed a fast-

paced, free-flow of knowledge building and sharing that was loud, kinetic and very unlike what typically happens in classrooms. Children shouted instructions to each other across the room and sometimes *through* their screens, as if shouting at a friend's avatar would have the same effect as calling directly to them. Children played elaborate pranks on each other that involved constructions that trapped their unwitting friends in between walls or sent them plummeting into pools of lava and their untimely virtual demise. The children also clashed when builds were destroyed, leading to tension between groups of players. Some children built elaborate structures while others rarely built anything and chose to spend their time touring the landscape, exploring and playing with creations they happened upon.

Many worlds away (literally) from the student-led, open-ended play in Burnett and Bailey (2014) is the classroom use of *Minecraft* observed by Saez-Lopez, Miller, Vázquez-Cano and Dominguez-Garrido (2015). Their research into the pedagogical benefit of using *Minecraft* brought them into Grades 6 and 8 history classrooms in the United States and Spain. Gameplay involved students moving their characters through teacher-built replicas of the Roman Coliseum and other historical sites. Students then completed a quiz about the buildings they visited. The significance of the findings from Saez-Lopez et al. (2015) is the way it reveals how *Minecraft* is sometimes used by educators. Leading students through a pre-made world removes from them opportunities to construct their own knowledge, through research, theory-building and problem-solving, by having them build the monuments themselves. The banking model of education (Freire, 2000) is alive and well in the digital age, where the student's autonomy is often removed, and their role is reduced to passive observer moving through a virtual amusement park of learning.

Dikkers (2015) interviewed teachers from North America, Europe, Australia and Asia who use *Minecraft* in their classrooms and found that how the game was used varied from subject to subject. Language Arts teachers were more likely to give open creative time, allowing their students to build freely and then connect what they built to the curriculum. Science and math teachers tended to use pre-built environments that forced students to focus their gameplay on performing in-game tasks in an effort to teach specific areas of the curriculum. Dikkers (2015) acknowledged the study's limitations and that the findings cannot be generalized the larger community of educators. While this may be true, examples of this 'we build it and they will learn' approach are becoming increasingly prevalent as more teachers bring *Minecraft* into their classroom.

Teachers Talking to Teachers Using Minecraft

As the use of *Minecraft* in schools becomes a mainstream teaching practice, the popular press has stepped in provide educators with how-to guides and lesson plans that promise an out-of-the-box DGBL experience. Gallagher (2014) draws together the work of ten teachers using *Minecraft* to share how they use the game in school. Each of these educators has extensive experience using *Minecraft* and are well-known within the DGBL community. From Science and Math to Language Arts and the Humanities, the pattern of 'teacher builds, students explore' is consistent throughout each educator's practice. The lessons are innovative and certainly more engaging than a traditional sage-on-the-stage format of instruction, but by doing all the building themselves these teachers are robbing their students of opportunities for their own constructionist learning. To teach measurement to his Grade 8 students, one teacher spent 30 hours creating a world called Mathlandia, filled with quests and challenges connected to the math curriculum

(Gallagher, 2014). His students, many of whom had not played *Minecraft* before spent one 45-minute session going over the controls before being brought into the world of Mathlandia. The result was that many students completely ignored the teacher's math tasks and chose to explore the world on their own and in their own way. After three hours of gameplay only two students completed all the math tasks (Gallagher, 2014). Another teacher spent over 800 hours building in *Minecraft* to create a world that was a virtual re-creation of ancient history (Gallagher, 2014). Known as *The Wonderful World of Humanities*, this world is available for teachers to download free of charge (MinecraftEdu, 2014c) and is an impressive example of what can be built in *Minecraft*. Unfortunately, it is the adult who did all the construction and in the process all of learning. This teacher admits to taking a "Disneyland approach" (Gallagher, 2014, p. 88) with his creation and relegates the role of the student to walking around and exploring their learning by reading signs and completing quests designed by their teacher. Students are able to build in this world, but that happens in a designated area away from the main features, which are the teacher's creations (Dikkers, 2015). Both these examples illustrate how teachers might have the best of intentions to be innovative and use *Minecraft* as a teaching tool, but end up being the ones controlling the blocks, doing most of the creating, having most of the fun and ultimately doing most of the learning.

Downloadable Teacher-Created Worlds

Teachers doing all the building is not a new phenomenon for *Minecraft*. Since the launch of *MinecraftEdu*, a library of teacher-created worlds, called 'maps', has been available and used widely across a range of subjects (MinecraftEdu, 2014b). Some of these maps are good examples of educators setting the stage for their students' constructionist investigations, but the majority

are much like the *Wonderful World of Humanities*, in which the role of the student is to simply walk through the world where most, if not all, the construction has already been done.

Minecraft Content for Sale

For-profit businesses are beginning to appear with the aim to help teachers use *Minecraft* in their classrooms. Minegage (2016) offers teachers a "Minecraft Educational Adventure", where students participate in a role playing game in *Minecraft* with quests tied to the school curriculum. Minegage also offers teachers built-in assessment tools to track their students' progress in the game. With students running around the world following the orders of in-game quest-givers, this use of *Minecraft* effectively removes its power as a constructionist learning environment.

With these examples, it is evident there are many approaches to using *Minecraft* as a learning tool. Pedagogically not all methods are created equal. *Minecraft* is a game about building and creating, and it is closest to this ethos when that power is in the hands of the students. For educators willing to step back and let their students follow their intrinsic interests a constructionist culture can be created in classrooms using *Minecraft*. How this might be done is the focus of this study.

Research Questions

Through observation and focus group discussions, this research study explores how open-ended play in *Minecraft* can promote inquiry and learning with children aged 6 to 8 years. To this end, the overarching question of this research is: What learning opportunities arise through young children's (6 to 8 years) open-ended play in *Minecraft*? Within this question, a few sub-questions arise:

- How can educators use these opportunities to connect learning to the school curriculum while respecting children's autonomy?
- What considerations related to children's autonomy and affinity should educators take into account when using video games, like *Minecraft*, in the classroom?

These questions seek to highlight the perspectives of students playing *Minecraft* in school, an institutional setting with a long history of dismissing the views and interests of children (Eisner, 1985). Focusing on the children's choices and opinions will offer educators insights into ways they can honour these perspectives and also cover the curriculum.

CHAPTER 3: THEORETICAL FRAMEWORKS

Introduction

To uncover the learning opportunities that arise through children's open-ended play in *Minecraft*, this study will be viewed through concepts that seek to understand children's choices as well as their learning. By drawing on theories outside the realm of formal pedagogy, such as play, affinity and physical space, this study aims to provide new insights that will add to the collective understanding of DGBL.

Constructing Learning Block by Block

Minecraft holds much potential for students to create and innovate while playing. Learning through play corresponds with Piaget's constructivist theory of learning, where children build their knowledge through interaction with their environment and draw on a network of sources to construct meaning (Kamii & DeVries, 1993). Piaget's theory will help untangle the myriad of existing knowledge some of the participants in this study brought to their gameplay sessions and how, in turn, these children became sources of knowledge for their peers' own learning.

