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Master's thesis

# Developing and learning common artifacts in small groups

*Understanding Minecraft in social studies from a CSCL perspective*

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Communication, design, and learning
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# Summary


TITLE:

Developing and learning common artifacts in small groups: Understanding Minecraft in social studies from a CSCL perspective

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KEY CONCEPTS

Sociocultural perspective, CSCL, collaboration, Minecraft, virtual worlds, technology enhanced learning, common artifacts, language, spontaneous concepts, scientific concepts, mediation, generic skills, 21st century skills, game-based learning.

# Abstract

In this thesis I have explored how Minecraft functions as a tool used in Computer Supported Collaborative Learning in socials studies and how small groups of pupils participate in collaborative learning activities to develop common artifacts. Minecraft used as a learning tool offer sandbox environments which promote creativity, collaboration, and flexibility in both the design of the learning activity and for the participants. To explore this topic, I asked three research questions which explores different aspects of collaborative learning within Minecraft:

1. What common artifacts emerged in the pupils collaborative learning and design efforts and what artifacts were provided?

2. What relations between everyday concepts/language and scientific concepts/language could be identified in the pupils' conversations?

3. What are generic skills in Minecraft and how is it manifested in domain-specific learning?

Within the sociocultural perspective of learning I explore central tennets such as the zone of proximal development, scaffolding, artifacts, and the Vygotskian concepts. I utilise a CSCL approach to Minecraft as a tool used in social studies and explore how generic skills, language and collaboration and the development of common artefacts take place within it.

This study uses a qualitative approach, and I utilised secondary data provided from the SMILE-project (UiO, 2020). The data was collected using video recordings as an observational method and focus group interviews. I used these video recordings to create my own transcripts of events of interest, as one of the challenges of using secondary data is to find the right material which can help answer my research questions. This data was analysed using thematic analysis as explained by Braun & Clarke (2006). The approach to the data was deductive, as the main topic and theory was decided before I had analysed data. Through the thematic analysis, the following themes were identified:

- Generic skills
- Interaction & information sharing

- Joint meaning-making
- Development of a common artifact

Many of these themes are connected to the core features of CSCL, as to effectively explore this topic from a CSCL perspective. Through analysis, the data indicates that through a learning activity with a collaborative design, the pupils were interacting and sharing information with each other while taking part in the reconstruction activity. This led to joint meaning-making through discussion and interaction within the virtual world. The groups developed common artifacts which took different forms and had different purpose. Group 1 developed a symbolic artifact by assigning group-meaning to an object, contextualised by the subject-matter. This object assisted the group in completing their reconstruction project through mediation of their actions. Group 2 developed CSCL-artifacts through collaboration and joint meaning-making providing intersubjectivity, which mediated their actions within the virtual world. Provided artifacts also supported and mediated the pupils' efforts, such as OneNote being a helpful tool for mediating the details of the building process through the information sharing and joint meaning-making processes. In addition, in-game scenery provided pupils with context for how to orient and place their buildings.

Generic skills were identifiable through the pupils' collaborative efforts within the game. There were multiple cases in which different generic skills emerged, such as creativity, collaboration, problem-solving, and parts of the basic academic skillset. The CSCL activity promotes the generic skill collaboration, while creativity and problem-solving were identified when the subject-matter interacted with Minecraft in such a way that the pupils needed to develop their own ways of completing the reconstruction, such as creative use of materials. A set of generic skills within Minecraft were also identified, such as movement and construction. These generic skills are needed to fully utilise Minecraft as a learning tool for domain-specific learning, and while peer-scaffolding happened throughout, the role of the teacher was still important for learning certain skills.

Instances of concept evolution were identified throughout the learning activity, suggesting that collaborative efforts within Minecraft and interaction with players of different skill levels and different levels of involvement with external game-communities can help players develop and transform concepts. However, because of limited data I recommend further

research within the topic of language and concept evolution through collaboration in virtual worlds.

# Acknowledgements

First, I'd like to say that my years at the University of Oslo has been some of the most fun I've ever had, both professionally and socially. Thanks to all the people who I've met over the years and helped make my time here as great as it was, even though we lost a year and had to work from home for a while! A special thanks to the people who joined me in long hours of work during the final weeks of the semester. Without you this process would have been a lot more difficult.

I would like to express thanks to the people who worked with the SMILE-project for granting me access to their data and their guidance while writing this thesis. I would like to express my thanks to Anders Mørch who participated in the SMILE project and who also was my supervisor for this thesis, providing excellent guidance which I would most definitely be lost without!

Thanks to my mother who always supported me through all my years of education. Even when I was stressed out of my mind, she'd always provide some good advice which would keep me going. Thanks to my dad for supporting me a lot, even though we couldn't see each other for a long time because of the worldwide pandemic, you're both the best.

June 2022, Oslo
*Kevin*

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# 1. Introduction

As technology and digital tools become more popular and widespread every year, it is not surprising to see an increase of games as educational tools over the last decade. Games, when used as learning tools can make active learners through participation, challenges, and engagement. As of 2020, the Norwegian Directorate for Education and Training have set new principles for education in the country which puts a spotlight on creativity, motivation, engagement, and exploration within the subjects present in modern education (Udir, 2021). Within these principles of education there is a bigger focus on using digital tools and knowledge in education than before, such as programming and algorithmical thinking. With a renewed focus on exploration, creativity, and engagement in combination with digital tools, Minecraft becomes a very interesting potential learning tool. Minecraft has been used in classrooms for some years at this point, and the developers even developed a separate educational edition of the game just for this purpose (Minecraft education edition, 2021).

