

Minecraft as a Sandbox for STEM Interest Development: Preliminary Results

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Abstract: After a brief review of the science of interest and the game of Minecraft, we present a taxonomy of common Minecraft actions and activities and propose that they represent links to specific STEM disciplines. We then discuss the development of a Minecraft survey intended to identify STEM-related interests, and present the results of a pilot study using the survey in three Minecraft camps held in the summer of 2017. We describe the most and least popular Minecraft activities, and report initial analyses of the surveys, revealing potential connections in the earth, biological, and environmental areas of STEM.

Keywords: interest, educational games, Minecraft, STEM education, informal learning

1. Interest and its impact on learning

1.1. *Why interest matters*

The presence of interest can have a profound impact on an experience. For example, someone who loves the game of baseball is more likely to enjoy a low-scoring, nine-inning game (even perhaps deeming it a “chess match”), while one who lacks that interest is more likely to leave by the 6th inning. Research has repeatedly demonstrated that interest in a topic (like baseball) has a powerful influence on one’s perceptions, beliefs, memories, attitudes, and willingness to learn more about that topic (Krapp, 1999; McDaniel, Waddill, Finstad, & Bourg, 2000; Renninger, Nieswandt, & Hidi, 2015b; Silvia, 2006). Hidi & Renninger (2016) summarize what research on interest has revealed:

People who are interested in what they are doing are recognizable because they tend to have positive feelings, be invigorated, and choose to reengage with a particular object/activity/idea, or content, repeatedly. Their engagement with the content is distinctive and appears to be self-sustaining; their interest positively affects their attention, goal setting, comprehension, motivation, and learning, and it can influence their ability to achieve and succeed in their careers (p. 1).

Interests do not emerge from thin air, of course, and are influenced by a wide range of contextual and experiential factors. For example, an attendee at a baseball game who is not really interested in the sport might be drawn in by the passion and excitement of the other fans. Children at a science museum may have their interest triggered in zoology after petting a worm or holding an insect. In this paper, we address the more basic question of how choices made while playing a video game may reflect potential interests in Science, Technology, Engineering, and Math (STEM). Specifically, we ask to what extent specific *Minecraft* activities may reflect interest in STEM disciplines.

1.2. *Defining interest*

Early empirical research employing measures based primarily on affect tended to describe interest as an emotion (Ainley, 2007; Reeve, Jang, Hardre, & Omura, 2002). More recent formulations present interest as a more complex construct that incorporates cognitive and temporal components. Renninger, et al. (2015b) describe five characteristics on which researchers tend to agree:

1. Interest refers to interaction with particular content (e.g., physics).

2. Interest exists as a relation between the learner and the environment.
3. Interest has both affective and cognitive components, which can vary over time.
4. Learners may or may not be consciously aware that interest has been triggered.
5. Interest has a neurological/physiological basis – it is rewarding and linked to approach behaviors.

At this stage of our work, we adopt the simplistic view that interests can be inferred via likert ratings to judge interest in Minecraft play and STEM fields, but will adopt a longer-term orientation for our upcoming studies.

1.3. *Consequences of interest*

The many positive consequences of establishing interest and its facilitating effect on learning are well-documented (Hidi & Harackiewicz, 2000; Renninger, Nieswandt, & Hidi, 2015a). When a learner is interested, that interest can actually feed on itself and grow (i.e., it is self-sustaining) (Barron, 2006). As a result, motivation to learn and attitudes about content improve (Potvin & Hasni, 2014), achievement and performance in school improves (Harackiewicz & Hulleman, 2010), and learners are more prone to establish deep conceptual understanding than are those lacking interest in the subject (Andre & Windschitl, 2003).

One of the most important findings is that interest is malleable and can change over time. A *four-phase model* (Hidi & Renninger, 2006) captures this malleability as two primary forms of interest: *situational interest*, a product of environmental features, followed by *individual interest*, a relatively self-motivating and enduring state that is marked by reengagement over time. Two sub-phases of each lead a four-phase model: 1) *triggered situational interest* can become 2) *maintained situational interest*, then under ideal conditions 3) *emerging individual interest* can grow into 4) *well-developed interest*, an enduring and resilient state. In learning contexts, a trigger is simply some experience (e.g., touching a worm) that establishes engagement and involves contextual features (Renninger & Bachrach, 2015).

