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"I'LL HAVE EVERYTHING IN DIAMONDS!" STUDENTS' EXPERIENCES WITH MINECRAFT AT SCHOOL

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Abstract

The aim of this article is to highlight the experiences of 11–12-year-old students at a Norwegian primary school regarding their use of Minecraft in mathematics classes and explore the consequences for their motivation. The present research was carried out as a single case study. This implies an in-depth investigation of a contemporary phenomenon, an intervention, studied in its real-life context, the classroom. The object of the intervention in the participating class in 2015 and the spring of 2016 was to use Minecraft as an attempt to restore motivation for mathematics. The teacher found his students were motivated to work with Minecraft, but a question emerged about students' motivation to perform the given tasks. This study suggests that formative interventions in which the researcher is present in a school context implicates the possibilities for the study of externalisation processes. These processes provide an opportunity to obtain an understanding of what happens when a popular digital game from youth culture is applied to tasks in mathematics to achieve pedagogical goals.

Keywords

digital games, formative intervention, classroom research, case study, motivation

Introduction

"*I'll have everything in diamonds! A sword and everything! A pickaxe and a spade, and everything there is!*" shouted Edward, a 12-year-old student from a Norwegian primary school, after playing Minecraft. Statistics from the Norwegian Media Authority (2016, 2018) show that about 96–97% of boys and about 63–89% of girls aged 9–14 play digital games every day, and Minecraft is one of the most popular digital games among children in this age group. The Minecraft world consists of blocks that players manipulate. Players have unlimited resources in creative mode and can help each other to build something from their own imaginations (Gallagher, 2015). Indeed, Minecraft may be the most successful commercial game ever created (Bebbington & Vellino, 2015, p. 7).

Minecraft has also found its way into schools (Callaghan, 2016; Cipollone, Schiffer, & Moffat, 2014; Mail, 2015; Nebel, Schneider, & Rey, 2016; Sáez-López, Miller, Vázquez-Cano, & Domínguez-Garrido, 2015). Research shows that Minecraft is used as an educational tool in various countries and subjects and at different grade levels (Nebel et al., 2016, p. 357).

Statistics from the Norwegian Media Authority (2016, p. 82) show that 8% of primary school students have the opportunity to use digital games at school, but these statistics do not distinguish between Minecraft and other digital games.

It is therefore interesting to explore what can happen when a popular digital game, such as Minecraft, is transferred to a classroom setting and, as will be outlined, used in mathematics to restore class motivation. This leads to the following research questions: How do students experience the use of Minecraft in their classroom and what are the consequences for their motivation?

A formative intervention (Engeström, 2015, pp. xxx–xxxii) was conducted in 2015 and the spring of 2016. The Change Laboratory process (Virkkunen & Newnham, 2013, pp. 12–13) was used to organise the intervention and is typically applied in the context of an activity system, for instance a classroom facing a transformation (Engeström & Sannino, 2010) such as the introduction of a new educational tool.

This approach may provide the opportunity to understand students' experiences and include them in further intervention processes. This is important because it must be remembered that students have the most experience with being students (Nilsen, 2010, p. 24) and little attention has been paid to their voices in research about game-based learning (Beavis, Muspratt, & Thompson, 2015).

The present research did not seek to evaluate the intervention but rather to investigate closely the students' experiences. The teacher's understanding of motivation is also considered in this dialectical approach.

In the following sections, Minecraft will be described and the study's context outlined. Then, the study's theoretical framework will be presented before the methodological approach is introduced. Finally, the study concludes with an analysis of the research findings, a discussion, and a conclusion.

Minecraft description

Owned by Microsoft but created by Mojang, Minecraft is a popular digital game (Abrams, 2017; Beavis et al., 2015; Nebel et al., 2016; Willett, 2016) that has, according to Marklund, Backlund, and Johannesson (2013, p. 308), received much acclaim. The game is innovative and features a player-driven narrative that differs from other games in that it does not have traditional goals including players collecting points or reaching a different level. In Minecraft,[1] players can collaborate and create stories with characters because the Minecraft world "provides participants with the space to do so" (Cipollone et al., 2014, p. 5). The game enables players to design the game themselves, choosing whether they want to play independently in single-player mode or with others in multiplayer mode (Niemeyer & Gerber, 2015).

From a constructionist perspective, Minecraft can be viewed as an educational tool whereby meaningful interactions contribute to knowledge building (Cipollone et al., 2014, p. 10). The earth, the vegetation, and the mountains are made of blocks that can be engineered collaboratively in various ways. Players can create their own goals using different tools, such as a pickaxe to dig or a torch to light up a labyrinth. In creative mode, the players have unlimited resources if they want to build advanced structures, such as landscapes and buildings, or to rebuild visual compositions from history or mathematics (Gallagher, 2015). Because of the possibilities mentioned above, Minecraft is known as a sandbox game (Canossa, Martinez, & Togelius, 2013; Mail, 2015; Niemeyer & Gerber, 2015) that can be modified to suit curricula (Gallagher, 2015, p. xi).

Moreover, according to the Norwegian Media Authority (2018), the game appeals to boys and girls, which is not the case with most other digital games. In a survey conducted by Beavis et al. (2015) of 270 students aged 9–14, Minecraft was the only game nominated by both genders as a favourite among numerous digital games (Beavis et al., 2015, p. 27).