The game itself promotes exploration, creativity and keeps students engaged and motivated (Ekaputra et al., 2013). However, games are often perceived as not having a place within education and classrooms, being more focused on entertainment and seen as a distraction. The challenge remains to integrate Minecraft as a tool for learning within education even further and utilise its strong points to improve education with digital tools.

## 1.1. Background

Around the year 2010 my friends showed me this new game they had just found on the internet, called Minecraft. Not long after, the game had become a worldwide hit among not just children, but people of every age. The creative and explorative nature of the game also led to it being used for educational purposes within educational institutions and at home. When I started my current education, I was heavily intrigued by how a game I have been playing for the better part of 10 years can be used as an educational tool, and therefore decided to take a deep dive into this topic. I also experienced Minecraft being used as an educational tool first hand, when I briefly worked at a primary school, piquing my interest. When I started my academic journey at the University of Oslo, I specifically chose communications, design and learning as my master's degree because of my interest in the topic of using games as tools for learning.

### 1.1.1. SMILE project

The project description for the SMILE project states the following: *"The aim of our research is to understand how student teachers perceive the value of generic skills in specific subject areas such as Social Studies, through a dialectical interplay of generic- and domain-specific skills' practice, exemplified in by children's building and playing in Minecraft and other block building games."* (UiO, 2020).

The project was active from January 2018 until December of 2020. During this period, student teachers are introduced to Minecraft and parts of the curriculum (grades 5 to 10) within Minecraft, which was then implemented into the teacher education. Students from different institutions (A & B), were part of the project, where students from institution A major in general education, and students from institution B major in social studies. They then carry out a *joint learning activity defined by an assignment* created by institution B (UiO, 2020).

Following the joint learning activity, the students at institution B introduce Minecraft and the activity to groups consisting of Norwegian 7$^{th}$ graders. The assignment is grounded in a specific social studies topic - the industrial breakthrough in Norway. The participants then partake in collaborative learning through creating a role play inside a historical building they themselves reconstruct within Minecraft. Through this activity, the students will acquire technical skills in Minecraft, detailed knowledge about the buildings they construct, and how they reflect society in that era. This learning activity was tested twice: once with teaching students and once with 7$^{th}$ graders in Norway (12-13 years of age).

## 1.2. Research questions

The aim of this thesis is to explore how collaborative learning emerges and functions within a virtual world setting. To explore this topic, I ask the question:

*How can one understand learning activities in Minecraft from a CSCL perspective?*

To further explore this question, the following research questions have been formulated to explore different aspects of learning activities within Minecraft:

1. What common artifacts emerged in the pupils collaborative learning and design efforts and what artifacts were provided?

2. What relations between everyday concepts and scientific concepts could be identified in the pupils' conversations?

3. What are generic skills in Minecraft and how is it manifested in domain-specific learning?

## 1.3. Research questions

This thesis consists of eight chapters. The one you are currently reading is the introductory chapter. Chapter two is an introduction to the game Minecraft which provides a knowledge foundation about the game, used for later chapters. The third chapter provides a literature review of existing studies conducted on relevant themes for this thesis. Next, the fourth chapter presents the theoretical perspectives this thesis will base itself on when answering the research questions. Chapter five consists of the methodical approaches I utilised when approaching the data set, and how the data set was collected. Chapter six begins the analysis of the data set proper, presenting excerpts from the data set which are important for answering our overarching questions. Chapter seven will provide a discussion on the finds made during the analysis, and chapter eight will be a closing summary and suggestions for further research.

# 2. Introduction to Minecraft

Minecraft is a block-based sandbox game with randomly generated landscapes, layouts, and structures. It was launched officially in 2011 after a long period of early-access alpha and beta testing open to the public. The game never prompts the player to reach a goal of any kind, instead it drops the player into a world and gives them the opportunity to exercise their creativity however they see fit, whether that be through building a small house or entire cities, digging out underground mines, or fighting one of Minecraft's many "mobs".

Everything in the world of Minecraft is made up of blocks. There are hundreds of different blocks with different looks and properties. Some blocks make up the base world – like the dirt and stone blocks, while others are crafted as decorations or tools by the player – like the brick and furnace blocks. As each of type of block have a unique texture applied to them, the player can pick and choose from hundreds of blocks to use in their projects.

There are four main ways to play Minecraft. There's the classic survival-mode where the player is dropped into a new, randomly generated world and must gather resources and survive as best they can. The player has a hunger meter on their interface, which the player needs to fill by eating various food items. Food can be gathered through crop-farming, or by getting them from animals like pigs, cows, and sheep. The next game mode is creative mode, where the player has access to every block and item in the game through their inventory, is invincible, has no need to eat, and can fly by double-pressing the space bar. The other two modes are adventure mode and spectator mode. These two modes are different in that the player cannot break or place blocks. In adventure mode, the player can still interact with interactable blocks, like furnaces, levers, and buttons. They still need to manage their hunger like in survival mode. The last game mode, spectator mode, lets the player fly around the world, but they have no way to interact with it (Minecraft Wiki, 2022a).