Importantly, a well-developed interest has been linked to higher levels of self-efficacy and decreased negative self-perceptions (Lipstein & Renninger, 2006) and is predictive of future academic choices (Harackiewicz, Barron, Tauer, & Elliot, 2002). Conversely, an absence of interest can hinder a learner's willingness to engage or persist (Nieswandt, 2007; Sansone, Fraughton, Zachary, Butner, & Heiner, 2011). Interest both emerges from experience and is heavily influenced by context. Our ongoing research integrates both of these aspects, and seeks to inform the design and deployment of educational technologies in informal learning contexts. How to foster interest development is a critical question with widespread implications for parents, educators, researchers, and policymakers. Appropriate triggers and continuing opportunities to pursue those interests are needed if interest is to flourish, both independently and with encouragement.

1.4. *Research aims*

We are engaged in a research project investigating the impact of video game play on STEM interest. Specifically, we are interested in two key research questions: 1) In what ways does use of modern entertainment technologies influence learners' interest in STEM? And 2) How can game-based learning experiences be deployed to trigger interest in specific areas of STEM? In this paper, we focus on the first question and in the context of *Minecraft*, a game rich in STEM connections. We are also designing customized versions of *Minecraft* (i.e., via "mods") that focus on Astronomy. The work reported in this paper focuses on the first research question, and lays the groundwork for linking interests to game play.

2. Minecraft

2.1. *Why Minecraft is relevant for education*

Minecraft has seen a dramatic rise in its adoption by educators worldwide who use it for educational purposes (Schifter & Cipollone, 2013; Schwartz, 2015). The simplest probable reason for its rise is that interactions in *Minecraft* involve a broad range of educationally relevant content, and how one learns to play the game is entirely compatible with classical and modern theories of learning (Lane & Yi, 2017). For example, in *Minecraft*, players routinely engage in activities that involve:

- Exploring and investigating different biomes and climates that match those on Earth, including deserts, forests, jungles, taigas, and many others.
- Navigating in and around different types of terrain, such as hills, mountains, caverns, caves, oceans, and more.
- Interacting with a wide variety of wildlife and agricultural content, including animals, fish, birds, wheat, grass, fruits, vegetables, and a long list of fictional content.
- Searching for, mining, collecting, and combining many different resources such as different kinds of wood, stone, metal, dirt, and more.
- Building electrical circuits, switches, and complex machines.

Players have even reconstructed world wonders, many of which can be found online (e.g. YouTube, dedicated servers) that are virtual copies of actual structures like the Taj Mahal or fictional places, such as Westeros from the *Game of Thrones*. To achieve such feats of engineering, players often work collaboratively by planning and coordinating their tasks. They assume roles (e.g., as resource collectors, planners, builders, etc.), work iteratively to refine their creations, and of course, share their work with friends, family, and the online community. In this paper, we ask what the choice to engage in such activities implies in terms of young players' interests.

2.2. *The popularity of Minecraft*

Since Markus Persson released an early version of *Minecraft* in 2009 (with the official release coming in 2011 through his Swedish company, Mojang), millions of children across the world have chosen to spend hundreds of thousands of cumulative years playing. With well over 100M players, 241M logins per month, and 2B+ hours played on Xbox alone¹, in 2016 *Minecraft* ascended to be the second most popular game in history (passing *Grand Theft Auto V* but still well behind *Tetris*) (Peckham, 2016). One report that looked at server usage data identifies 15-21 year olds as the largest demographic (43%) and children under 15 as the third largest (20.6%).² Another way to think about its reach is that millions of children worldwide have decided to interact deeply and meaningfully with a simulation of the natural world. Given this, we believe that it is probably having *some* influence on the way they think about the world around them – what it consists of, how it works, how we manipulate and exist in it, the use of resources, etc., and we wish to gain insights into how.