[1] Or Minecraft: Education Edition, which is made especially for schools. See https://education.minecraft.net/.

Related research

Recently, researchers have been occupied with what implications can be drawn from using Minecraft for future learning (Abrams, 2017; Niemeyer & Gerber, 2015). Some research has concluded that there is not necessarily any improvement in academic results after implementing Minecraft in schools (Sáez-López et al., 2015, p. 125) despite the advantages highlighted in contemporary research on motivation (Canossa et al., 2013; Plass, Homer, & Kinzer, 2015; Sáez-López et al., 2015). Motivation is defined as both the reason for behaving a certain way and the desire to do something. Motivation is divided into extrinsic (external) and intrinsic (internal) motivation, with a special focus on the latter in recent research (Canossa et al., 2013; Plass et al., 2015; Turkay, Hoffman, Kinzer, Chantes, & Vicari, 2014). It has also been emphasised that students may be intrinsically motivated to play but not necessarily to learn (Jessen, 2011; Plass et al., 2015). Students can find ways to complete their game without learning the educational content, the reason being that "to play", according to Jessen (2011, p. 159), is not a means but an end in itself. He connected this assumption to a possible understanding of the motivation to play games. He drew on Huizinga (1955), among others, to express that play is, in and of itself, a meaningful human activity that we practise for the simple joy of it (Jessen, 2011, pp. 158–159). Another explanation for the assumption that games can but do not necessarily motivate learning is connected to the idea that learning content and game mechanics are not always linked tightly enough (Plass et al., 2015, p. 269). In their review, Plass et al. discussed the design elements of games that facilitate learning, such as motivation and affective elements, summarising that constructs related to motivation often include affective components, such as emotions and attitudes (Plass et al., 2015, pp. 270–272). This finding was investigated further by Abrams (2017), who presented the case of 11-year-old Anita to explore how feelings and imagination may influence creation and play within a space such as Minecraft. The study illuminated the importance of emotions when working in the Minecraft world that should not be dismissed as supplementary resources to motivate and engage students (Abrams, 2017, pp. 505–506). Another research study connecting emotions with Minecraft involved a survey distributed by Canossa et al. (2013) to participants aged 12–49 from 21 different countries. Their research indicated that the greater a player's dedication, the more he or she used and crafted objects made with diamonds, the stronger his or her curiosity was, and the greater his or her use of stone objects was. Their survey showed that curiosity, as a part of intrinsic motivation (Reiss, 2012), was evident among Minecraft players. Canossa et al. defined curiosity based on Reiss (2012) as the universal desire for intellectual activity, learning, and creating. They also explained that Minecraft affords great freedom for expressing curiosity. This is also in line with Cipollone et al.'s (2014, p. 5) understanding of Minecraft, outlined above.

The aforementioned research was selected because it problematised various aspects of how digital games, and Minecraft in particular, can be understood in connection with motivation, play, and emotions and emphasised learning. Furthermore, the selected research influenced me, a qualitative researcher, and offered ideas about what topics have been given attention recently. Therefore, in consideration of this research, while proceeding with my study I have been open to the fact that my research could contribute to other perspectives.

The context and aim of the intervention

From the collaborative network of schools associated with my university, one school was purposefully selected (Creswell, 2013, p. 156) because of the head teacher's expressed interest in developing the use of information and communication technology (ICT) at his school. The participating school, with approximately 300 students, is in northern Norway and offers education from first to tenth grade. The head teacher at this school informed the teachers of the possibilities regarding collaboration in a research project. The teacher who joined the research project has about 30 years of experience as a primary school teacher. He expressed that the books they were using in mathematics were dissatisfying for his students and decreasing their motivation. After conducting an informal study in his class, he realised about 20 of his students were eager to play Minecraft for fun in their leisure time. At the beginning of January 2015, the teacher clarified his reason for collaborating in this research, outlined as an intervention. He selected Minecraft as our entry to working with both ICT and mathematics. He wanted to restore students' motivation by trying a new educational tool, Minecraft, to teach mathematics.

The participating class had 27 students, 11 girls and 16 boys, aged 11 and 12. The intervention started in January 2015, when they entered the fifth grade, and it continued through the spring of 2016. For practical reasons, teachers in several subjects divided the class into two groups; this was also the case during the intervention. Group A, with 16 students, performed well at mathematics. In the smaller Group B, the students needed a peaceful working environment with more support and attention. Group A studied mathematics on Mondays and Group B on Tuesdays. One ICT teacher informed me that, because of a lack of access and time, Minecraft had not previously been an option as an educational tool at this school.