## 2.1. Minecraft as an educational platform

After the success of Minecraft as a game made for entertainment, it was clear that people both young and old got heavily engaged and immersed in their Minecraft worlds - whether they were working on huge projects in creative mode or playing around with their friends in survival mode. This engagement combined with the creative and problem-solving nature of

Minecraft's gameplay set the scene for Minecraft to be used as a game-based educational platform (Minecraft education edition, 2022)

The developers of Minecraft education edition highlight different areas of impact the game can have on children's education. According to their own website, Minecraft education edition "*prepares students for the future, building future-ready skills like creativity, problem solving, and systems thinking, and nurturing a passion for play.*" (Minecraft education edition, 2021).

There are several significant differences between the educational edition and standard edition of Minecraft. The Minecraft Wiki (2022b) mentions features like tools for the teacher to allow or deny certain elements of gameplay to create the teaching environments they want, pre-made lesson plans to reuse, and several added features to make teaching easier in a digital environment, like chalkboards, cameras and learning portfolios.

## 2.2. Minecraft as a sandbox video game

### 2.2.1. World and interaction

The gameplay featured in Minecraft can be described as explorative and creative. Minecraft generates worlds randomly, and even infinitely if the player keeps expanding their area of exploration. The world generates in "chunks" of 16x16 blocks on the X-axis, and all the way from the bottom world limit to the top limit on the Y-axis. These chunks generate in proximity to the player, ensuring they never run out of usable space (Minecraft Wiki, 2022c).

As the world generates, it not only spawns in chunks, but also in different biomes (figure 1). A biome is an area with a set "climate", or look to differentiate it from the rest, such as plains, forest, or deserts. As of the writing of this thesis, Minecraft (Java edition) currently features a total of 61 different biomes. Each biome has a set of unique qualities to it to differentiate it from the rest, such as desert biomes generating the ground as sand blocks, instead of the plains biome's grass blocks (Minecraft wiki, 2022d). They also have different climates such as no rain, rain, snow, and thunderstorms. The players will find that it is beneficial to explore different biomes for different resources – for example the jungle biome contains large amounts of wood to utilise, and the mesa biome has large amounts of gold ore for the player to harvest (Minecraft wiki, 2022d).

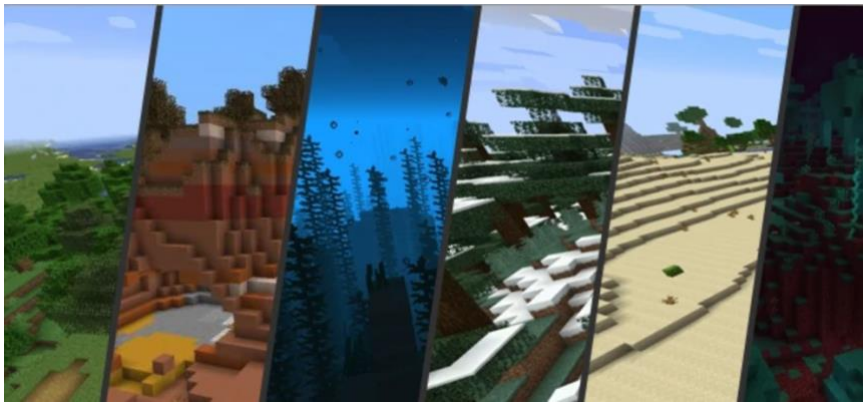

**Figure 1: Some of the many biomes in Minecraft (Minecraft Wiki)**

To interact with the world around them, the player starts out with nothing but their hands, and can punch blocks to “harvest” them for later use. This is the core gameplay-loop of Minecraft – interacting with and collecting blocks to use for whatever purpose the player needs them for. To do this, the player utilizes their inventory for storage space and the crafting system to craft new blocks, get new tools, and create helpful items.

### 2.2.2. Inventory and crafting

Minecraft’s inventory is essential for the player when interacting with the game, as this is where they store tools and materials used in construction projects. The inventory screen differs according to which game mode the player has selected. In survival mode (figure 2a), the inventory features 27 slots of storage, 9 hotbar slots for quick access to items, and a 2x2 crafting grid. Each slot can store a stack of items up to 64. Players can freely drag and drop items in the slots of their choice, with their hotbar being always visible on screen. The survival mode inventory also features 4 armour slots for the player to equip armour in for protection against enemy mobs.

The creative mode inventory (figure 2b) differs quite heavily from the survival mode inventory. This inventory works more like a list of every single block and item in the game which the player can use to drag and drop into their hotbar to use, infinitely. The inventory is sorted into tabs, dividing blocks and items into different categories such as decorative blocks, tools, and plants. This inventory also features a search bar, for easy access to blocks and items.