2.3. *What is Minecraft?*

Simply put, *Minecraft* is played in a world made entirely out of blocks. The various blocks encountered in the game have different compositions and functions, such as many variants of stone, wood, and metal. Even liquids, such as water and lava, are modeled as block units, although they adhere to natural laws such as gravity and flow accordingly. Prior to starting a single-player game, the terrain (i.e., a virtual world) must be generated. These digital worlds are *huge*. The exact cubic

¹ <http://www.wired.com/2015/05/data-effect-minecraft/>

² <http://minecraft-seeds.net/blog/minecraft-player-demographics/>

volume area of a Minecraft world is two hundred sixty-two quadrillion by one hundred and forty-four trillion blocks (West & Bleiberg, 2013). The terrain generation algorithm produces remarkable (block-style) landscapes and includes features found in the natural world, such as varying biomes (e.g., desert, forest), caves, mountains, oceans, rivers, and lakes (Figure 1 shows two typical screenshots).



Figure 1. Typical Minecraft interactions. The left screenshot shows a player-constructed shelter on the hillside above a creek with animals. The right screenshot shows a crafting screen where the player can create new items (like an anvil) from more basic items (like iron ingots).

In stark contrast to a majority of commercial games, *Minecraft* does not include an active narrative or set game play objectives. Nor is there a direct way to “win” or even obvious ways to “level up,” although some elements of experience points are used and patterns have emerged for imposing goals (e.g., killing the Ender Dragon). The two most commonly used game modes are: *Survival*, where the player must actively seek resources, craft tools, build safe houses, and fend off monsters each night to survive as long as possible; and *Creative*, in which monsters are non-aggressive and players are invincible, can fly, and are given an unlimited supply of resources. Survival mode is more action packed and stressful, while Creative mode is typically for large-scale projects and experimentation.

3. A Taxonomy of Minecraft Activities

In order to more formally approach analysis of *Minecraft*, we first created a *Minecraft* action/activity taxonomy. To begin, we reviewed documentation, research literature, discussion boards, *Minecraft* wikis, and talked with expert players to create a master list of actions. The first three authors independently organized the actions into groups, then came together to form an overarching structure. Common but significant in-game actions were selected, and six categories with subcategories emerged (see Figure 2).

We then tagged each action using the 2010 Classification of Instructional Programs (CIP) Codes from the US Dept of Education and National Science Foundation in the order of highest relevance.³ CIP codes provide structure for STEM fields, skills, and professions. The purpose of the CIP is to support the tracking and reporting of fields of study and program completions activity. When combined with our *Minecraft* action taxonomy, the resulting tags become our claims of relevance to those STEM fields. The links trace each action taken to specific STEM contents. For example,

³ <https://nces.ed.gov/ipeds/cipcode/>

building a functioning clock from scratch in *Minecraft* requires an understanding of circuitry, the ability to make the appropriate calculations, and the ability to craft and design a model. Therefore, in accordance with our taxonomy, building a clock would relate to electrical engineering, mathematics, and mechanical engineering (from the greatest to the least significance).