Papert's theory of constructionism builds on Piaget's constructivism (Harel & Papert, 1991). Constructionism brings a child's internal knowledge building, through their theory-building, testing and reflection, to the outside world by building "public entities" (p. 1) that exist for others to see, interact with and build upon. For Papert, the public entity could be computer code written in Logo or physical objects children might construct. Casting aside a pre-set path of learning, Papert compares the constructionist learner to a tinkerer who draws on a "disorderly bag of tricks and tools" (Harel & Papert, 1991, p. 2) to create objects and in the process build

understanding. Harel and Papert (1991) contrast this constructionist mode of learning-by-making with the instructionist mode, where knowledge is delivered by the teacher to the students. It is this instructionist mode that forms the basis of the emerging model of how *Minecraft* is used in schools today. Locating this study within the continuum between these two modes provides insights into what unfolded over the four days of gameplay and raises questions around how viable it is to bring open-ended play in *Minecraft* into the classroom.

Playing with Autonomy

Kamii and DeVries (1993) build on Piaget's concepts of moral autonomy, and their insights help identify the limited borders of responsibility granted to students by their teachers in *Minecraft* game worlds. Kamii and DeVries (1993) define moral autonomy as the conviction about rules and values a person constructs about themselves. This is countered by heteronomy, characterized by obedience and conformity to external rules or wishes defined by others. The heteronomous child obeys rules out of fear, where the autonomous child will cooperate with requests he or she sees as being reasonable. The goal of the constructivist educator is to support a child's autonomy, so they respect the rights and feelings of others, are alert to their own curiosity and have the initiative to pursue these interests. As we look closer at the children's choices while playing *Minecraft*, we will see how this autonomy can conflict with a teacher's authority potentially causing tensions and leading to missed opportunities for student learning.

Playing with Play Rhetorics

*Minecraft'*s use in school is often framed around the act of play. Children are said to be playing while they move through an educator's pre-build world, completing activities, challenges or quests (Gallagher, 2014). Sutton-Smith's (2006) rhetorics of play, serve as useful markers to

identify how various forms of play are more valued by teachers than others. The seven rhetorics of play: *progress, fate, power, identity, imaginary, self* and *frivolity* can all appear to a varying degree throughout a child's time engaging with *Minecraft*. Focusing on three rhetorics in particular, *progress*, *identity* and *frivolity*, clarifies the choices of the children in this study and reveals the possible tensions these rhetorics might bring to the classroom.

'Play as progress' is a rhetoric often favored by DGBL educators because it sees play as being more about development than enjoyment. The educator creating or using a pre-built *Minecraft* world harnesses the 'play as progress' rhetoric when they encourage their students to tour the environment and only engage with it by completing purposive curriculum-based activities. The goal here is for the students to progress through the learning material with the hope they also make some progress with their learning. Deviations from this play rhetoric are viewed as failures, like when the students in the Mathlandia world ignored the teacher's activities and instead chose to explore the world on their own (Gallagher, 2014).

'Play as identity' often focuses on community celebrations and festivals, and is usually only valued by educators during days of cultural significance or holidays. Within video games like *Minecraft*, this form of play acts to connect the player with a larger culture that exists outside of the game itself in spaces like YouTube (TheDiamondMinecart, 2016b), online communities (Mineplex LLC, 2016) or social media (Facebook, 2016).

'Play as frivolity' taps into the tradition of the trickster or fool and is a popular form of play in the video game community (TheDiamondMinecart, 2016a). Neuß's (2006) investigation into children's humour confirms this tradition of trickery exists in the physical world, too. Boys in particular enjoy laughing at others' mishaps (Neuß, 2006). In the virtual world of *Minecraft*,

the freedom to create makes it especially fertile ground for playing tricks, as evidenced by some of the game's top YouTube stars creating videos specifically dedicated to pulling pranks (TheDiamondMinecart, 2016a). These insights help identify innocuous joking from potentially harmful bullying in the fast-paced and fluid actions of the children during their gameplay in this study. The ability to break any block in *Minecraft* can sometimes lead to 'griefing', where a player intentionally antagonizes another player by breaking the other player's constructions. This same freedom to break and create, however, can also lead to 'trolling', where a player tries to be funny by pulling pranks or playing tricks on other players. The definitions of trolling and griefing vary across the spectrum of video games, but in *Minecraft* there is a very clear difference between the two (MrEndermanGuy, 2012). Trolling falls within the definition of the frivolous rhetoric. It is considered harmless and annoying, but ultimately amusing to everyone involved. Griefing is only amusing to the perpetrator and is often harmful to the victim (MrEndermanGuy, 2012). It exists within the rhetoric of 'play as power', which often appears as competition or simulations of warfare and serves to fortify positions of dominance of those who control the play (Sutton-Smith, 2006).

Assessment: Tapping into Higher Order Thinking

As Burnett and Bailey (2014) note, children's play in *Minecraft* can be loud and fluid as they shift their attention between their computer screen, their friend's screen and the real world around them. The authors' observations help identify the fast-moving actions of the participants and clarify them as learning in action, rather than uncontrolled chaos. Bloom's Digital Taxonomy (Churches, 2009) seeks to codify learning with digital technologies. Building on Bloom's Revised Taxonomy (Churches, 2009), the digital taxonomy places students' actions

while using technology into categories ranging from lower order thinking skills (LOTS) up to higher order thinking skills (HOTS). While the digital taxonomy focuses on students using websites, wikis and blogs, the categories can be mapped onto other technically-mediated practices, such as DGBL. Beginning with LOTS and moving up the hierarchy to HOTS, the categories of thinking skills are: *remembering*, *understanding*, *applying*, *analysing*, *evaluating* and *creating* (see Appendix A for an infographic detailing each order of thinking skill). Each category of thinking skill is essential to learning and builds on the previous thinking skill, however they are best viewed as a learning process rather than a rigid hierarchy. The goal of an educator is to support learners so they eventually move to the highest order of thinking. This does not mean, however, that all learners begin at the lowest order of thinking. A learner can begin anywhere in the process if they have already learned the elements of the previous thinking skills. This point became crucial to understanding the learning occurring with the children in this study as we mapped Bloom's Digital Taxonomy onto their actions during their gameplay.

Communities of Construction

Bruckman (1997) laments that tools designed to empower learners with new practices are instead used in the old ways that are disempowering. Having students tour through a teacher-built environment in *Minecraft* is an example of this. Bruckman encourages educators to avoid this by creating a constructionist culture around the technology they bring into the classroom. The constructionist culture comes from the educational philosophy that inspires the creation of a learning tool or activity that draws people together. Bruckman (1997) likens this to an example used by Seymour Papert of the samba schools in Brazil, where a diverse group of people gathered together with the goal of creating a presentation for Carnival. The act of creating

something becomes the motivation for the community and shapes its activities. Bruckman's (1997) argument that these communities can form in virtual spaces has been shown countless times in the twenty years since MOOSE Crossing, through the many online communities that have formed around special interests from video games to gardening guides and beyond. As Bruckman (1997) focused on a children's digital learning community, her recommendations remain useful for educators working in the virtual communities that form when *Minecraft* is used in school. Some of the most relevant guidelines for creating a constructionist culture with a technological tool are: topics of creation must be voluntarily selected and personally meaningful to the participants, limits on the creation should not be too specific or too broad, and all members (and their creations) should be free from judgment from others.