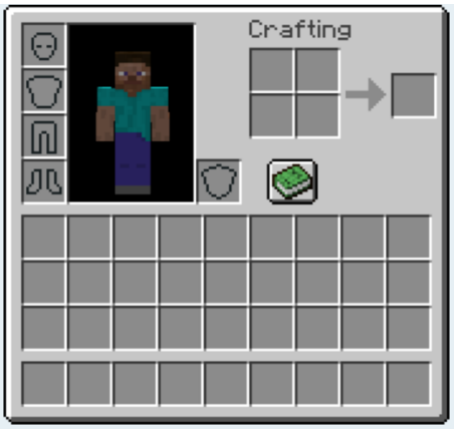


**Figure 2a: The survival mode inventory screen (Minecraft Wiki).**


**Figure 2b: Creative mode inventory, featuring a search bar and item selections.**

Note the 2x2 grid named “Crafting” in the survival inventory screen. This is another core gameplay system in Minecraft. Crafting enables players to combine items or blocks to create a new block or item. This system is essential to a player “progressing” in Minecraft. For example, the player starts out with their hands as their tools. After harvesting some wood, the player can craft a wooden pickaxe from it and use it to harvest stone, iron, and coal. The player can then fashion better quality pickaxes from better materials e.g., a stone or iron pickaxe (figure 3). Higher quality tools enable the player to harvest materials they wouldn’t be able to get without them and works at higher speeds and are more durable – effectively giving access to more blocks and materials. Players can also expand the crafting grid to a 3x3 grid by building a crafting table. This is needed for more complex crafting recipes, such as a pickaxe.

**Figure 3: All types of pickaxes in Minecraft, ranging from wooden to “Netherrite”, a durable material in the Minecraft world, which is not present in Education edition. (Minecraft Wiki)**

To use tools, place blocks, or interact in with the world in other ways, the player needs to select their item of choice by dragging them onto their hotbar and highlighting the slot with said item using either their number keys (1-9) or the mouse scroll wheel (figure 4). In an instance where a pickaxe is selected, the player’s avatar will hold it in their hand, and the player can freely use it to mine blocks.

**Figure 4: A player highlighting an iron pickaxe in their hotbar and holding it in their hand.**

### 2.2.3. Notable gameplay aspects

This chapter will present various aspects of Minecraft that will be important to be familiar with for later understanding in this thesis. These features can both be systems within the game, objects, or items.

*Block variations*

Within Minecraft there are hundreds of different blocks, some of which have similar names, texturing, or functions. Some blocks might even take different shapes, such as stairs or half-slabs. Many of these blocks are created using other blocks and may confuse players or onlookers. Here I will present some blocks that turned out to be central during the analysis, to give further context.

**Figure 5: Oak planks (left) and an Oak log (right)**

Figure 5 (above) shows the “Oak plank” block and the “Oak log” block. The oaken planks can be crafted from an oak log, each log giving four oak plank blocks. In addition to the

pictured blocks, there also exists shaped variations of the oak plank block, like stairs, fences, and slabs, while the oak log can be de-barked to change its appearance.

**Figure 6: Stone (left) and Cobblestone (right)**

Figure 6 (above) shows the stone block, which makes up a big part of the underground terrain in Minecraft, and the cobblestone – a block the player acquires when mining a stone block using a pickaxe. Both stone variations can be crafted into shaped blocks or used as decoration, similarly to the blocks in figure 5.

The purpose of showcasing these two variations of the same block type (being wood and stone), is to visualise how similar some blocks are when it comes to naming conventions in Minecraft, even when they are different blocks, e.g., stone ≠ cobblestone.

*Redstone*

Redstone can be defined in two main ways in Minecraft. The object "Redstone" itself is a powder (Figure 7) the player can gather by mining Redstone ore underground which can then be placed on the ground to create a trail of powder, functioning as Minecraft's substitute for wiring and electricity. The powder can also be crafted into various other parts to be used in wiring such as Redstone torches (which sends power through the wiring), Redstone repeaters (which extend the signal coming through the wire) and many more. This system is complex enough for players to create actual working circuitry within Minecraft, and this is precisely the second way players have chosen to define "Redstone": a *system* created using Redstone, to accomplish some sort of task. A Redstone system can be as simple as a player placing a

power source to power a lamp through wiring (Figure 7), or as complicated as a fully working circuitry for calculators or computers *(*Minecraft wiki, 2022e*)*