In week 22 during the spring of 2015, the teacher and I conducted an introductory session where we tried some mathematics tasks and observed how well the students knew Minecraft. In week 29, we had a session without Minecraft where I conducted participant observations. During 2015–2016, we had sessions with both groups during weeks 41, 44, 45, 2, 3, and 6 as well as a follow-up session in week 24. All mathematics tasks were prepared according to the overarching national curriculum.[2] The tasks focused on problem solving, cooperation, creativity, orality, engagement, differentiation, and the understanding of such mathematical concepts as area, volume, perimeter, scale, fraction, reflection of patterns, and parallels. The teacher and I made use of the creative mode in Minecraft with unlimited resources. Figure 1 shows one given task during week 45 where students had to rebuild their classroom in Minecraft.[3] Our learning objectives[4] connected to this task were concerned with measurement, scale, collaboration, and orality.[5] In pairs, the students measured the classroom, decided how big the blocks should be, and then rebuilt the classroom in Minecraft. They had to determine whether one block should correspond to one meter or be smaller. If the blocks were too small, for instance 5 centimetres, they had much more work to do. Students could see one another's solutions in multiplayer mode to understand the consequences of different choices (see Figure 1). Figure 1 shows that pairs in Group A were working near one another. The classroom towards the front, being made by one pair, will be much smaller than the other classroom.

2 The Knowledge Promotion, *Kunnskapsløftet* (LK06).

3 The inspiration for this task came from: https://iktsenteret.no/ressurser/minecraft-gir-laeringskraft, https://minecraftiskolen.wordpress.com.

4 According to the national curriculum, we were working with digital competence.

5 The ability to express oneself orally is one of five basic skills described in the national curriculum.

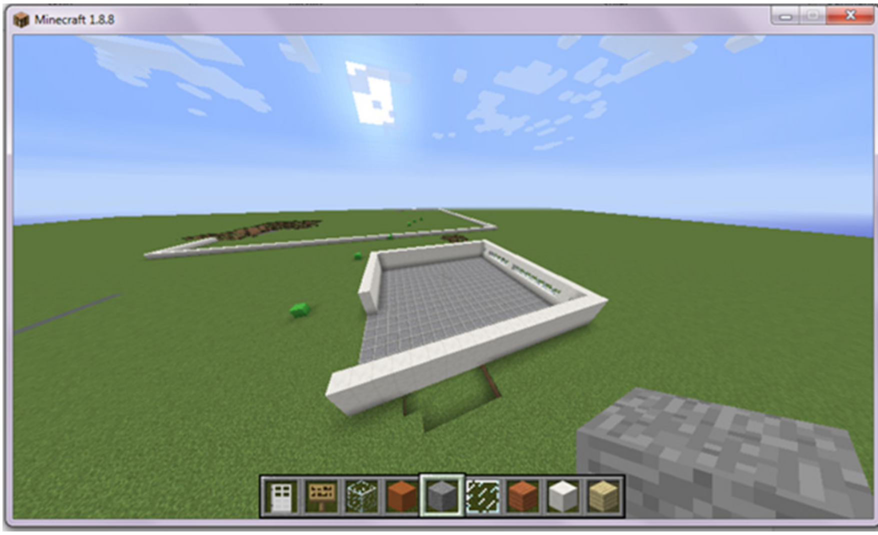

Figure 1. Build your classroom task (screenshot from week 45, Group A)

The teacher wanted to work with the mathematics tasks according to ideas about deeper complex learning using digital tools. Such a focus included reflections on such matters as the choice of block size mentioned in the task presented above and an evaluation of this choice in collaboration. We were inspired by a study by Jahnke, Nordqvist, and Olsson (2014), the findings of which show different components of deeper learning when it comes to group learning.

Research and theoretical framework

Cultural-historical activity theory (CHAT; Engeström, 1999, 2015), which implies that formative interventions contribute to a change in practice through expansive learning, was selected as the theoretical framework for this study because it supports an understanding that games are dynamic and players and conditions change (Plass et al., 2015, p. 273). An artefact, such as Minecraft, can facilitate actions between students that are cooperative (Engeström, 2015). According to Leontjev (2002), human activities exist in the form of actions or a chain of actions. Leaning on Leontjev, Engeström explained that the object of an activity is its true motive (Engeström, 2015, p. 54), meaning an activity is realised by goal-directed actions, as in this outlined intervention with solving various tasks in mathematics.

CHAT is often used as an analytical tool to contribute to knowledge about a situation both before and after a formative intervention. As a tool for development, it is called the Change Laboratory (Virkkunen & Newnham, 2013), based on the experiences of Engeström and his colleagues with developmental work research (Engeström & Sannino, 2010; Virkkunen & Newnham, 2013).

As claimed by Engeström and Sannino (2010, p. 5), expansive learning typically calls for formative interventions based on Vygotsky's principle of double stimulation in which a neutral external artefact is filled with meaning, increasing the chance of solving a problem. Expansive learning is also the process of resolving contradictions, including dilemmas or conflicts (Engeström, 2015, p. xxiii) embedded in the lives of the participants, whether students or teachers. When a contradiction is resolved, a new form of activity emerges, which can be understood as a solution. In addition, a new practice has been experienced among participants. As presented in the context of the current study, the teacher's contradiction was that the mathematics books were not good enough for his students and their motivation for mathematics was decreasing. He expressed a need for change. His new solution was to try another educational tool, an artefact, to obtain his object: restoring students' motivation for mathematics. Minecraft was also a new experience for him.