Questions of Space and Affinity

Finally, Nolan and McBride's (2014) framework for the dimensions of informal learning in DGBL help make meaning out of much of the participants' gameplay during the study. The authors outline considerations around autonomy, play, affinity and space that are often overlooked by educators using video games in the classroom. For the purposes of this study, I focused on two of the dimensions, affinity and space, to better understand how structures of the DGBL environment are as important to a child's learning as the game itself. Affinity looks at the interests, experiences and locations that intrinsically engage the learner (Nolan and McBride, 2014). The authors note that a child's intrinsic interests are often not represented in the explicit curriculum of the teacher's lesson plans, classroom materials or school policy. These interests become sites of struggle within a classroom when they transgress what is deemed acceptable or age appropriate by the teacher. The child's interests are dismissed from the learning environment

and become part of the null curriculum (Eisner, 1985), or learning that is intentionally omitted from the curriculum of the school or classroom. Looking at the affinity for particular practices shown by the children in this study through their game play choices helped to clarify the diverse range of sources they drew from to express themselves.

Space is the dimension of the framework that considers the physical environment in which the gameplay happens. Nolan and McBride (2014) note that a child's out-of-school gameplay environments often allow for free physical movement and have soft surfaces. When children play video games outside of school, they often do so in the comfort of their own home, on couches and beds, either alone or with friends, in a relaxed and safe environment (Stevens, Satwicz & McCarthy, 2008). Schools, with their hard plastic chairs and easy-to-clean tile floors rarely allow for such comforts. Where the children chose to play with their iPads was a key element in the design of this study. Nolan and McBride's (2014) insights into the dimension of space in DGBL help clarify the children's choices around choosing where to play.

CHAPTER 4: METHODS

Introduction

Observing the fast-paced actions of children's play in the virtual world of *Minecraft*, as well as their actions in the real world presented a unique challenge. I was equally interested in the children's gameplay as well as their out of game choices and perspectives. I did not want to miss any detail that could prove relevant to the research question. This chapter describes how the study was organized to ensure data was accurately collected from both the virtual world and the real world.

Participants

Eight children aged from 6 to 8 years, attending a day camp in Toronto, Canada participated in this research study. Requests for participants and consent forms were sent home by educators to the families of children attending the program. From the children whose families gave consent, eight were selected at random by pulling their names out of a hat and placed into two groups of four. For identification purposes these groups were called Group A (M=4) and Group B (F=3, M=1). Of the eight children who participated, seven attended all the sessions. One child from Group A attended three of the four sessions. He was absent for the third session.

Procedure

All children participated in a 40-minute session each day for four days in a single week. Each session consisted of 20- to 25-minutes of playing *Minecraft*, followed by a 10 to 15-minute focus group discussion. Assent was sought from the children prior to each day's session. Children were made aware that they could refuse to participate completely and that they could stop participating at any time, for any reason during the session. Each day's session took place in

the school library, away from the other children attending the day camp. Participants were given the choice of playing *Minecraft* while sitting in plastic chairs around an adult-sized table or on a child-sized couch or stuffed chairs placed around a brightly coloured carpet.

The children played *Minecraft Pocket Edition*, v0.15.2, (iTunes, 2016) on iPads provided by the researcher, in four separate sessions in the school library. Each child had their own iPad. A fifth iPad ran the Minecraft world (known as a server) in which the children played. Two separate Minecraft worlds were created, one for each group. Each day, the children continued their gameplay session in the same world and played the same character (known as an avatar). This helped to create a seamless gameplay experience for participants because they continued their play from the exact same spot where they had left off the day before.

At the end of each day's gameplay session, I led a focus group discussion with the children. These discussions took place with me sitting on the floor and the children sitting on the couch or stuffed chairs and lasted between 10- to 15-minutes. I began each discussion by asking the children to describe their most favourite or least favourite part of that day's gameplay session. From there my questions were inspired by the answers the children gave. This was an intentional decision to allow the children to shape the focus group discussion by talking about their interests or challenges they had while playing the game. The duration of each focus group was determined by the children's interest to participate. For each of the focus group discussions, several children stopped participating after about 10 minutes. They left the group and starting moving around the library. This signaled that they were no longer were interested in participating in the focus group; therefore, I ended the discussion.

Minecraft Gameplay Choices

Minecraft is a highly customizable video game that allows players to control many elements of world creation and gameplay. To provide a consistent experience for all participants, both groups played under identical game settings that were set before the beginning of the study.

The Game Mode in each group was set to Creative, in which players cannot die, have access to all items and building materials and are able to move around the world easily by flying. The alternative game mode is Survival, in which players can die, must harvest and craft their own materials from the game environment, feed themselves and defend themselves against monsters. Creative Mode was chosen because of its focus on creating and building, practices that are at the heart of constructionist learning.

A second key gameplay choice was to select the Always Day option for both worlds in the Edit Your World menu. This selection stopped the sun from setting in the game world, preventing it from becoming night. Nighttime is when most of the monsters (e.g. zombies, skeletons, creepers) appear in the game. While in Creative Mode, these monsters will not attack players, but there was a concern that their appearance could frighten the children. Additionally, the Difficulty Level was set to Peaceful to prevent any daytime monsters (e.g. spiders) from appearing.

The third key choice was to select the players' avatar names and what their avatar looked like in the game (known as the player's 'skin') prior to the first gameplay session. This choice was made to allow participants who had never played *Minecraft* to bypass the starting gameplay option menus and begin playing the game as quickly as possible. These starting menu options offer players the choice to create their own worlds, set up of networks to connect with other

players and many more customization options. In my experience as a teacher using *Minecraft* with young children, these starting menus can cause confusion and frustration with first time players, which was something I wanted to avoid. The children were told that they could change their avatar's name and choose a new skin at any time by going to the character creation menu. I offered to guide them through the process.

For the purposes of confidentiality, the children will be referred to by their avatar names. See Table 1 for the avatar names, player age and groupings.

Table 1
Participant's Avatar Names and Groupings

Group A			Group B		
Avatar Name	Gender	Age	Avatar Name	Gender	Age
Haxalor	M	7	Scoral	M	6
Aralan	M	8	Reela	F	8
Rizzo	M	6	Eggton	F	6
Denalor	M	6	Waffly	F	8

Table 1: Participant's Avatar Names and Groupings Table

Data Collection

The iPads were connected through Wi-Fi to a computer via AirServer software (Airserver, 2016), which displayed all four iPad screens on a single computer monitor, so each participants' gameplay could be viewed at the same time. Selected portions of the children's gameplay were recorded via AirServer for reference during the analysis of the data. The criteria for recording gameplay was any in-game actions that could be directly connected to a school

curriculum. Typing messages into the game's chat system, for example, could be linked to literacy lessons around writing. Ultimately, recording and saving large video files proved too cumbersome for a single researcher to do and still accurately observe the children's fast-paced play, so portions of only one day's gameplay was recorded. It would have been beneficial to have a second person assisting with the technical side of the data collection. This is something to consider for future DGBL research with children.

This recorded gameplay is known as a 'screencast', which only recorded what appeared on the participant's iPad and the in-game audio, but not the children's voices. Audio of the children's conversations during gameplay and the focus group discussions after gameplay was recorded on a separate digital recorder.