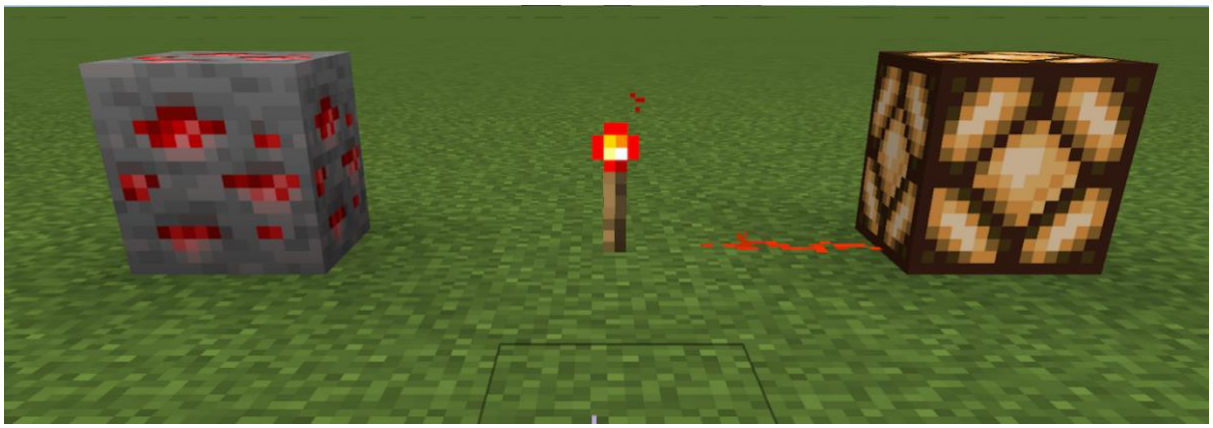

**Figure 7: A block of Redstone ore (left), and a Redstone torch (middle) powering a Redstone lamp (right) via a Redstone powder wire placed on the ground in between them.**

Redstone is explained briefly in this chapter, as it is mentioned later in this thesis during the literature review.

*1st person view models*

Naturally when in a virtual world where the player is represented by an avatar the player sees the world from a 1st person perspective, meaning you see through the eyes of your avatar. Depending on what slot the player has highlighted on their hotbar, they will hold an item in their hand, or if the slot is empty their first-person view model will display the avatar's arm instead (figure 8a & 8b)

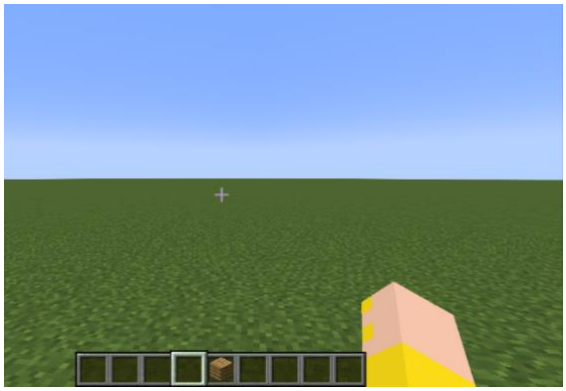

**Figure 8a: A player in first person view, not holding anything.**

**Figure 8b: A player in first person view holding a block of oak planks.**

What the player is holding will also be displayed on their avatar when other players are looking at them. For instance, a player holding oak planks will have the block visible in their avatar's hand (figure 9).

**Figure 9: A player holding a block of oak planks.**

Although this seems simple, players holding different blocks can be used as a tool during roleplays or other activities, which becomes relevant during the analysis.

# 3. Literature review

This chapter will present literature and previous research pertaining to the central topics of this thesis and the research questions asked. First, I will present empirical studies on virtual worlds, as this is an overarching theme of this project. Next, I will present literature about language and how it evolves through interaction with games and with players within it. Lastly, I will present literature on CSCL in games, as how CSCL works within the space of a game is important for this project.

## 3.1. Empirical studies on virtual worlds

To start off we must ask the question: what is a virtual world? Minocha, Tran & Reeves (2010) explains three-dimensional virtual worlds as:

> *«Three-dimensional virtual worlds, also called synthetic worlds, are multimedia, simulated environments, often managed over the Web, which users can "inhabit" and interact via their graphical self-representations known as "avatars." In a virtual world, the users, represented as avatars, experience others as being present in the same environment, or "being there together" even though they are geographically distributed».*

They further explain that virtual worlds contain multiple ways of communicating, such as voice chat, text chat, gestures, and that the avatars representing the player in the physical space makes communicating feel as real face-to-face communication (Minocha et al., 2010). Their empirical study was conducted in Second Life (SL), a virtual world that works as a "platform" for the users to shape to suit their needs. The cited article contains two studies, in which the first project has a focus on researching the designs of learning spaces within SL, however the article has a focus on presenting challenges of the empirical process in a virtual world, rather than the conclusions from the study itself. This project was conducted with the participants being experienced SL educators, designers, and lastly students. The methods utilised were virtual interviews through SL, panel discussions, observation and focus group interviews (Minocha et al., 2010). They state that the aim of virtual world research is to find out whether these emerging technological ways of communication truly are facilitating meaningful conversation, to further give us social and educational benefits (Minocha et al., 2010).

Minocha et al. (2010) elaborates on the challenges of conducting empirical research in virtual worlds. They are ever-changing products where new technological innovations might change the way the virtual worlds work, both on a technical level or on a social level (Minocha et al., 2010). They also found there is a notable difference in conducting a study within a 2D – virtual environment and a 3D – environment such as SL, or Minecraft. A two-dimensional virtual space in this case would be a chatroom such as Facebook. Minocha et al. (2010) states that the extra dimension of being able to move and customize your avatar and seeing a physical presence of other avatars makes a noticeable difference in communication, closer to face-to-face real-world communication. The avatars are often able to move around in many ways, such as flying or teleporting. This leads to the challenge of gathering data during an empirical study both during observation where the avatars might be moving between locations, or during interviews where the interviewer needs to be a part of the virtual context, if being participative (Minocha et al., 2010).