There is a crucial difference between *objects* and *outcomes*. Objects are carriers of motives, meaning they are foci of attention, volition, effort, and meaning. People, through their activities, are constantly changing and creating new objects. In addition, new objects can be the unintended consequences of activities (Engeström, 2015, p. xvi). The outcome, however, is the actual product (experience) of the action taken with the help of tools (Engeström & Sannino, 2010, p. 6). Furthermore, participants can redesign the tools (Virkkunen & Newnham, 2013). Two important processes explain this activity. The internalisation process entails the reproduction of a culture, including an artefact, and the externalisation process is about how artefacts can be used innovatively (Engeström, 1999; Postholm, 2015). Engeström crystallises all this in his expansive cycle model (Engeström, 1999, pp. 33–34), depicted in Figure 2. According to Engeström, this circular process of development linked to Vygotsky's (1978) zone of proximal development can also occur at the level of collective activity (Engeström, 1999, pp. 33–34). Any activity begins with an emphasis on internalisation, for instance training, to become more competent in an activity as it is carried out. Externalisation first occurs as discrete individual innovations. As the activity becomes more demanding, the search for solutions increases, accompanied by the growing process of externalisation, which will reach its peak when a new model for the activity is applied (Engeström, 1999, p. 34).

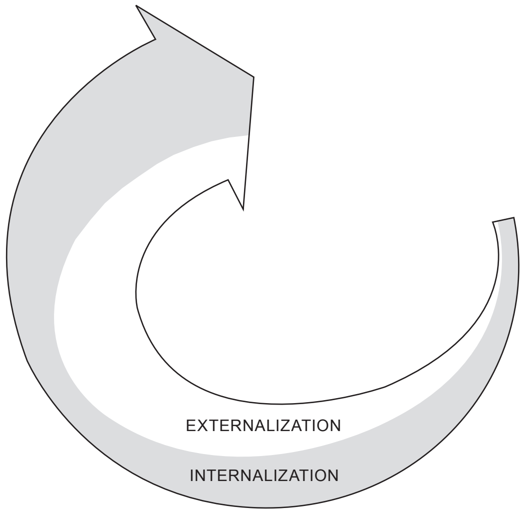

Figure 2. The expansive cycle (Engeström, 1999, p. 34)

Methodology

The research was conducted as a single case study (Yin, 2014), which implies an in-depth investigation of a contemporary phenomenon, in this case an intervention in its real-life context (Creswell, 2013; Yin, 2014), the classroom. The emic perspective (Fetterman, 2010) of the processes and intracultural diversity among the students involved have been important to understanding their actions. CHAT also propounds this view with the explanation that CHAT is a dialectical theory in which a new concept is transformed step by step into a new form of practice by participants (Engeström & Sannino, 2010, pp. 4–5) and where the dialogue is accompanied by an activity during an interaction (Postholm, 2010). The nature of this understanding classifies this study under the social constructivist approach (Creswell, 2013; Postholm, 2010), with the epistemological assumption that researchers can acquire knowledge through participants' subjective experience of collaborating in their context (Creswell, 2013, pp. 20–21).

A formative Change Laboratory intervention (Virkkunen & Newnham, 2013) was the method by which developmental processes were approached. This strategy anchored the intervention in the school context as it can be applied to case study research (Yin, 2014, p. 4). This kind of work takes about 5 to 12 Change Laboratory sessions, usually with a follow-up session (Virkkunen & Newnham, 2013, p. 15). The number of sessions that were used in this study's intervention is noted above.

Data collection

A major strength of case study research, according to Yin (2014), is the opportunity to use multiple sources of evidence. Consequently, I collected different data types to develop converging lines of inquiry. Thus, the case study findings build on several sources of information that support the study's construct validity (Yin, 2014, pp. 118–121).

The relevant data corpus, described in Table 1, consists of transcriptions of eight semi-structured interviews with individual students conducted early in the autumn term, eight focus group interviews after the lessons, conversations from weeks 2 and 3 with the teacher during lessons, and participant observations from the classroom. During my process of analysis, screenshots were used to support my observations (Creswell, 2013, p. 160). These screenshots of student products exemplify how they solved tasks (Virkkunen & Newnham, 2013, pp. 15–16), and the teacher and I jointly evaluated them during the intervention. The screenshots served, then, as physical artefacts, that is, printouts (Yin, 2014, p. 117), both in the collaboration with the teacher and later in my process of analysis.

Table 1
Data corpus

Data types	Source
Recordings of eight single semi-structured interviews	Week 40, 2015, four students from each group. From 5 to 15 minutes.
Recordings of eight focus group interviews	Weeks 44, 45 (2015), 2 and 24 (2016). Four interviews from each group with four students in each interview. From 15:32 to 28:00 minutes.
Recordings of four conversations with the teacher during lessons	Weeks 2 and 3 (2016), total 22:34 minutes.
Notes from participant observations	Notes from 23.5 hours in the classroom (2015–2016).
Physical artefacts	133 screenshots from student tasks, weeks 44, 45, 2, 3, and 6 (2015–2016).

Furthermore, my conversations with the teacher during lessons involved sharing our direct observations (Yin, 2014, p. 106). This kind of immediacy, especially when recorded, enables access to action in real time.

I received permission to interview 20 of 27 students from their parents. They received a letter to sign with information about the project and the proposed interviews. Both the students and their parents were informed that the study would be anonymised, students could withdraw from the research project at any time, and they could listen to the recordings. Data collection and storage followed the requirements for personal data (NESH, 2016).