As the children played, I observed and made notes of their avatar's actions on the screen and their own actions in the real world. I recorded where and how the children were sitting (e.g. stretched out on the carpet, alone in the stuffed chair) I also noted what they were doing in the game and when they watched another child's screen or shared their iPad with another child. These field notes proved extremely useful as I analyzed the data.

A final source of data gathering came from in-game images captured by the children. These 'screenshots' act like photographs that display only what is on the screen of the iPad. At the start of each day's session, the children were encouraged to take screenshots of anything they found interesting or were proud of (e.g. something they built in the game). I demonstrated how to take a screenshot with the iPad, and the children were able to practice taking screenshots using an extra iPad. Of the eight children, six expressed an interest and took screenshots during their gameplay, while the others chose not to take screenshots.

Minecraft Play Agreements

With the technology in place and the participants ready to play, there was one final step to take before diving into the virtual world of *Minecraft*. To ensure that all participants felt safe in game and were enjoying themselves, I led a short discussion with the children about how they could ensure that everyone playing was having fun. This led to the creation of our Minecraft Agreements, which listed some of the positive ways they could play the game, from respecting each other and each other's creations to helping another player if they're seeking assistance (see Appendix B for images of the Minecraft Agreements from each group)

Analysis

At the end of the data collection phase, the audio recordings of the children's gameplay, and our focus group discussions were transcribed and organized with the children's screenshots, screencasts and my field notes. The transcripts were hand coded for themes as they became apparent. The fast pace of the children's gameplay meant there was a wide range of material to draw from, which led me in unexpected directions. Originally, I thought the children's screenshots would be a rich resource, but we ran out of time before the children could tell me about them and provide their perspectives on their pictures. Without the children's voice, I could only offer my adult perspective on what the screenshots might mean and could never hope to achieve an accurate or equitable analysis. Therefore, the screenshots were removed from the rest of the data. To avoid the loss of such valuable data in future research, it is essential that time be allocated for children to not only take screenshots, but also explain the meaning of their images after the fact. Only by ensuring that there is time for both elements of this form of data collection, can children's video game screenshots be examined equitably.

The most valuable source of data came from my own field notes. These notes, combined with the transcriptions of the children's audio, allowed me to sort through the children's rapid talk and segment the data into themes around autonomy, affinity and space.

Researcher Connections & Affordances

It should be noted that my own connections with *Minecraft* affected how the data were collected for this study. As previously explained, I am a researcher who is very experienced with *Minecraft,* through my own personal experiences of playing the game and using it with children in the classroom. I feel this familiarity with the game afforded me certain advantages when documenting the actions and choices of the children during the study. I entered this research already fluent in the lexicon of Minecraft terms (e.g. trolling, griefing, TNT), which allowed me to more easily talk with the children about their experiences in the game. Through many hours of my own gameplay in *Minecraft*, I have become very knowledgeable about what can be done in the game. This allowed me to quickly identify the children's in-game actions and document them in my field notes, even without the benefit of reviewing recorded screencasts after each session. For example, when I saw a child placing blocks of TNT on the ground, I knew from my own experience that the child could be exploring the properties of the explosive. This allowed me to quickly note this activity as 'playing with TNT' in my field notes.

By no means is this experience with *Minecraft* a pre-requisite for studying the game. It was, however, an asset during my own data collection. Making my own connections with the game explicit may help to inform future researchers studying *Minecraft*.

CHAPTER 5: FINDINGS & DISCUSSION

Introduction

Over the four sessions of playing *Minecraft*, the children explored many aspects of the game. In the course of their gameplay, there were examples of their developing moral autonomy, their affinity to out-of-school cultures and the value of comfortable spaces. The examples below best demonstrate these themes and highlight the ways educators can support children's intrinsic interests while also supporting their learning.

Autonomy & Space: Minecraft Agreements, New Skins and Comfy Couches

Minecraft agreements. In our first session, before the children had even logged into *Minecraft*, there was evidence of the children's developing moral autonomy (Kamii & DeVries, 1993). It centred around the Minecraft Agreements, the list of ways they should act with each other while in the virtual world to ensure everybody has an enjoyable time. While I called them 'agreements', the boys in Group A were quick to point out the list was really just a set of 'rules' they had to follow. For them, this clarification did not diminish the validity of the agreements, instead it placed them in a frame of reference they all understood. Rules, from 'no running in the hallway' to 'wait your turn', are something children live with every day at school. These children were no exception. This is an example of the complex negotiations that exist on the borders of autonomy and heteronomy. The heteronomous child follows a rule out of fear of punishment or desire to be rewarded, while the autonomous child will obey a rule if it seems reasonable (Kamii & DeVries, 1993). For the boys in Group A, it did not matter what you called them, rules or agreements, they all agreed that following them was a reasonable thing to ask, to ensure everyone to have fun while playing the game.

New skins. Several of the children asserted their autonomy very early on by choosing new skins for their avatar, changing how their character appeared to other players in the game. These choices around their in-game identities were determined by a variety of factors that had little to do with their abilities or performance in the game. Rizzo, for example, picked a new skin based on Jesse, a character from *Minecraft Story Mode*, a story-driven version of Minecraft (Telltale, 2016). The following conversation from our post-game focus group highlights the reasons behind Rizzo's choices:

Researcher: Rizzo, why did you change your skin?

Rizzo: Because my other skin looked so zombie-ish. It looked like a dummy.

Researcher: Why did you choose a skin from Minecraft: Story Mode?

Rizzo: Because DanTDM plays Minecraft: Story Mode.

Researcher: Who is DanTDM?

Rizzo: He's a YouTuber!

Here we see Rizzo has a very clear idea of what he likes and does not like when creating identities in virtual environments. My choice of a zombie-like avatar was one I hoped would appeal to young Minecrafters, but clearly Rizzo disagreed and felt empowered enough to say so. His decision to change his avatar's skin reflects play as identity (Sutton-Smith, 2006) as Rizzo sought to connect his in-game character with the larger community of *Minecraft: Story Mode*, an alternate version of the game, and DanTDM, a YouTube celebrity who plays *Minecraft* and is extremely popular with young people (TheDiamondMinecart, 2016b). Rizzo's search for a new identity also highlights his existing knowledge of the game's culture that he brings his gameplay,

drawn from the network of sources he uses to construct meaning, as Kamii & DeVries (1993) point out in their study of young children's play.

Comfy couches. Where the children chose to play was as important as how they played. Each day, after the children received their iPads, they chose where to play *Minecraft* (e.g. the couch, the stuffed chairs, on the carpet). Usually they did not stay seated for long. Similar to the flurry of activity seen by Burnett and Bailey (2014), the children moved from the couch to the chairs and back again as they played *Minecraft*. They climbed onto the arms of the stuffed chair to watch another child's iPad screen. They sprawled on the carpet side by side and stretched out on the couch, legs in the air. They shared their screens to show features of interest in the game or when seeking assistance with technical issues, often actually handing the iPad to a peer, allowing them to control their avatar. As Nolan and McBride (2014) note, the hard surfaces normally found in classrooms do not allow for this free physical movement. This ability to move throughout their physical space was a key element to supporting the children's collaboration together in-game and also their enjoyment. When asked why they chose to play on the stuffed chairs, Reela summed it up best when she said: "The blue couch is comfy."

Affinity: Explosives in School and LOLs in Trolling

Explosives in school. Like many children who play *Minecraft*, Haxalor shared his highlight from the first day of our study. "My favourite part," he said, "was putting TNT in the chest and blowing up the entire island."