Another study done on the topic of virtual world is Lim (2020), which conducts a study on a collaborative music-making activity in Minecraft, using *Redstone* as a material for the participants to create music using note blocks (a note block plays a note when it receives a Redstone signal). The study aims to explore how teaching and learning happens through the music-making activity, and how first-time players can be taught to guide others within the activity. Focus was put on the collaboration between Minecraft "experts" and the musical "experts" and examining how both their knowledge fields would work together in a musical Minecraft project. As Redstone can be a complicated matter to new players (akin to circuitry and logic gates, tutorials were made compulsory before starting the activity (Lim, 2020).

The results of the study show that novices put in an unfamiliar setting often results in the novices' work being very similar or the same as the expert tutor, with little originality or focus on actual *creation*, but rather *replication* (Lim, 2020). However, it was also found that the amount of prerequisite knowledge needed was reduced significantly when creating musical compositions in Minecraft, as the game itself has functions for different notes, meaning the player only must be able to operate their avatar movements in the game. This can also apply to other areas of expertise, where the game already has built in functions for novice players to utilise (Lim, 2020). As a result, the study concludes that Minecraft works well as a virtual world with flexibility in its tools for learners, however having the technical

skills to operate the basic controls of the game is necessary (Lim, 2020). Similarly, Nebel et al. (2016) make finds during a literature review of Minecraft being used in education and research that supports the conclusions made by Lim (2020) regarding the game containing functions that can be used by players without much prerequisite knowledge, making learning more accessible. In this case, Nebel et al. (2016) refers to Minecraft's existing animals, plants and crops and the interaction between them creating a natural ecosystem for the player which they can then gather knowledge from. They also highlight benefits such as easily accessible multiplayer, the block-based nature of the game being easy to understand and being able to create most shapes using these blocks (Nebel et al., 2016).

When it comes to the limitations of Minecraft in educational design, Nebel et al. (2016) mentions the importance of learning the game controls as the player will be unable to interact with the learning tools in the game with little understanding of the basic controls, similarly, to finds made by Lim (2020). Nebel et al. (2016) also state the importance of learning and research design when using Minecraft as a virtual world in these settings:

> «*Additionally, despite optimistic estimates (Ekaputra et al., 2013), a scenario is not automatically more fun by using Minecraft. Not every teacher or researcher is a talented game designer, and variations of the original Minecraft are not always entertaining to pupils".*

Ekaputra et al. (2013) states in their article that Minecraft has endless educational opportunities because of its sandbox and creative nature and its capability of "illustrating a creation about everything". While Ekaputra et al. (2013) leans more towards the positives of the creative and open nature of the game as an educational possibility – systems like the different biomes naturally occurring in the world educating about ecology, and that breaking and placing blocks teaches the player about architecture and orientation, Nebel et al. (2016) underlines the importance of *designing* the educational activity in Minecraft. Nebel et al. (2013) also disagrees with Ekaputra et al. (2013) that just the activity of being present in Minecraft while learning creates engagement and motivation for learning.

## 3.2. Language and games

As games have become more and more culturally common, the influence games have over language learning, comprehension, and acquisition is a topic that has become very interesting. Sundqvist (2016) examines the relation between gaming and young language learners between the age of 5-12 learning English as a secondary language. They highlight that the level of competence in the English language varies from both child to child when starting education, but also from country to country, however, a common denominator is that children tend to be implicit learners, therefore making previous gaming experience a likely influence on the level of language competence when entering education (Sundqvist, 2016). When taking part in the activity of playing a game, Sundqvist (2016) mentions the sociocultural approach to learning, in which the player (novice) would interact with other players (skilled) inside the social context of the game world, making it an ideal platform for language learning through sociocultural methods. According to Sundqvist (2016), gaming has many implications for later language learning in an educational, formal context.

There are multiple studies delving into the relationship between games and language. Alavi & Gilakjani (2019) made founds that suggest games work well as secondary language vocabulary teaching tools because of the motivating environment it creates for the learners. They also highlight that learning secondary language vocabulary through games invites the learners to be more efficient in their acquisition of the language, as the game activates the learner, and invites them to "friendly challenges" (Alavi & Gilakjani, 2019). Piirainen-Marsh & Tainio (2009) found that repetition during gameplay, either through repeated words, utterances, sentences, or statements made by the game characters, or by repeated words associated with objects in the game, would often make players repeat these words to themselves and other players while engaging with the game, making the repetition a factor that creates collaborative play. These studies both conclude with children being able to learn a secondary language through playing games, which Sundqvist (2016) states is a potential reason why there is a noticeable difference in English skills as a secondary language when starting formal education, as not everyone has interacted with games. An important aspect of the language learning process would then be to utilise the *everyday* knowledge of the language the pupils have from their experiences with video games in the formal learning process, something Sundqvist (2016) highlights as a potential issue:

> *"As regards in-school use of digital games for language learning, problems may arise in some countries, for instance where the curriculum conflicts with teachers' incorporation*

*of games in the language classroom. In addition, there may also be countries or communities where parents would find the use of games for language learning controversial. Further, an incorporation of learners out-of-school experiences can also be difficult in places where schools end to focus more on social control than on learning"*

Research has shown that vocabulary, slang use, and speech patterns can be learnt from different types of games, which will in turn give the learner a background to resort to in formal education (Piirainen-Marsh & Tainio. 2009).

