EXPLORING THE EDUCATIONAL POTENTIAL OF MINECRAFT: THE CASE OF 118 ELEMENTARY-SCHOOL STUDENTS

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ABSTRACT

The goal of this study was to explore the educational potential of Minecraft. This project was conducted with 118 elementary-school students from Canada during the 2016-2017 school year. To explore the educational potential of Minecraft on the students, we designed a "Minecraft challenge" for students. 10 game levels of ascending difficulty were created for them, each containing 3 sublevels to pass before moving up to the next level. In order to advance to the "Minecraft Master level", the students had to complete a total of 30 tasks. A moderator specialized in Minecraft gameplay was present during the gaming sessions, which took place at the schools. Ten different types of data collection tools, such as online surveys, interviews, classroom observations, "think aloud" interviews during Minecraft gaming sessions, student-generated Minecraft "creations", etc. In this study, we first report on how Minecraft was used with those 118 elementary-school students. We then highlight the educational potential of Minecraft by describing how the use of Minecraft benefitted students in various aspects of their learning. These positive outcomes include, but are not limited to: an increase in motivation, the development of collaboration skills, the learning of computer programming, and the development of other computer science competencies.

KEYWORDS

Minecraft, Educational Games, Motivation, Collaboration, Creativity

1. INTRODUCTION

A study called "Can Minecraft Transform Schools?" might ring some alarm bells for parents. And their concerns would be justified, given the immense appeal of this game for youngsters. It is the second most popular video game of all time, with over 100,000,000 copies sold. The chief concern for parents is that these games will have negative impacts on their children: that it will generate more conflicts at home and more violence in general. What parent has never asked their child to quit playing a video game, or has never felt queasy about inappropriate content? So, parents and teachers are right to be worried, for the most part. Furthermore, their disquiet has been fed by the media and studies that have spread fears of how technology abuse can harm child development. That said, aside from the widely held view that technology abuse can have negative consequences, people are largely unaware of the enormous educational potential of Minecraft. In fact, this video game is rapidly catching on at schools, and an educational children's version (Minecraft Education Edition) was released in the fall of 2016. Since 2013, American[1] and Swedish[2] schools have been systematically integrating Minecraft into their schools,[3] and it is being used around the world to teach science, urban planning, and foreign languages. Closer to home, in Montreal, a number of schools have joined Mission 375,[4] a contest in which students use Minecraft to reproduce historic sites and events around

[1] https://www.washingtonpost.com/lifestyle/kidspost/minecraft-spawns-classroom-lessons/2013/03/14/717aed66-87b8-11e2-98a3-b3db6b9ac586_story.html
[2] http://www.pcgamer.com/minecraft-becomes-a-compulsory-class-for-swedish-school/
[3] https://minecraft.net/fr/
[4] http://plus.lapresse.ca/screens/d787353b-43e3-4342-b537-8c379d9de0fd%7C_0.html

Montreal in celebration of the city's 375th anniversary. As a bonus, masses of educational applications and experiences using Minecraft are available on online sites and forums. Accordingly, and in line with our research program, we felt it important to shed scientific light on the educational potential of Minecraft in order to provide a deeper understanding of the impacts on young learners.