Individual interviews obtained students' individual understandings (Kvale & Brinkmann, 2015; Yin, 2014) of Minecraft and other digital games, their attitudes towards mathematics in school, and their expectations from the intervention. Focus group interviews were conducted to understand the range of their experiences (Kvale & Brinkmann, 2015; Yin, 2014) with the lessons and their suggestions for other tasks in future.

In both kinds of interviews, I asked the students about their classroom experiences, which enabled me to confirm my understanding of my observations and access their views. I also applied this strategy during conversations with the teacher (Yin, 2014, p. 117). Such methodological triangulation can be used to confirm interpretations, but it was even more valuable for me to gather additional observations and interpretations (Stake, 1995, pp. 114–115). This kind of procedure also strengthens the study's trustworthiness (Postholm & Smith, 2017, p. 89).

Data analysis

The constant comparative method of analysis (Corbin & Strauss, 2008) was selected to analyse my transcripts of interviews, conversations with the teacher, and observation notes. This method of analysis can be used in qualitative studies other than the grounded theory approach (Postholm, 2010, p. 87), such as case study research (Yin, 2014, p. 138). Furthermore, this method acknowledged the researcher's presence and is in line with the social constructivist approach. I experienced being part of the construction of data material (Charmaz, 2014), for instance when the teacher and I discussed our observations in the classroom. Our shared experience or the knowledge we gained was created through collaboration. This acknowledgement of the researcher's presence is also emphasised in Change Laboratory interventions (Virkkunen & Newnham, 2013).

The data from the interviews were structured and reduced through the processes of coding and categorising according to the constant comparative method of analysis (Corbin & Strauss, 2008). The process of coding involved aggregating the text into smaller categories (Creswell, 2013, p. 184). This means I made a list of codes after I had opened the data up to all potentials and possibilities (Corbin & Strauss, 2008, p. 160), considering possible meanings during reading. Then, I reduced the number of codes by searching for similarities and differences among the emerging categories, constantly comparing them until I had three main categories. These will be outlined below.

Observation notes and conversations with the teacher became complementary data to support the categories that emerged during the analysis. Screenshots supplemented displays of task outcomes.

From the beginning of the intervention, students expressed positivity about using Minecraft when we had lessons and during interviews. This positivity was such a natural part of the intervention that it could be taken for granted. During the analysis, I called this positivity "positive attitude". This attitude can be defined as a general viewpoint on the intervention, as well as positive expressions about Minecraft (Abrams, 2017), and it was defined as the core category. This is followed up in the discussion section. This core category was supported by the following main categories: *motivation and fooling around*, *tasks*, and *learning*.

Expressions such as *fun* or *funny* and emotions such as joy and dedication appeared in the classroom and the interviews. During conversations, the teacher connected these expressions and emotions to motivation. This understanding of motivation is also in line with previous research (Abrams, 2017; Plass et al., 2015). Based on his experience with this class, the teacher could uncover changes in motivation, something on which I relied. I had, as mentioned earlier, one mathematics lesson without Minecraft, that is, without a strong basis for questioning the teacher's understanding of motivation in his class. As will be shown, however, this motivation was double-sided. That is why this category was named "motivation and fooling around".

The *tasks* category concerned experiences with the completed tasks and suggestions about the future use of Minecraft at school regarding mathematics and other subjects and other ideas that emerged. The *learning* category included learning outcomes students may have experienced when working with the tasks.

The main categories outlined above will guide the following text. Going through the transcripts from the interviews, some parts illustrate the variation in students' understandings and experiences especially clearly and exemplify the main categories outlined above particularly coherently. Excerpts from these parts were chosen for presentation. They do not represent all students, but they reflect differences between Group A and Group B.

Findings

Motivation and fooling around

As I observed, the students expressed positivity on mornings when the computers were turned on for work. With excited faces, they wanted to get to the computers as fast as they could, but when told to wait, they listened patiently—more or less—to what the teacher and I had to say.

Observations from the lessons revealed that students from Group B wanted to continue with their tasks even when the lessons were finished. Students in Group A were in a hurry to finish their tasks and then play Minecraft. Sometimes they did their tasks, but simultaneously also did something else in the Minecraft world. It quickly seemed to me that the received tasks were of secondary importance. During one lesson, when students in Group B were working with the tasks, the teacher and I summarised what was going on. The teacher said:

> *Well, there are many students in the other group (A) who like this (task) but were too busy to do what they wanted to do. But here (in Group B), it seems that the disciplinary aspect is more fun through the use of Minecraft. At first, you'd think that the opposite was the case. So that's why I think it was very surprising that it's worked so well. It's very enjoyable to see.*

The teacher and I observed that the working process was different in Group B. Students worked in a more dedicated manner, showing how they managed to solve the tasks using Minecraft. The teacher was surprised that this group was more interested in working with the tasks. The main argument for splitting this class into groups was that Group B needed more support, but according to the teacher they managed well on their own during these lessons. A screenshot from two students in Group A (Figure 3) and one from two students in Group B (Figure 4) exemplify the differences in their efforts on the tasks.