TNT is the *Minecraft* version of dynamite, which when detonated to creates a loud explosion and destroys the other blocks surrounding the TNT. The more blocks of TNT that are

placed together and detonated, the larger the explosion. TNT explosions will destroy everything in their path, including trees, animals and anything built by a player.

Haxalor was not alone in his appreciation for explosives. Every child who participated in the study remarked about how much fun they had playing with TNT at some point during the four sessions. To teachers not familiar with *Minecraft*, the children's talk of blowing up islands with TNT could be a cause for grave concern. Even those who are familiar with the in-game explosive might not approve of its use in school. It is with this simple block that the tensions between a child's affinity with video games and reality of school conflict against each other. As Nolan and McBride (2014) point out, any interests a student might have that does not fit within the explicit curriculum is pushed aside, becoming part of the null curriculum (i.e. that which is excluded from a learning environment). With the educator controls in *MinecraftEdu* and *Minecraft: Education Edition*, teachers can remove TNT from the game, effectively nullifying the source of the child's affinity. While TNT does have the potential to cause unwanted destruction in *Minecraft*, it also holds the potential for much intrinsically motivated learning, as another child's experience shows.

At the start of the study, Aralan was uninitiated in the ways of TNT, but he was definitely curious. He observed the others exploding TNT blocks and quietly sat by himself trying to do the same. He was new to playing *Minecraft*, so he did not know how to ignite the blocks. In the boisterous gameplay of the first day, his appeals for help from the other children went unanswered, but that did not stop him experimenting. Intrinsically motivated to detonate the TNT, he attempted many strategies including hitting the TNT blocks with various tools and firing at the TNT with arrows. With each attempt, *Minecraft* became Papert's 'object to think

with' as Aralan built his theories, tested his ideas and constructed his knowledge. On the third day of the study, Haxalor supplied a key piece of information when he showed Aralan how to use the flint and steel item to ignite the TNT block. With this new knowledge, Aralan detonated his first block of TNT and cheered in triumph. But his investigations did not stop there. He continued to theory build with TNT. First, he built a house out of TNT to see if it would blow up. Then, he built a tower of TNT blocks to see how blocks stacked on top of each other would explode. The experiments with explosives continued until the end of our data collection period, but the intrinsically motivated questions kept coming. When asked what he wanted to do on the fourth and final day of the study, Aralan said: "I want to blow up the whole world and then the galaxies and see if I can be the first Minecrafter on the moon." It is clear that for Aralan, blocks of TNT with their power for explosive destruction, were objects of inquiry. For educators, finding something that engages the intrinsic curiosity in a student is the ultimate gift of learning. But if that educator does not understand or dismisses, through in-game classroom management controls, the object of the student's affinity because it is not located in the explicit curriculum of the classroom, that gift of engagement is wasted.

LOLs in Trolling. Right from the start of the study, some children were more interested in getting laughs than building impressive structures. Shortly after logging into the game, Haxalor, an experienced *Minecraft* player, quickly drank an invisibility potion and vanished. He then proceeded to chase Rizzo, hitting him with a sword while calling: "You can't see me!" Both boys dissolved into giggles as Rizzo tried to find his attacker. "Where are you?" he called between fits of laughter. The next day, it was Rizzo's turn to play the joker, and it was the highlight of his gameplay session. "My favourite part," he said during our focus group that day,

"was making myself a skeleton. I put on armor and a skeleton head. I wanted to scare Haxalor." With both children enjoying the respective jokes, this is an example of Minecraft trolling in action. In *Minecraft*, when a player plays a harmless practical joke on another player it is called trolling (MrEndermanGuy, 2012). Jokes and pranks are a part of children's culture in the physical world (Neuß, 2006) and in the virtual world of *Minecraft* (TheDiamondMinecart, 2016a). Through their pranks, Rizzo and Haxalor displayed an affinity with this element of *Minecraft*'s culture and showed that it is as much a part of playing *Minecraft* as building with the blocks. With educators focused on using *Minecraft* to teach math or science or other curriculum specifics, there is often no time for these seemingly silly or spontaneous activities. Students pulling pranks on each other during a teacher-created Minecraft lesson can be viewed a classroom management issue. The child might be reprimanded, and the rhetoric of play as frivolity gets pushed to the null. The child's affinity with the part of *Minecraft* that resonates with them is dismissed as the teacher's definition of the game dominates in the name of the explicit curriculum.

Constructionist Culture: Gaping Craters & Shifting Plans

Gaping craters. If you visited the Minecraft worlds used in this study, you could be forgiven for thinking the children did very little during their four sessions of playing. The only evidence they were there at all are the craters left from TNT explosions, the burned-out shell of someone's home and herds of feral horses, sheep and pigs wandering the land, impulsively spawned and quickly forgotten. There are no roller coasters, sprawling mansions or other impressive structures typically displayed by educators as evidence of *Minecraft*'s creative potential. This does not mean learning did not happen. Indeed, Papert's (1980) public entities

were created, they just did not resemble the neat and tidy end product of a purposive lesson plan. By imposing no building goals or specific requirements on the children, this study sought to avoid the instructionist mode of learning-by-listening to explore the constructionist mode of learning-by-making as identified by Harel & Papert (1991). The result was a landscape of messy learning where a constructionist culture was born and thrived for four days.

Shifting Plans. With the children darting from couch to chair to show their iPad screens, shout instructions and share ideas with each other, the sessions did very much resemble Papert's samba party (Bruckman, 1997). There was, however, one difference. Instead of a single building project sustained over the four sessions, the children in each group jumped from one project idea to another as fast as their imagination could carry them. The samba party became a traveling feast, where the children moved from one plan to another as soon as it was conceived.

While out looking for a village, for example, Haxalor and Rizzo stumbled on a pack of wolves. This chance discovery changed the activity of 'looking for a village' to 'taming the wild animals'. They quickly changed their focus and began searching for the materials needed to make the wolves their pets. Reela, Waffly and Scoral's game of hide-and-seek in the fiery world of the Nether was unceremoniously abandoned when Reela decided she preferred to build a new house. In an instant, Reela was placing blocks, and their conversation turned to discussing which wall was best for the windows and doors. Some of this shifting of plans may be attributed to the exuberant energy of young children, however, the open-ended structure of *Minecraft* should also be considered to play a role in their rapidly shifting engagement.

Minecraft's potential for creation makes it an ideal constructionist tool and a natural home for a constructionist culture to flourish. The game's near limitless options for inquiry and

investigation can lead to the frenetic pace set by the children in this study. Educators seeking to foster this culture while achieving some form of curricular learning, may prefer more focus from children so they can complete one activity before rushing off to explore whatever grabs their attention next.

Digital Assessment: Minecraft Master and Blocky Beginner

For educators new to DGBL with *Minecraft*, the children's fast-paced, goal-shifting activities in an unfamiliar digital landscape can seem like an assessment nightmare. How can detonating piles of explosives, taming wild wolves and building wooden houses be used to assess a child's learning on a report card? Bloom's Digital Taxonomy (Churches, 2009), with its range of lower order thinking skills to higher order thinking skills, can provide educators with a language to communicate their students' learning. The stories of two children, one an experienced Minecrafter and the other a beginner, show how seemingly random activities can reveal a complex thinking process in action.