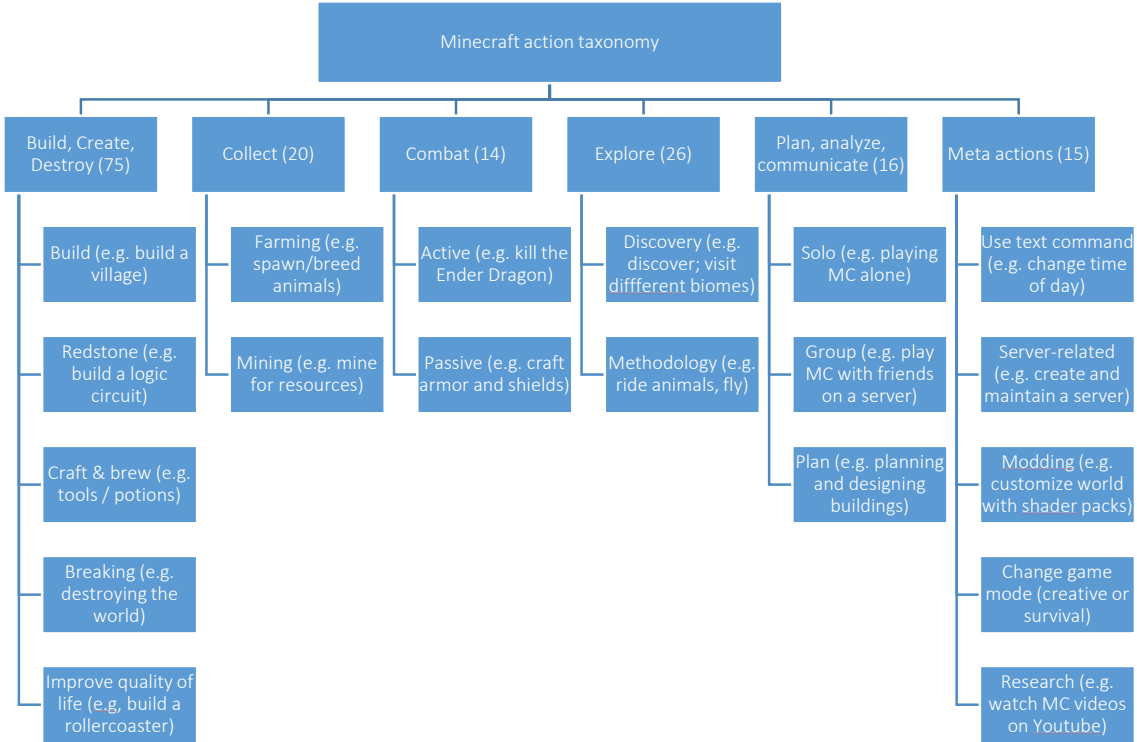


Figure 2. Top two levels of our *Minecraft* taxonomy. The number of actions in each top level is shown in the figure, with 166 total distributed across the sub-categories.

It is important to note that not all actions can be sensibly tagged with a CIP code. This is especially true in areas of communication (e.g. playing alone vs. playing with friends). Nonetheless, the social aspects of *Minecraft* may be just as important as the correlation between in-game actions to STEM. Furthermore, non-STEM activities may play a mediating role in triggering interest: a player may enjoy the social aspects of *Minecraft* while working on projects, and then choose to become an expert in Redstone to promote these social goals (Redstone is a *Minecraft* version of electricity).

4. Method

As an initial evaluation of our *Minecraft* taxonomy and of the efficacy of our tags, we conducted a pilot study using two surveys: one for *Minecraft*, based on our taxonomy, and a second, previously developed STEM-attitudes survey. In this section we describe the study and report preliminary results.

4.1. Participants

In July 2017, we recruited 39 children participating in three, *Minecraft*-themed summer camps held at the Champaign-Urbana Community FabLab. The camps used *Minecraft* for different purposes, including to play group survival mode, 3D printing of *Minecraft* structures, and advanced topics (such as using mods, setting up servers, command blocks, etc.). Participants ranged in age from 9 to 15, and were all from the Champaign-Urbana, IL area. Based on survey responses, 9 were female (23%), 27 were male (69%), and 3 preferred not to answer (8%). In terms of ethnicity, 8 participants identified as Asian (21%), 2 as Hispanic (5%), 22 as White/Caucasian (58%), and 11 preferred not to answer

(29%). In terms of experience with Minecraft, 2 said they were “new” (5%), 4 had played before and knew the basics (10%), 10 played “often” and for “hours at a time” (26%), 19 considered themselves experts (49%), and 4 said they play “way too much” and explore advanced topics often (10%).

4.2. Procedure

Upon arrival on the first day of each camp, parents were approached by researchers who introduced themselves and described the goals of the research. Children were then invited to participate in the research project if they chose to and their parents approved. Consent forms were given to the parents to read and sign. Researchers spent the first day of each camp getting to know the participants, observing their work, asking general questions, and helping whenever possible. At a designated time during each camp, two surveys were given to participants who had consented: the first survey focused on *Minecraft* play and the second on attitudes and interests in STEM topics. At later times, we interviewed selected campers to gain a better understanding of their interest in *Minecraft* and STEM.