2. IS THERE A PLACE FOR VIDEO GAMES AT SCHOOL? WHAT THE RESEARCH SAYS

For many decades, researchers have underscored the value of games for educational purposes (Dewey & Deledalle, 1983; Piaget, 1959; Winnicott, 1975). Today, with the advent of digital technology, video games are earning profits of over 100 million dollars annually, and are now considered a major "cultural industry." The good news is that studies have repeatedly shown that video games can help students learn (e.g., Baranowski et al., 2003), with positive effects on the cognitive, affective, and psychomotor domains (Shaftel, Pass & Schnabel, 2005). A comprehensive literature review on the educational impacts of video games showed that they can increase learning in youth by at least 12%, with improved hand-eye coordination, problem-solving skills, and memory, among others (see Clark, Tanner-Smith & Killingsworth, 2013). Some studies have demonstrated that surgeons who regularly play video games are more effective at their job (Rosser et al., 2007). In short, the evidence indicates that video games contribute directly to academic success. Nevertheless, the reality is a little more complicated, and games, particularly video games, have not yet achieved hallowed status in the education world. There is no doubt that education systems are undergoing a digital transformation in Québec, across Canada, and abroad. However, some questions have been raised, notably concerning the discrepancy between the presence of technology in daily life and in the classroom. Besides having a bad reputation, video games suffer from this discrepancy between society and school. Digital resources are now an assumed feature of school life, and there is little doubt that some video games and apps for tablets and cell phones have educational value. For example, apps such as Scratch[5] and ScratchJr allow students to have fun creating virtual stories and video games as they learn how to code. Since 2016, other newly introduced apps such as Swift Playgrounds[6] definitely fall into the educational category. A recent development is the holding of commercialized tournaments using video games like Assassin's Creed, which teaches students history (Joly-Lavoie & Yelle, 2016) and geography (Gilbert, 2017). To gain a better understanding of the educational potential of digital resources (i.e., apps), two characteristics could be assessed. The first is the educational potential (what do learners derive from playing the game?), and the second is the fun potential (how much do players enjoy playing it?). In other words, a game that scores 10 out of 10 on educational potential (it elicits a lot of learning) but scores only 1 out of 10 on fun potential (it's not very interesting) would probably be less valuable as an educational resource than a game that scores 5 on educational potential and 9 on fun potential. It wouldn't take much persuading to get students to play a really fun game. We therefore set ourselves the rather pleasant task of classifying a number of games, educational resources, and apps on a two-axis graph. The results are thought-provoking. For example, we attributed a fun score of 9 out of 10 to Minecraft (the second most popular video game ever) as well as 7 out of 10 for educational potential. In contrast, Grant Theft Auto (GTA) was rated only 1 for educational potential (a few minutes of play sufficed us to realize that the skills acquired in this game can't be transferred to actual driving), but received a 9 for fun potential, and indeed, it was one of the most popular games in 2017.

According to our classification, Minecraft rates the highest for combined educational and fun potential. The Minecraft Education Edition appears to be particularly suitable for helping students develop their teamwork skills, computer skills, and coding skills. In addition, it is highly entertaining. We then decided to push our hypothesis further as part of an exploratory study conducted to gain a deeper understanding of the educational potential of Minecraft.

[5] https://scratch.mit.edu/
[6] https://www.apple.com/ca/fr/swift/playgrounds/

3. METHOD

We examined the use of Minecraft Education Edition in two schools in the Greater Montreal Area (Québec, Canada). The participants were 118 elementary school students in grades 3 to 6. To investigate the effects of Minecraft gaming on the students, we adopted an action research approach in which we applied several newly created game levels. Specifically, we designed 10 game levels of ascending difficulty, each containing 3 sublevels to pass before moving up to the next level. In order to advance to the Minecraft Master level, the students had to complete a total of 30 tasks (Figure 1).[7] A moderator specialized in Minecraft gameplay was present during the gaming sessions, which took place at the schools.