When players engage in more social or interconnected games such as MMORPGs (massive multiplayer online role-playing game) they are part of a community, similar to more conventional situations of learning through the sociocultural perspective, except virtual. Every community works in certain ways and can also develop linguistic or social languages very different from other communities (Thorne et al., 2012). Thorne et al. (2012) conducts a study on the MMORPG "World of Warcraft" with attention to its qualities as a setting for learning second languages. Their method was a questionnaire sent out to Dutch players who had English as a secondary language, and American players with English as their primary language, to gain an international perspective of their experiences (Thorne et al., 2012). The questions asked included the time spent playing every week/month, in addition to how many years/months they had been actively playing the game. To gauge the engagement with text both in-game and in the larger community, they also conducted interviews with players and asked them about the importance of reading in-game quest texts, and to which degree the players were utilising external websites such as wikis (Thorne et al., 2012). The results of the study showed that most players engaged with external community resources such as player written guides and wikis, and that these sites also displayed a high linguistic complexity:

*"Analyses of nearly 2,000 WoW-related forum posts revealed that 86% of the entries displayed ''social knowledge construction'' rather than ''social banter'' alone, that 65% treated knowledge ''as an open-ended process of evaluation and argument'', that more than half of the posts included evidence of systems-based reasoning, and that 10% showed scientifically precise model-based reasoning"* (Steinkuehler & Duncan (2008), cited in Thorne et al., 2012)

Thorne et al. (2012) suggests that exposure to both in-game text and external community resources are helpful for secondary language acquisition. Through these external community resources, the players create a community vocabulary which helps promote language acquisition through the players wanting to engage with said resources because they are tied to specific practices within the game (Thorne et al., 2012). It is highlighted that player-to-player in-game chat was too big for the scope of the study, but that finds indicate that MMORPGs present a complex linguistic and social learning environment (Thorne et al., 2012).

## 3.3. CSCL in games

As CSCL pertains to collaborative learning using computers and digital tools, games would naturally be a platform of interest for CSCL researchers. When it comes to games designed to be used in an educational setting, these are referred to as "serious games" (Wendel et al., 2012). These games were designed to teach and be used as a learning platform, rather than being used for education through a teacher utilising gamification to motivate and engage the students. Wendel et al. (2012) conducts a study aiming to better support the teacher as a "game master" while using serious games as a CSCL tool, as the teacher's role in the process of learning is important within CSCL to promote interaction between learners, and coordinate the activity (Wendel et al., 2012). For the teacher to be able to take on these responsibilities, Wendel et al. (2012) highlights that the teacher must be able to observe the learners, interfere when deemed necessary, and must be able to recognize the mistakes of the learners to help rectify them and prevent further missteps.

The setting used for this study is a 3D- multiplayer game, where Wendel et al. (2012) define three components of the game: the game world, the players, and the interactions. These three components make up the game activity, and through this study Wendel et al. (2012) aims to give the teacher control over the necessary components to further promote CSCL within the game. To give the teacher information about *who the players are,* their player-model would change based on a chosen *player-archetype,* e.g., *the explorer, the socializer.* This way the teacher would know some of the behaviour from just looking at the learners' player model. The teacher was also given a fully controllable camera within the game to observe students, as well as split screens to observe multiple at once. The most important aspect of "controlling the game" during this study was the teacher's ability to manipulate the stat attributes of the

player characters (such as health, saturation) and influence what the NPCs (Non-player characters) would say to the students to influence their behaviour (Wendel et al., 2012).

As already established, a teacher's support during the CSCL process is important to the learners and the conclusions from the Wendel et al. (2012) study suggests that it is doable for a teacher to stay involved, informed, and to influence the learner's activity within a game to further promote the important aspects of CSCL. However, this approach requires a lot of resources and effort to be put into tools for the purpose of controlling the game for educational purposes, which usually is only available in serious games. A non-serious game such as Minecraft, which was never developed with education in mind might require a different approach to CSCL, which Minecraft education edition might provide with its teacher tools.

Mørch et al. (2019) conducts a study on collaborative learning through Minecraft using role-play theory and practice. Through role-play the learners engage in conversation different from usual conversation because of its scripted nature. During this study the participating students would 1): construct a Minecraft-replica of the Norwegian parliament building, then partake in a political meeting role-play within it, and 2) Create a model of a historical riverside building in Oslo, then create a roleplay of a historical event involving owners, tenants, and workers in the middle of the industrial revolution (Mørch et al., 2019). The scripts would be developed within groups as a collaborative activity, like how the construction of the buildings would happen. Through these activities, two themes were found among others: the interweaving of generic and domain specific skills, and knowledge sharing between the students.

Important finds during this study shows that knowledge sharing (intersubjectivity) was achieved through three phases of the activity: introduction, reconstruction and transformation – three levels in which the students would 1): collaboratively search for information to understand the task and activity (such as the history of the building, or the dimensions of the construction itself, 2) construct the building and write the role-play, and 3) use what had been created in the previous phases to conduct the role-play (Mørch et al., 2019). At each level, different skills would prominently appear, such as collaborating during information gathering and knowledge acquisition at the introductory level, and creativity and collaboration during

the reconstruction phase and argumentation and persuasion during the transformation (roleplay) phase (Mørch et al., 2019).