4.2.1. Minecraft interest survey

We designed a 60-item survey by pulling a representative sample of items from the *Minecraft* action taxonomy (section 3), which currently has 166 leaf nodes (recall: leaf nodes represent game actions or activities). We chose items based on several criteria. First, we sought balance across the STEM disciplines, but also included other critical aspects of playing that were not directly STEM-related, such as playing with friends, decorating buildings, and combat-related activities. This opens the possibility to infer a more nuanced understanding of why children choose to play. Second, we attempted to include critical game activities that were somewhat core to game play (such as crafting, building, exploring, mining). Finally, for advanced activities (such as Redstone), we sought activities that were more common and likely to be recognized by a wider range of players. Some sample items and a screenshot of the survey is shown in Figure 3. Given our focus on middle school learners, we chose to use emoji rather than verbal descriptions for eliciting judgments. The selected set is based on research that these specific representations have been shown to have high reliability and appeal for children (Rounds, Phan, Amrhein, & Lewis, 2016). A big smiley represents “strongly like” and progressively less positive faces through to the tongue out emoticon represent “strongly dislike”. Participants were instructed to mark the middle item, “neither like or dislike”, for actions that they did not recognize.

* 2. Please rate how much you like each of the following Minecraft activities. 

					
Exploring a brand new map.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Exploring caves and finding new underground structures and resources.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Playing in creative mode.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Playing in survival mode.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Building a safehouse or base for protection.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fighting off creepers, zombies, and other enemies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Building structures that could exist in the real world (Eiffel Tower, Sears Tower, bridges)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 3. Example survey items and interface (from SurveyMonkey).

4.2.2. *STEM attitude survey*

Participants also completed the Student Attitudes toward STEM survey (S-STEM), developed and validated by researchers at North Carolina State University as an attempt to capture attitudes that middle school and early high school students have towards STEM and 21st Century learning skills (Faber et al., 2013). Part 1 of the survey consists of subscales capturing learner beliefs about their abilities in key areas: math, science, engineering/technology, and 21st Century skills (e.g., “I am confident I can set my own learning goals”). Part 2 of the survey focuses on future interests of the learner – it provides short descriptions of 12 STEM-related fields (physics, environmental work, biology, veterinary sciences, mathematics, medicine, earth science, computer science, medical science, chemistry, energy, and engineering), and asks participants to rate from 1-4 how interested they are to learn more in that field. In our correlational analysis below, we refer to part 1 as “S-STEM beliefs” and part 2 as “S-STEM Future”.

4.3. *Results*

Here, we report preliminary analyses of our data by sharing results from each survey individually, followed by initial results that show modest correlations between STEM-related items (and sets of items) on the Minecraft survey with specific items on the S-STEM survey. At the time of this writing, we have not yet analyzed additional aspects of surveys, such as those related to gender, age, ethnicity, or *Minecraft* experience.

4.3.1. *Stated interest in Minecraft activities*

Unsurprisingly, participants in the study – generally experienced *Minecraft* players – positively rated many of the activities covered by the 60 items. Indeed, the mean rating across all items was 3.91 (with the highest rating scored as 5, and the lowest 1). Nonetheless, some notable differences do emerge from the data with respect to the relative scores between items. For example, as shown in Table 1, of the five highest rated items from the survey, two fall into the *meta* category (playing with friends and playing on a server), one in *build-create-destroy* (blowing things up with TNT), and two in the *explore* group (new maps and flying/viewing from high up).

4.3.2. *S-STEM*

Survey results also generally suggested that participant attitudes towards STEM fields and beliefs about their skills with respect to STEM were also positive. While responses to specific career-related questions were modest with respect to math (3.67) and science (3.54), participants responded very positively to questions related to creativity and engineering. Three of the five highest rated items were found in the *Engineering & Technology* portion of the survey (*):

- *I can get good grades in math* (4.28)
- *I like to imagine creating new products** (4.26)
- *Knowing how to use math and science together will allow me to invent useful things** (4.23)
- *When I have many assignments, I can choose which ones need to be done first* (4.13)
- *I would like to use creativity and innovation in my future work** (4.10)

The two lowest-rated beliefs of participants both had to do with science. They had less interest in pursuing a career in science (3.54) and were less sure they could do advanced work in science (3.51). We note that these are still positive scores. Interestingly, while students claimed to know how best to select assignments during homework (a metacognitive skill), they rated their ability to use time wisely far lower (3.64). Our current study lacks the power to determine if these are significant differences, however the differences are certainly worth of future investigation. Finally, in part 2 of the survey that focused on future interest, *computer science* and *engineering* were clear leaders (3.28

and 3.23, respectively, on 4-point scales), with *veterinary and medical science* coming in with the lowest ratings (2.31 and 2.28).