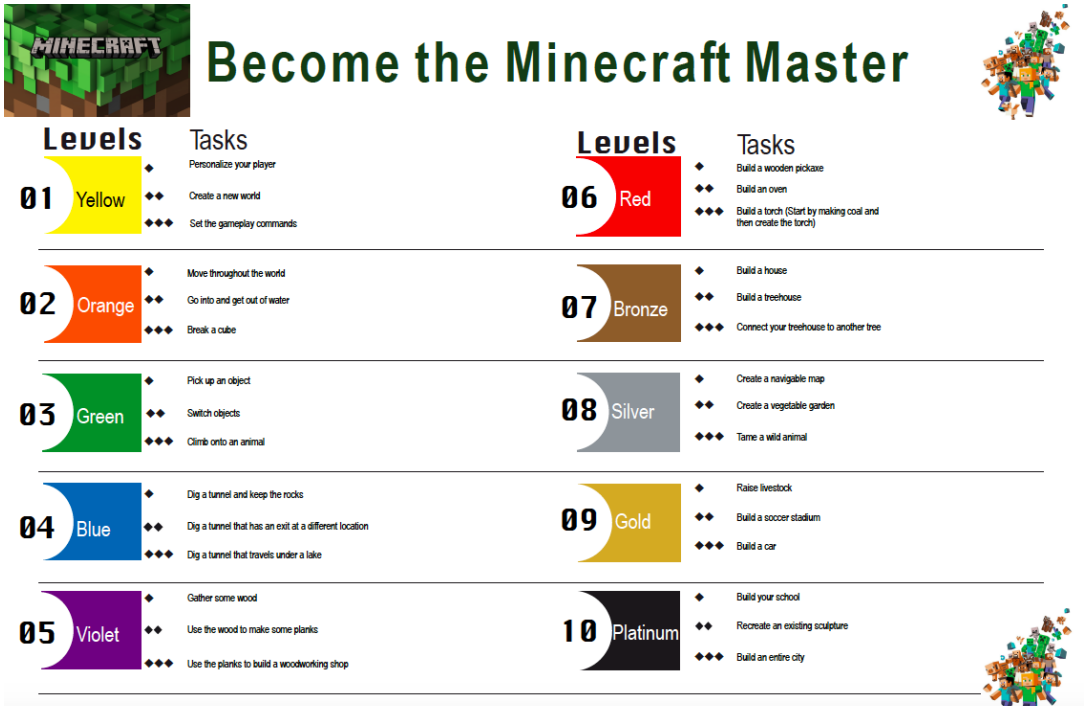

Figure 1. The Ten Advancement Levels in Minecraft Education Edition

During the experiment, we gathered data using the following 10 methods:

- Survey questionnaires (n = 4) administered to all participants (n = 128)
- Individual, semi-directed interviews (n = 6 X 30 minutes) outside of supervised game time
- Short individual interviews (n = 118 X 5 minutes) during supervised game time
- Group interviews with students during Minecraft gaming sessions (n = 3)
- Videotaped observations (n = 6 X 75 minutes) during supervised game time
- Videotaped observations of think aloud protocols during Minecraft gaming sessions (n = 3 X 30 minutes)
- Individual interviews with teachers and moderators during supervised gaming sessions (n = 6)
- Tracking of students' advancement through the game levels
- Weekly journals kept by the Minecraft moderators (n = 14)
- "Digital footprints" (Jaillet & Larose, 2009), i.e., student-generated Minecraft products.

[7] The levels are available at: http://www.karsenti.ca/code/minecraft-education-edition/

4. RESULTS

The results of this exploratory study highlighted a number of educational benefits of using Minecraft in class. The main benefits are listed as follows:

1. Increased overall motivation toward school
2. Stronger computer skills
3. Greater creativity
4. Increased feelings of academic self-efficacy
5. Positive learning environment
6. Improved reading skills
7. Improved writing skills
8. Autonomy development
9. Increased collaboration between students (many chose to work in groups)
10. More mutual assistance between students (students tended to help each other troubleshoot gaming issues)
11. Improved computer programing and computational logic skills (Minecraft's advanced levels elicited basic programming skills)
12. Improved problem-solving skills
13. Improved informational research competencies (to accomplish certain tasks)
14. Development of math concepts (perimeter, volume, calculation of required resources and numbers of blocks, etc.)
15. Deeper understanding of scientific concepts (e.g., identifying the elements required to start a fire, grasping basic agricultural principles in order to accomplish certain tasks)
16. Greater perseverance in the face of adversity (Minecraft tasks could be highly challenging, and some tasks had to be repeated to improve productions)
17. Better understanding of history (especially when re-creating scenes from past decades or centuries)
18. Improved ability to follow instructions (methodological skills)
19. Greater academic self-esteem
20. Improved oral communication skills
21. Improved ability to create high-quality products
22. Improved social skills
23. Improved information and communication technology (ICT) skills
24. Improved information organization skills
25. Improved inductive and deductive reasoning.

Along with all these benefits came a few challenges. For example, technical glitches interrupted the fun far too often. Some workstations disconnected in the middle of games, which the students naturally found unnerving. Updated equipment in good repair and with adequate capacity would go a long way to avoid this nuisance problem. Nevertheless, even though Minecraft could be rather challenging for some students who were new to the video game, all the participants made rapid progress in their gaming skills.

5. CONCLUSION

The results of this exploratory study of 118 students in two Québec elementary schools confirm that Minecraft has real educational value. Notably, gaming allowed the students to fully engage in activities that were both educational and fun, and the outcomes were many and positive. The advancement levels (see Figure 3, Become the Minecraft Master) encouraged the students to progress step-by-step through a series of skills. Similar initiatives implemented in other schools in Québec, Canada, and abroad would undoubtedly produce similar positive outcomes, as demonstrated in Sweden, a pioneer in the educational use of Minecraft. Considering the 25 benefits for students that we identified in the present study, there is every reason to believe that Minecraft projects could be equally beneficial for students elsewhere. Finally, along with the benefits for students, certain limitations and guidelines need to be taken into account. Unless they are supervised, children may not have the self-discipline to stop playing by themselves. Knowing this, we implemented a structured Minecraft program in a school setting with a moderator present during gameplay.

As a general rule, a good balance should be struck between video gaming and other types of activities. Because obsessive gaming may take precedence over constructive learning, it is up to parents and teachers to weigh the merits of the different ways that children spend their time. Therefore, in order to derive the full educational potential of Minecraft, it must be used judiciously.

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