Minecraft master. During our focus group discussions Reela spoke of extensive experience playing *Minecraft* at home with her friends and family. Her familiarity with the game controls and knowledge of the materials at her disposal allowed her to begin her use of *Minecraft* by creating, the highest order of thinking in Bloom's Digital Taxonomy (Churches, 2009). She announced early on during the first session that she was going to build a Nether Portal. She set off searching for obsidian blocks, a key ingredient for its construction. Nether portals act like doorways to a second Minecraft world known as the Nether, filled with unique monsters not found anywhere else in the game. For a Nether portal to work it must be constructed from a particular material (obsidian) and built to specific proportions (a rectangular frame four blocks

wide and five blocks high). It can only be activated with a flint and steel tool or a redstone charge, which provides a spark that fills the hollow of the rectangular frame with a purple light. Any variation from this plan and the Nether portal will not work. Reela quickly completed all these steps to create a working Nether portal and led her two peers into the realm of the Nether. Educators observing Reela's gameplay would see many of the actions associated with creating in the digital taxonomy, including: devising, constructing, planning and producing. In only a few minutes, Reela located a suitable spot to build the portal, she sorted through the extensive inventory of building materials to locate obsidian, placed them in the correct formation and used the correct tool to activate the portal. Reela was able to do this so early on in our gameplay sessions because she had already acquired the skills and knowledge of the lower order thinking skills: remembering, understanding, applying, analysing and evaluating, through her previous interactions with *Minecraft.* By viewing Bloom's Digital Taxonomy as a process and not a hierarchy, a student's out-of-school experience with a digital tool can lead to richer learning more quickly.

Blocky beginner. For Scoral, participating in this study was the first time he had played *Minecraft*. Over the four gameplay sessions, he spent much of his time watching his friends play. On closer inspection, however, it becomes clear that, through observation and questioning, Scoral made the journey from lower order thinking skills to the highest level of creating.

From the first day, Scoral played in the virtual world alongside Reela and Waffly. With his eyes on his own screen and sometimes the screens of the other two, Scoral spent most of his time during the four days observing the others and the world around him. He watched Reela build her house. He explored his inventory, asking her about the functions of various items. He

placed blocks and then quickly broke them. He appeared to have no clear building plan. A few times he wandered away from Reela and Waffly, got lost in a forest and spent much of the remaining session finding his way back. Throughout all of this, he chatted and laughed with the others and clearly enjoyed himself. It was not until the fourth and final session that Scoral started creating. He was standing inside Reela's nearly completed house, watching her finish building the roof. Then, he placed bookshelves along the walls. He did not ask Reela for permission, instead he quietly added the blocks, placing each one next to the beds Waffly had laid down earlier.

Over the course of the four gameplay sessions, Scoral moved from using lower order thinking skills to higher order thinking skills. He began by observing and asking questions of his peers, then tested his knowledge by placing and breaking blocks in no particular order. Here Scoral was working through the lowest order skills of remembering, understanding and applying. On the final day of the study, Scoral began analysing and evaluating, which is demonstrated through his actions of comparing, organizing, critiquing and judging. In this case, Scoral seemed to silently critique the decor inside Reela's house and judge that some bookcases would be a positive addition. With that decision, Scoral harnessed his higher order thinking skills and began creating by deciding the best locations for the bookcases.

Reela and Scoral's stories highlight the importance of children's hands-on, self-directed, non-purposive play as a conduit for accessing higher order thinking skills. When introducing digital tools into any classroom activity, time needs to be provided for this exploratory play in order to build a student's knowledge about the tool. Reela did this before the study when she played *Minecraft* with her friends and family. Scoral was unfamiliar with the digital tool, so his

exploratory play happened during the first three sessions. It is not enough for educators to give students a quick overview of the controls and then expect everyone to just dive in and complete a curriculum-based lesson. Doing so, not only limits the possibility of students accessing these higher order thinking skills, it gives an inequitable advantage those already familiar with the tool.

These findings highlight just some of the many ways in which children construct and display their knowledge during open-ended play in *Minecraft*. The fast-paced and boisterous play that happens in games like *Minecraft* provide many opportunities for educators to observe and assess this learning in action.

CHAPTER 6: QUESTIONS & IDEAS FOR EDUCATORS

Introduction

For teachers new to DGBL and *Minecraft*, it can be a challenge to foster a constructionist culture where student autonomy, affinity and higher order thinking are allowed to flourish. The pressure to connect the student's play to the curriculum can lead teachers to replicate top-down models of instruction by using pre-made worlds or purposive lesson plans presented to them as exemplars of DGBL (Dikkers, 2015; Gallagher, 2014; MinecrafEdu, 2014c).

This chapter offers guidance to teachers seeking to move away from the top-down, teacher-centric model in favour of DGBL that harnesses the power of 21st learning tools like *Minecraft* while also respecting students' rights to autonomy and honouring their affinity to a culture that thrives outside the school walls.

Five Questions to Foster a Constructionist Culture in Minecraft

This study has shown that fostering a constructionist culture in *Minecraft* through open-ended, student-led play offers many opportunities for children to construct their knowledge through inquiry and exploration. Students miss out on these opportunities when educators choose activities in *Minecraft* that are teacher-created, offer limited opportunities for exploration and serve purposive goals with fixed curriculum targets. This does not mean that lesson plans or curriculum-driven activities should never be used in *Minecraft*. It is just to note that when it comes to constructionist learning, not all lesson plans are created equal. Any lesson plan, downloadable Minecraft world or in-game activity should be interrogated by classroom teachers to ensure there is space for a constructionist culture to grow. Teachers routinely view their classroom texts through the lenses of equity, diversity and social justice before using them with

their students (Au, Bigelow & Karp 2007). The following five questions bring this tradition of critique to the digital tools used for learning in the classroom. Each question is designed to have two possible answers: teacher or student. Before implementing a Minecraft activity with students, educators are encouraged to ask:

1. Who is doing or has done most of the creating in the game for the lesson? (Teacher or Student)
2. Who decides what to create in the lesson? (Teacher or Student)
3. Who decides how students spend their time in-game during the lesson? (Teacher or Student)
4. Who decides where or how the students will sit while playing the game during the lesson? (Teacher or Student)
5. Who decides who the students get to play with in-game during the lesson? (Teacher or Student)

If the majority of the answers to the questions (i.e. 3 or more) are the teacher, then the chances of constructionist learning happening during the activity will be minimal. Ideally, the answer to all five questions will be the student, but even a majority (i.e. 3 or more) will help create the conditions for a constructionist culture to form within the classroom while using *Minecraft*. By critically examining how *Minecraft* is used during DGBL lessons, teachers can meet their curriculum goals and create a culture of constructionism while respecting student autonomy and affinity.

Connecting In-Game Learning to the Curriculum

Handing control of the blocks over to children will result in constructionist knowledge building, but translating that learning into something that fits neatly on a report card can prove challenging. There are no grades given for 'Use of TNT', but playing with explosives and other activities in *Minecraft* can provide the basis for learning in subjects teachers do report on.