Table 1: Top 5 (blue) and bottom 5 (red) items from Minecraft survey (of 60 items total).

Item (M)	Strong like	Like	No opinion	Dislike	Strong dislike
Playing Minecraft with friends (4.62)	71.8%	23.1%	2.6%	0%	2.6%
Destroying things / blowing things up with TNT (4.44)	66.7%	15.4%	12.8%	0%	0%
Playing Minecraft on a server (4.41)	59.0%	30.8%	5.1%	2.6%	2.6%
Exploring a brand new map (4.36)	46.2%	43.6%	10.3%	0%	0%
Flying / viewing from high above the ground (4.36)	51.3%	35.9%	10.3%	2.6%	2.6%
PVP combat (3.41)	25.6%	25.6%	23.1%	15.4%	12.8%
Calculating and measuring distances when building a large structure (3.41)	5.1%	41.0%	41.0%	10.3%	2.6%
Watching Minecraft story videos (fiction) (3.08)	20.5%	25.6%	18.0%	12.8%	23.1%
Watching YouTube videos about combat (3.05)	20.5%	25.6%	18.0%	10.3%	25.6%
Building a calculator (3.0)	15.4%	18.0%	38.5%	7.7%	20.5%

4.3.3. Exploratory Factor Analysis (Minecraft survey)

To identify latent variables influencing the survey responses and compare them to our STEM categories (referred to as a “rational” approach), we conducted an exploratory factor analysis (EFA) on the Minecraft survey. We performed a principal components extraction with orthogonal rotation. A scree plot suggested 4 possible factors. We also suppressed cross-loadings less than .30, which are items that contribute to multiple factors simultaneously (thus might be double-barreled and candidates for removal in future surveys). We ran rotated factor loadings for 3, 4, and 5 factor solutions, but only report on the 4-factor solution here. Further, we present the cleaned version removing items that cross load.

Table 2 shows the factor loadings for the 4-factor solution with double-barreled items and items with lower factor loadings removed (space limitations prevent showing the full matrix). We note that this solution (as well as the 3- and 5-factor solutions) are likely to be very unstable and that more data are needed with the same items for the solutions to be admissible via proper EFA techniques and for there to be confidence in the scales that are generated. Nonetheless, we were interested in the factors that emerged. Component 1 seems to capture a great deal of the exploration, animal interaction, and farming/agriculture, and outdoor/nature aspects of our taxonomy (albeit with some noise). Component 2 seems to emphasize building and designing, while 3 (interestingly) combines redstone use (electricity and machine building) with combat/survival aspects of the game. There is no discernable theme for component 4, and it consists of the least number of contributing items.

Table 2: Items of 4-factor Component Matrix with largest factor loadings.

Component	Item codes
1	Brew-potion (.839), tame-animals (.812), fishing (.799), watch-sky (.786), craft-armor (.779), use-farming-tools (.778), find-npcs (.759), build-portal (.749), fly-with-elytra (.745), visit-biomes (.738), swim (.725), ride-animals (.719), create-storage (.693), collect-common-resources (.684), craft-weapons (.683), mining-resources (.672), hunt-with-bow (.666), spawn-animals (.635), plant-harvest (.625)
2	Build-real-buildings (.671), role-play-friends (.637), decorate (.601), plan-design-buildings (.590), build-fantasy-buildings (.573)
3	Build-complex-redstone (.647), fight-monsters (.596), use-redstone (.491), survival-mode (.468)
4	Build-irrigation-system (.598), creative-mode (.576), build-cannon (.489)

4.3.4. Cross-survey correlations

Our overarching hypothesis is that *Minecraft* play reflects underlying STEM interests of children who play, in part because the game models significant aspects of the natural and engineered world. Furthermore, our ultimate goal is to design *Minecraft*-based experiences that trigger interest in specific STEM areas (e.g., Astronomy). In this initial phase of the work, we seek to show connections between stated *Minecraft* and STEM interests. For example, we posit that a player who uses Redstone frequently is more likely to be drawn to mechanical engineering and electronics than one who focuses more on farming and interacting with animals in *Minecraft* (who we would predict would be more drawn to the agricultural sciences). As discussed earlier, we have attempted to articulate these connections through linking our Minecraft action taxonomy and STEM CIP codes. Viewing these links as hypotheses, we have completed an initial correlational analysis of our two surveys.