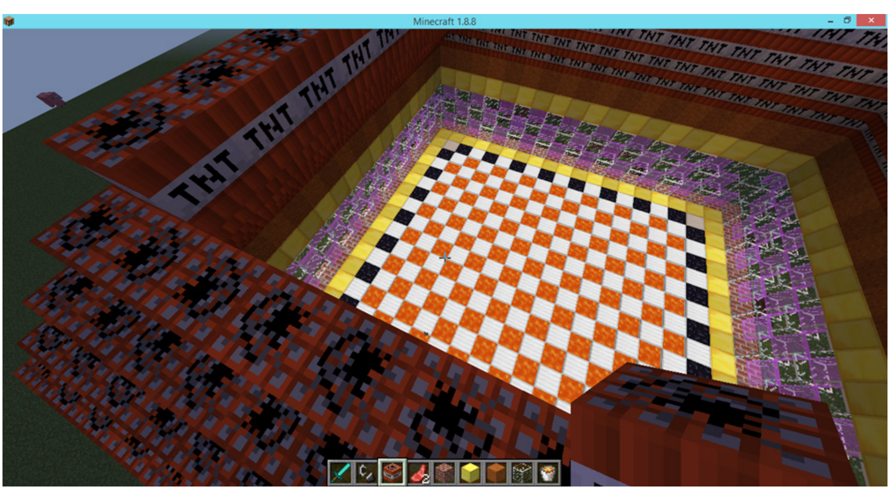

Figure 3. Screenshot from two students in Group A (week 45)

Figure 4. Screenshot from two students in Group B (week 45)

These two students from Group A built their classroom with TNT blocks and blew it up after they took their screenshot. The two students from Group B were busy ensuring all the details were right. They proudly showed the teacher and me their classroom construction, and one asked if they could show their classroom to the rest of the group. This question surprised the teacher because he thought of this boy as a highly modest student. Later, the teacher expressed more about his reflections connected to our observations of this group:

> *Again, I think that this group does more of what they're supposed to. They're not fooling around so much. They cooperate better, too. Many of them, those who usually have challenges, are doing very well with this working method. This is something they're good at and can use for schoolwork. I think that it must be motivation. The other group should have the prerequisites to do more difficult tasks, but obviously not. It's funny that those who usually aren't working so much during the lessons are very active.*

From our observations, we decided that Minecraft was a reasonably good choice of educational tool for Group B. Such emotions as pride and the feeling of mastering the game in connection with schoolwork (Plass et al., 2015) were observed during the lessons. Based on an understanding of the research presented above and the teacher's reflections, Group B showed motivation to solve mathematics tasks using Minecraft.

During one focus group interview, Simon from Group A was quite convinced it was much more fun to work in Minecraft than with the book. He said: "*Somehow, I don't see this as a class in mathematics*." The excerpt below relays the conversation in Group A when students were asked how they could work with Minecraft:

> Simon: *I haven't really learned anything new in mathematics. We've worked with things I already knew, but it's more fun.*
> Lotte: *It makes it easier to learn if it's more fun.*
> Jonas: *We can use fractions to make weapons.*
> ABJ: *How?*
> Jonas: *The sword. You have four diamonds and* (…) *then you can have two swords. Four divided by two will be two.*
> ABJ: *I didn't know that. But your tasks were about fractions. How did they work?*
> Simon: *They were okay, but it was a little bit difficult when we didn't think to read the whole task before we started.*
> Emilie: *I did.*
> ABJ: *So you* (Simon) *were in a hurry?*
> Simon: *Yes, we planned to do it fast.*
> ABJ: *Why?*
> Simon: *Because then we could just fool around.*
> Jonas: *We could hang some zombies!*

Lotte noticed the connection between fun and learning. However, Simon was unsure of whether he was learning and did not read the tasks properly. He instead emphasised the fun of playing (Jessen, 2011). Jonas argued about fractions when he wanted to play Minecraft. Their main motives were, then, not to work with mathematics tasks but to get through them quickly and then do anything else more meaningful, such as hang zombies. Engeström (2015, p. xvi) clarified this kind of issue by stating that objects are carriers of motives. Through their activity during this intervention, they created a new object: fooling around. Fooling around was also a term the teacher used when he described their activity when they were doing anything but solving the tasks, and Simon confirmed this object in our conversation above. The fun of playing may be the reason for their explanations above. As emphasised earlier, "to play" can be an end and not a means (Jessen, 2011), but it is also possible that the content of the tasks had an unclear link to the game mechanics (Plass et al., 2015).

In an interview with Group A on Monday of week 24, Simon said that he had a confession to make.

Simon: *Okay, I'll just confess.*
ABJ: *Yes?*
Simon: *Bendik and I were doing some stuff behind room one, when no one else was there, and we made a crafting table of planks and we made swords. We gave one sword…*
Lotte: *An axe!*
Simon: *So an axe, to Lotte. And we had lots of fun there!*
ABJ: *So you were in a completely different place?*
Simon: *Yes. You can break those three planks and you can make a crafting table and then you can make sticks and…*
Lotte: *Four planks!*
ABJ: *And the teacher didn't know anything about it?*
(Laughing)
ABJ: *He didn't catch you?*
Simon: *No, on crowds, the tags don't show!*
ABJ: *Yes, you fooled us!*
Lotte: *Yes!*
Simon: *We just didn't find any stones, and then we couldn't mine iron and gold.*
ABJ: *But you also did the tasks?*
Simon: *Yes.*

Again, Group A students showed they have an alternative object in their mathematics lessons. They did the tasks, but that was not what they were eager to discuss. Their attention was on the crafting table, where they could make weapons for other students. This kind of additional and creative activity (Abrams, 2017; Canossa et al., 2013) also allowed them to express satisfaction with fooling the teacher and me. It seemed a fair thing to do, as they had completed the tasks. However, they showed openness and pride in telling me this. Indeed, various emotions appeared during this interview, awakening attention about the overall Minecraft experience (Abrams, 2017). When I asked Jonas from this group if there was too much Minecraft in mathematics, he and the three others clearly said, "No." This answer was given after the last lesson in week 24.