Bruckman's (1997) recommendation that limits on creation not be too specific or too broad is useful for educators to keep in mind as they bring *Minecraft* into their classroom. A teacher-created activity that has all students performing the same task places limitations on creation that are too specific for constructionist learning to occur. Conversely, a purely open-ended play session with no limits on creation, as seen in this study, might too broad for a teacher with a limited amount of class time to dedicate to DGBL. With no limits on creation, students might race from one interest to another, like the children in this study, abandoning their plans for new ones at the first distraction. While there will still be much learning, it will not have the focus needed for the teacher to connect to the curriculum.

This dilemma can be solved by pairing a student's open-ended explorations in *Minecraft* with specific academic expectations outside of the game (O'Donnell, 2012). Asking students to reflect on their in-game activities through drawing and writing in journals, creating presentations, constructing machinima (i.e. movies from in-game video recordings), places limits on their play that are neither too narrow or too broad. Through out-of-game activities students can bring their learning out from *Minecraft* and into to the classroom, providing teachers with ways to make connections with the curriculum. In this study, for example, Aralan's exploration with TNT would make an ideal topic for him to draw or write about in a journal. Through words and

pictures, he could relate his struggles and eventual success with getting the TNT to explode. He could also share his newfound knowledge by creating a How-To guide, explaining to others how to ignite the TNT. His teacher could connect both these activities with Language Arts, Math or Science curricula in the primary grades. For older students, an interest in Minecraft TNT could lead to a research project investigating TNT in the real world, opening many avenues for critical pedagogy around its history and uses. In both examples, the teacher is not assessing the learning happening in the game. Instead the assessment is focused on the academic work that happens outside *Minecraft*, inspired by the student's self-directed, intrinsic interests discovered while playing the game.

Building academic learning around a student's intrinsic interests is not a new or ground-breaking strategy, but a simple constructivist teaching practice used by educators around the world (Sharma & Hannafin, 2007). It seems, however, to be what is missing with many of the Minecraft lesson plans and pre-made worlds being held up as exemplars for educators to follow. This is a cause for concern because *Minecraft*'s true potential for learning is its ability to connect with the intrinsic motivations of so many young people. From blowing up TNT to planting gardens, taming horses and beyond, *Minecraft*'s global appeal with young people is in part because there seems to be something of interest for just about everyone who plays it. This power does not have to be lost when bringing *Minecraft* into the classroom.

CHAPTER 7: CONCLUDING COMMENTS

Further Questions & Opportunities

This study focused on the open-ended play of a small group of children over a short period of time. Because of these limitations, the findings are not generalizable beyond this scope. The findings discussed, however, raise new questions and offer avenues for further exploration into children's self-directed digital play in *Minecraft* and other video games in the classroom. A longer study tracking children's open-ended play in *Minecraft* over months, not days, would add much to the current research. Additionally, there are many unanswered questions around children's video game use in classrooms and issues of gender, race, social class and disability. While these are worthy subjects of inquiry, they fell outside the scope this research. Again, these offer new opportunities for further study to add to the collective understanding of DGBL.

Teachers: The Block Stops Here

Since its alpha release in 2009, *Minecraft* has evolved from a simple building game to a global phenomenon that has captured the attention of children around the world and the purchasing power of corporations like Microsoft. Much has changed about *Minecraft* since the first educators installed the game on their classroom computers and unleashed the messy constructionist learning that Papert (1980) envisioned with his Turtle. Despite corporate buyouts, pre-made curriculum-focused worlds and education-friendly editions that focus more on teacher control than student learning, the potential for chaotic, rich learning in *Minecraft* remains.

Ultimately, whether this potential is realized is up to the individual classroom teacher. So often portrayed as an obstacle to innovation in the classroom (Bruckman, 1997; Nolan & McBride, 2014), educators have the power to be the part of the solution. Through their critical

reflection of pre-made Minecraft worlds and lesson plans, teachers can ensure they use the game in ways that enhance student learning while also supporting student autonomy and affinity. For this to happen on a scale that matches *Minecraft*'s global reach, there is a need to educate the educators. It is the aim of this research to provide a starting point for that education.

By knowing *Minecraft*'s history and the history of computers in the classroom, today's teachers can reject the top-down, adult-created model of Minecraft learning, instead choosing to build on the work Papert (1980) and Bruckman (1997) to construct the future of DGBL in the classroom side-by-side with their students, one block at a time.

APPENDICES

Appendix A: Bloom's Digital Taxonomy

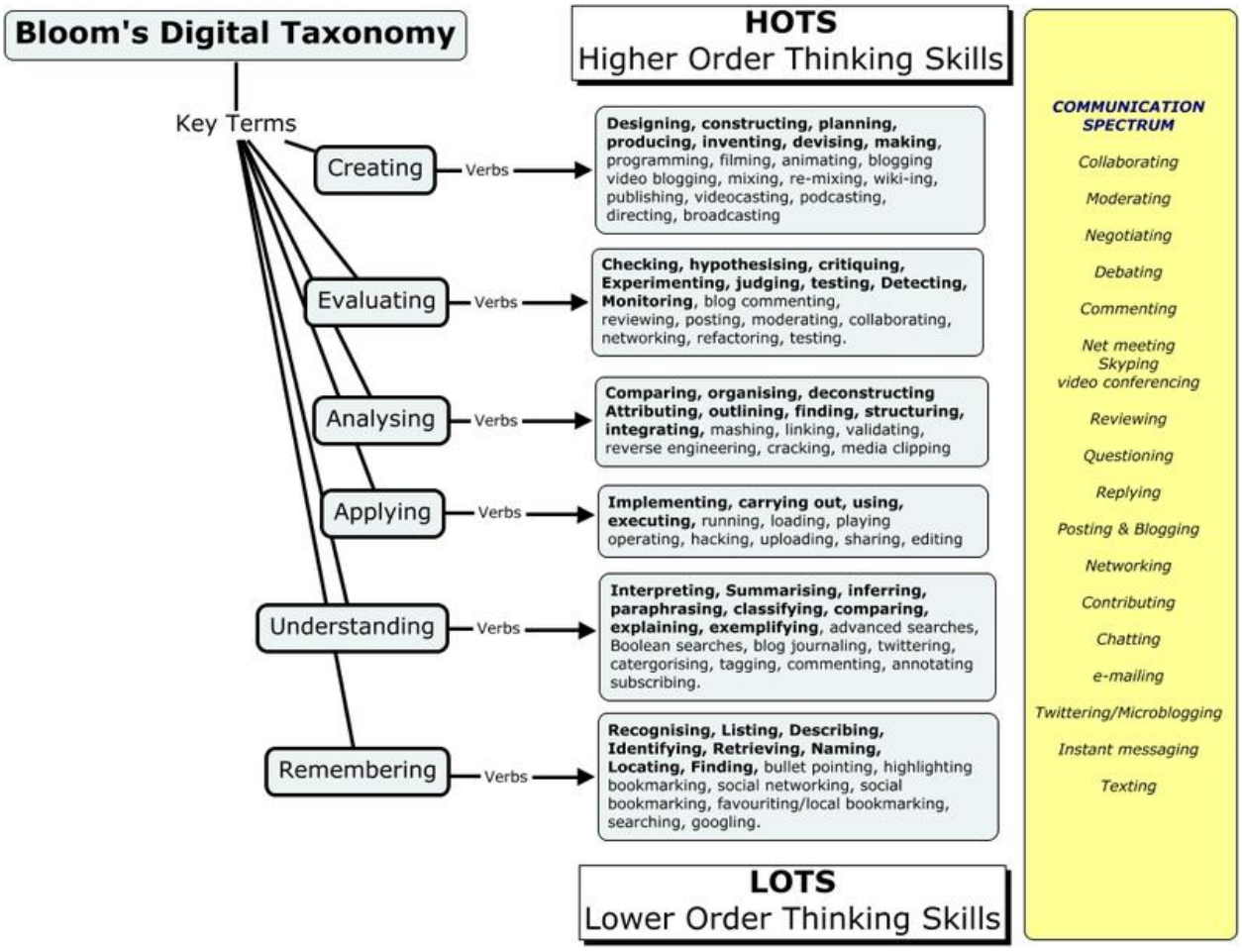

Figure 1. Bloom's Digital Taxonomy. This figure illustrates the learning actions within each of the thinking skills in Bloom's Digital Taxonomy. Image courtesy Churches, (2009).