Using only the first coded tags of the items on the *Minecraft* survey, a Pearson correlation coefficient was calculated between the mean ratings of sets of MC-items of a given STEM tag and the corresponding relevant items on the S-STEM survey. For example, all items tagged as relevant to agriculture (AG) were checked for correlation with S-STEM items related to both general science beliefs and the specific future interest question for agriculture. All “sensible” correlations were run, and are displayed in Table 2. We note that this correlational analysis is only suggestive, and that our next step of analysis will be to run correlations between factors that emerge from our planned Confirmatory Factor Analyses on both surveys.

Table 3: Cross-survey Pearson correlation coefficients (NOTE: MC = Minecraft survey, ENG = Engineering, ANS = Animal Science, COMP = Computer Science, VETR = Veterinary Science)

Minecraft items	S-STEM (Beliefs)			S-STEM (future interest)									
	ENG	MATH	SCI	AG	BIO	CHEM	COMP	EARTH	ENG	ENV	MATH	PHYS	VETR
MC-AG			-0.126	0.437									
MC-ANS			-0.023		0.433								0.359
MC-ARCH	0.205								0.062				
MC-MATH		-0.119									0.011		
MC-CHEM			-0.109			0.241							
MC-CIVE	0.033								-0.044			-0.044	
MC-MECHE	0.171								0.150				
MC-COMP	0.037						0.053						
MC-GEOL			0.085					0.394		0.314			
MC-PHYS			-0.095									0.092	

4.4. Discussion

All of our observations require the caveat that this was only a small pilot study with a limited number of participants. The goal of this work is to begin to identify the links between *Minecraft* play and

STEM interest. We will use the pilot to refine the instruments and improve the accuracy and usefulness of the *Minecraft* taxonomy.

With respect to ratings of *Minecraft* activities, none of the top 5 activities are particularly surprising, however it is notable that combat-related items did not make the list. Interestingly, the highest rated items in our *combat* category were “build a safehouse” (4.26) and “craft armor and shields” (4.23), both of which fall into the protection (or “passive”) subcategory of *combat*. Based on the fact that 33 of our 39 respondents indicated *at least* that they were experienced *Minecraft* players with strong knowledge of the game, these results are most likely skewed towards the later stages of interest (in *Minecraft*, that is). In other words, novice players may find basic resource management and exploration more appealing until they emerge into more advanced topics. We will analyze our data along different experience dimensions in the future. Readers familiar with *Minecraft* are unlikely to be surprised by the high ratings for engineering and creativity found in the S-STEM survey. The links between creative aspects of STEM and *Minecraft* play are also worthy of further investigation.

Our initial EFA on the *Minecraft* survey suggested that 4 factors contributed to the survey results, with only 3 forming somewhat sensible groups. In particular, those related to the natural sciences, animal sciences, exploration, and agriculture fell into the first component. Our preliminary correlational analysis of both surveys suggested items and categories related to many of the same topics seemed to have the highest correlations with our S-STEM responses, although far more work and survey respondents is needed to reach confidence in this conclusion.

5. Future work

Our work seeks to elaborate on the links between *Minecraft* play and interest in STEM. Our overarching hypothesis is that video game play not only reflects interest in STEM, but influences it as well. We have reported our initial steps into investigating these questions and found modest relationships between some aspects of STEM and stated *Minecraft* preferences (mostly those revolving around agricultural, animal, environmental, and earth sciences). The ultimate goal of our research is to design informal learning experiences that *trigger* interest in STEM via specially designed *Minecraft* mods. In particular, we are development mods that represent hypothetical but scientifically valid versions of Earth (e.g., “What if the Earth had no moon?”). Using the tools developed in this pilot work, we will investigate whether exposure to such virtual worlds has the power to trigger interest in astronomy, astrophysics, and Earth science.

Acknowledgements

We thank Johnathan Phan for his help in conducting the EFA. This material is based upon work supported by the U.S. National Science Foundation under Grant No. 1713609.

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