Tasks

Students from Group A were convinced about the benefit of using Minecraft in English.

Ulf: *I think that it would've been better to have Minecraft in English lessons.*
Jesper: *Yes, if you choose to set the language as English, you'll learn more English.*
Jonas: *You see the pictures and you have to think. I had to, about what it means and so on.*
ABJ: *So if you received tasks in English …*

Jonas: *Yes, like, "build an elephant", so you have to know what it means.*
ABJ: *Wouldn't it take a terribly long time to build an elephant?*
Jesper and Jonas: *No.*
Jonas: *You only need to make a head.*
Jesper: *Use grey blocks.*
Jonas: *It doesn't have to be very big.*
Martin: *It can be a block here, one block there, one block there, and there, there, there.*
Jonas: *And build it upwards; it would've been awesome!*

Students explained how English could be used because they know how Minecraft works and could transfer their experience to the school context. They had an understanding of the issue (Engeström, 1999, p. 33).

When I asked Group B what they wanted to do during their lessons, they suggested playing together in multiplayer mode.[6]

Melody: *We can build a city together.*
Edward: *But then everybody needs a username.*
ABJ: *Some of you have one.*
Edward: *I don't remember my password.*
Teo: *Oh, I have an idea!*
Melody: *People who don't have a username can join someone else.*
Teo: *If we got Minecraft all the time in school and got homework with Minecraft, then we could play at home together. We could get tasks and do them together.*
ABJ: *So your idea is to get homework in Minecraft? We can think about that.*
Edward: *You can make a school account and give us usernames.*
Ella: *Yes, you can make them.*
Teo: *Yes, but it costs money, so you must talk to the head teacher.*
Edward: *You can buy it on sale. It's a super deal on Halloween!*

Group B students were preoccupied with solving the problem of gaining access to the game for everybody and the fact that it should be possible to work together in a single game when doing homework. Based on their experience, they suggested redesigning what we had established, including the idea that everybody should have a username. Their internalisation process had advanced from their leisure time to the school context. Their focus was on the opportunities that appeared, particularly how they could be resolved. According to Engeström (1999), they had reached the externalisation process when designing new possibilities for this intervention. In week 45, we tried

6 In multiplayer mode, students can play in the same game/save and cooperate.

their suggestion, but our success was limited, especially with Group A. Several students used TNT[7] to blow up their own and other students' classrooms. In Figure 1, a hole is clearly visible. The following dialogue highlighted this event.

> ABJ: *Do you mean that it was more fun to be in the same save?*
> Ada: *Yes, very.*
> Emilie: *Yes, but boring when they had to blow things up.*
> ABJ: *Did anybody really do that?*
> Emilie: *Yes, they blew up the city.*
> Lotte: *It's a little bit fun to blow things up!*
> Ada: *They can do it on their own server!*
> Melody: *And not at school!*

Learning

Students were asked if they thought they were learning mathematics with Minecraft. Students from Group B had the following answers.

> Ella: *Yes, I'm learning a little.*
> Mads: *Things we have to learn.*
> June: *Not really … or just a little bit.*
> ABJ. *Yes, what makes you feel that you aren't learning?*
> June: *I don't know; I'm not learning mathematics this way. When we do these tasks, we're just building; it doesn't feel like we're doing tasks.*

Bendik, from Group A, joined this interview because one student had to leave. His reaction to June's words can be traced to others in his group.

> *I was going to say … Minecraft is a slower way of learning, but much more fun. I'd rather have a whole day playing Minecraft than one hour with mathematics, especially when I'm finished with the tasks. Instead of doing the tasks for the next week, you can do what you want in Minecraft.*

Bendik turned the focus from the uncertain learning outcome that started to emerge when June was talking about the possibilities connected to play and again clarified his group's object – he finished the tasks and then he did something more meaningful for him. Tasks belonged to work at school, and he was not interested in doing more of the tasks than the minimum. The focus on play indicates more intrinsic motivation than working with the tasks (Jessen, 2011; Plass et al., 2015). Bendik's last sentence shows his understanding of Minecraft as an arena of freedom with possibilities for a curious mind (Canossa et al., 2013).

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7 Special TNT blocks can be used to blow up constructions.

Discussion

This case study dealt with the following research questions: How do students experience the use of Minecraft in their classroom and what are the consequences for their motivation?