Appendix B: Minecraft Agreements

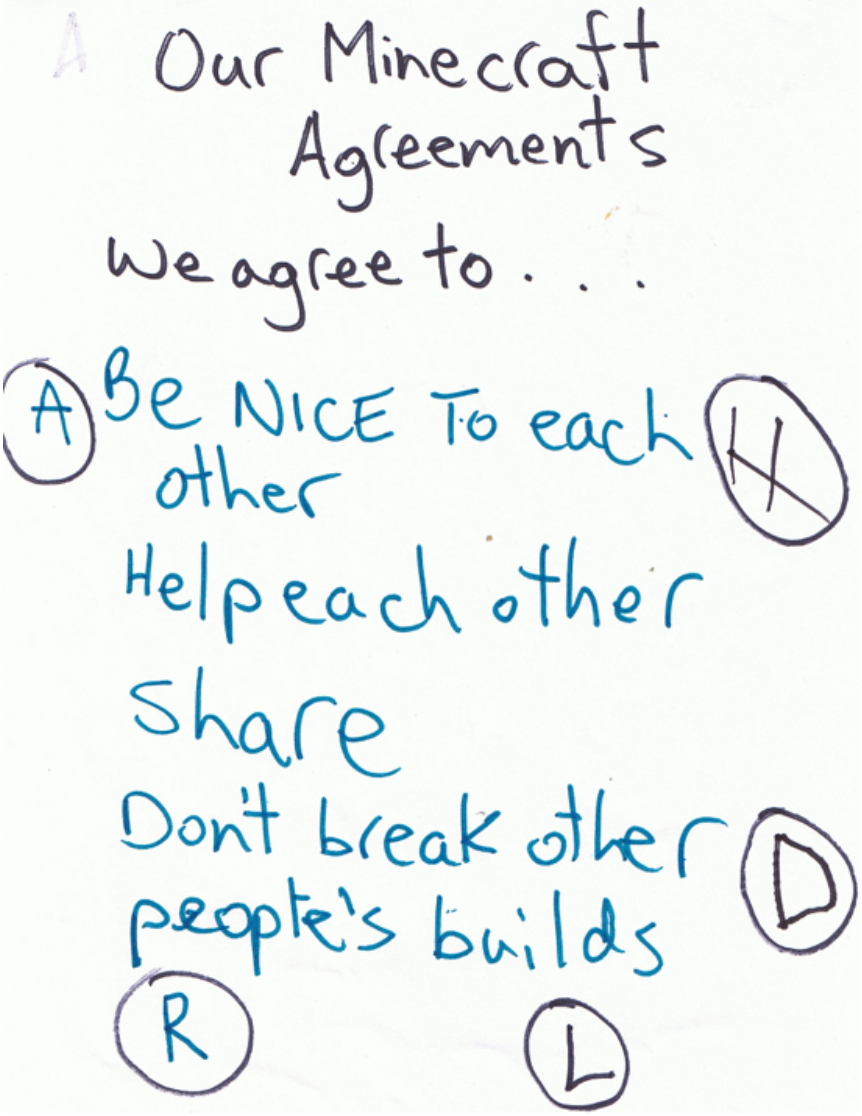

Figure 2. Minecraft Agreements, Group A. This figure illustrates the rules the participants in Group A agreed to follow while playing Minecraft. They each signed the agreement with the first initial of the name of their Minecraft avatar. I circled the initials for clarity.

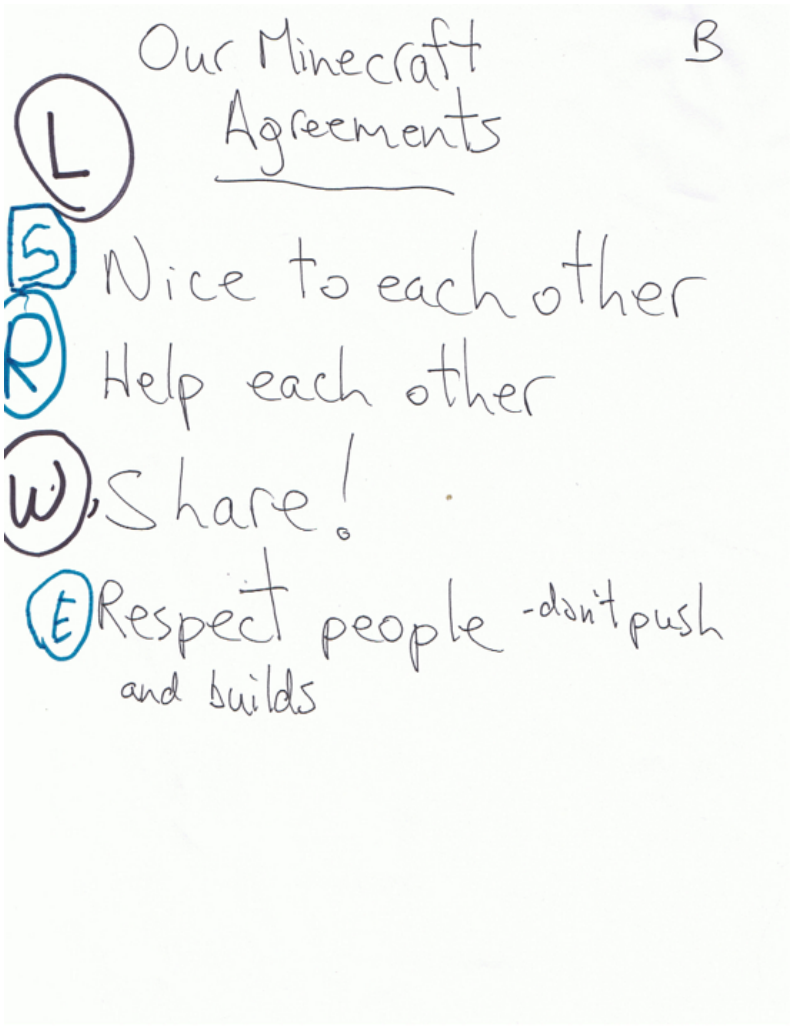

Figure 3. Minecraft Agreements, Group B. This figure illustrates the rules the participants in Group B agreed to follow while playing Minecraft. They each signed the agreement with the first initial of the name of their Minecraft avatar. I circled the initials for clarity.

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