Students experienced positivity, showing a positive attitude throughout the intervention. However, it seemed that groups A and B had different motives when working with tasks. Consequently, the experienced outcome in terms of motivation was two-sided: in Group A, motivation appeared when students played or talked about playing Minecraft, but in Group B, motivation appeared for tasks in mathematics and students worked dedicatedly to complete them in Minecraft. The teacher expressed surprise at this finding, as he had expected the opposite. This finding contributes to an understanding that variation may be present among students in a class, despite displays of overall positivity. According to CHAT, it is important to distinguish between the expressed object and the actual outcome as well as to accept that a new, unplanned object may be created (Engeström, 2015). It became clear as the intervention progressed that students in Group A had created their own new object: fooling around, as evidenced through both interviews with the students and observations with the teacher. Fooling around involves doing something other than the task at hand, that is, playing, such as "*hang[ing] some zombies*", as noted by Jonas in Group A.

Students from Group A were more eager to discuss what they had been doing other than the tasks, which seemed more meaningful and enjoyable; this can be anchored to Jessen's (2011) explanation of the joy of playing games, informed by Huizinga (1955), who argued that play is considered a fundamental human activity. Furthermore, according to the students' experiences, Minecraft is fun but they were unsure of whether they were learning. This was the case for both groups, but it was more apparent with Group A. Students' doubt in this matter is supported by Sáez-López et al. (2015, p. 125), who did not identify significant improvement in academic results using Minecraft in their study but concluded that Minecraft is fun. Leaning on Plass et al. (2015), the game mechanics in Minecraft must be investigated closely in connection to different subjects and various students in school to gain a more complete view of this digital game's potential when it comes to learning.

Students did not seem to get tired of Minecraft, despite having had this game incorporated into many lessons. In the introductory part of this article, Edward expressed, "*I'll have everything in diamonds!*" This kind of emotional involvement is understood by Canossa et al. (2013) as a part of intrinsic motivation (Reiss, 2012) where learners can discover knowledge as they play (Turkay et al., 2014). Canossa et al. (2013) suggest that emotional involvement indicates a special dedication to Minecraft that they detected in their survey but did not discuss in relation to the age range of their participants. The present qualitative study gives information about a particular group of students aged 11–12; thus, the research contributed to these students' experiences localised in the classroom as a part of school research. Excerpts from several interviews show curiosity (Reiss, 2012) and a desire to create, which is in line with Canossa et al.'s (2013) findings. Students made a crafting table, made axes and swords, and experimented with different types of materials and blowing up buildings. They showed involvement in describing possibilities and creative solutions, demonstrating affective expressions about working with Minecraft. Similar findings are described by Abrams (2017). She was engaged with how 11-year-old Anita experienced Minecraft. The description of Anita's experiences did not include other girls or boys her age but emphasised the impact of various emotions on her overall meaning-making experience. In the present study, attention was drawn to interactions among students and their dialogue with me during interviews about Minecraft. The uncovered emotions provide an important understanding of students' attitudes; however, this understanding has a collaborative dimension that must be considered for future learning (Niemeyer & Gerber, 2015, pp. 224–225). In other words, this case study contributes with a focus on dialogue and cooperation that exploits the possibility of using Minecraft for knowledge building (Cipollone et al., 2014, p. 10).

Finally, it is interesting to understand what the students experienced themselves. If we take a popular digital game such as Minecraft from youth culture and incorporate it into the school context to increase motivation with the idea that it will work, we will be taking this idea for granted. Why would students perceive this idea positively and think it fair that adults suddenly decide what they should do in the digital arena? According to Jessen (2011), children are good at revealing pedagogical objects in combination with digital games and see any work in the school context as a duty. Jessen argues that, from an educational perspective, this is about the interpretation of play (Jessen, 2011, p. 154). If the understanding is that when we play we are not working and not learning and that games are made for playing, we have a mismatch. Leaning on Engeström (2015), a contradiction is created when we use a commercial digital game in a school context. This was especially evident in Group A, where fooling around was their solution.

Formative Change Laboratory interventions as a dialogical approach are concerned with the study of externalisation processes (Engeström, 1999). As the intervention proceeded, it was possible to detect how students engaged in this new activity, fooling around, as part of an externalisation process. This shows what students did or experienced when a teacher exploited a popular game to reach pedagogical goals, and motivation in relation to both positive emotions and mathematics tasks can appear in the same class. Motivation in connection to digital games is seen as a highly complex subject by researchers and needs to be explored more in a classroom context in addition to through surveys, such as those conducted by Canossa et al. (2013), Sáez-López et al. (2015), and Beavis et al. (2015).

Conclusion

The aim of this article was to highlight the experiences of 11–12-year-old students from a Norwegian primary school regarding their use of Minecraft in mathematics and explore the consequences for their motivation. The use of Minecraft in the classroom has gained popularity; the students showed overall positivity. I have argued that this positivity should not be taken for granted. Nevertheless, such a positive attitude has been useful to enhance the classroom context and gain more knowledge about this specific commercial digital game. That said, in this study, CHAT offered meaningful lenses through which students' actions and motives (Engeström, 2015) in connection to Minecraft could be better understood. Minecraft offers space for students to discover possibilities in collaboration, and while not everything may be according to the curriculum, it still may be a meaningful discovery of knowledge for both boys and girls. In further research, it would be interesting to explore boys' and girls' motives to play this particular game, particularly with a focus on their age. Such research could affect how teachers choose other games as educational tools or how to work with the curriculum regarding game mechanics. I hope this text has provided readers with a sufficiently vicarious experience to contribute to related work in the future.

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