Arnseth et al. (2018) discuss the uses of games as tools for dialogic learning and teaching. Dialogic learning consists of the learners learning using dialogue, and when using games as tools this dialogue can happen with in-game NPCs (Non-player characters) or with the avatars of other players. During this research game-oriented learning in the classroom, the learning design of said learning, and the teacher's facilitating role becomes important themes. First, when thinking of the elements within the games being used as learning tools it is important that the games represent the subject matter goal, in which Arnseth et al. (2018) uses Assassins' Creed III as a good fit for learning about the Renaissance architecture through the dialogue and environments within the game. Second, the teacher must monitor and enable students to reflect on the experiences within the game. This reflection is necessary to make the self-assess, as well as creating meaning from their experiences in the game (Arnseth et al., 2018). Lastly, the teacher must design the learning activity with the learner's previous experiences in mind.

Within the GTDT- model (figure 10) developed during the research conducted by Arnseth et al. (2018), the most crucial features a teacher must keep in mind that was identified when designing learning with games as a teaching tool are

1. To facilitate dialogue using open and authentic questions in relation to the learner's in-game experiences. Make the experiences relevant to curricular topics through this dialogue.
2. Identify different perspectives and experiences among learners and use this to facilitate discussion between them.
3. Reflect on the learners' ability to collaborate within and outside the game, both through action and dialogue (in and out of game).

Through this research, Arnseth et al. (2018) make some closing remarks. They believe the model they put forward as a helpful tool to introduce games into classrooms, however they do recognize that it is not possible to create an all-encompassing model for this purpose and concludes by stating games are interesting tools for learning and dialogic teaching, as they afford some interesting possibilities and creativity.

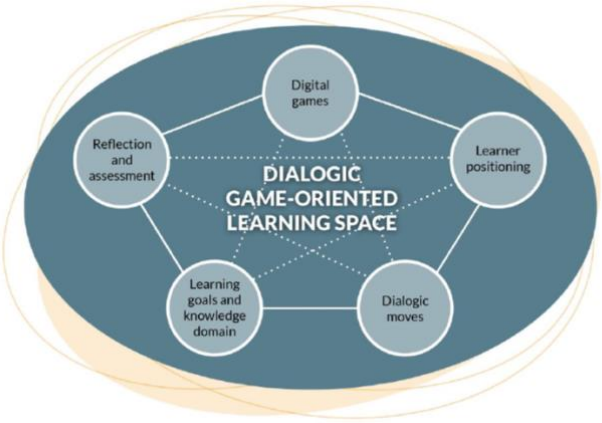


**Figure 10: Arnseth's Model of Games as Tools for Dialogic Teaching. Adopted from Arnseth et al. (2018).**

# 4. Theoretical perspectives

This thesis focuses on a relatively new field in social studies, the use of games and digital tools in learning. While games and digital tools might be relatively new, the act and process of learning through interaction and collaboration with others is not. This chapter will present *the sociocultural perspective of learning* and explain some key concepts within this perspective, highlighting *scaffolding, the zone of proximal development, artifacts,* and *language.* I will then present generic skills, then move on to the research field *Computer Supported Collaborative Learning* (*CSCL),* and some of the core features of CSCL.

## 4.1. The sociocultural perspective

A sociocultural perspective of learning focuses on learning as a process that happens through social interaction (Vygotsky, 1978). The sociocultural perspective is founded on the works of Lev S. Vygotsky, his students and contemporaries, and later researchers who utilized this perspective. The core of the sociocultural perspective is learning through social interaction and mediation, and how it affects human cognitive development. As humans we give meaning to the world and objects around us through interactions with others, acquiring shared knowledge, by gradually internalizing it, making it personal. This makes learning a process of knowledge where social interaction precedes the individual internalizing of it (Vygotsky, 1978). A central theme of the sociocultural perspective according to Säljö (2010) is the learner and their relation to the context around them. As the social interactions are central to this perspective, the community around the learner also becomes central. Säljö (2010) states that the human is an innate learner, and as the individual learns, so too does the community and society around them, and as the society and community changes over time with technological developments or societal shifts, the skills that are important to learn also changes, and this is the relationship between the individual level and the social level of learning (Säljö, 2010). To describe the sociocultural perspective, Säljö (2010) further explains that this perspective of learning is about how individuals and groups can acquire and utilise cognitive and physical resources of learning, and how the relationship between the individual and the group works.

Within the sociocultural perspective many concepts exist that explain the various aspects of learning through social interaction, which will be explained in this chapter.

### 4.1.1. ZPD & Scaffolding

The concept of scaffolding is derived from the Vygotskian concept of the Zone of Proximal Development (ZPD), a concept that bases itself on the existence of multiple developmental levels – the current level the learner is on, and the level the learner can reach through the assistance of "the more knowledgeable other" (MKO). The MKO is a role taken by a teacher, a peer, parents, or any other person more knowledgeable about a topic when in a learning situation (McLeod, 2018). By using the knowledge provided by the MKO the learner will be able to go from the first developmental level to the next (Figure 11). Vygotsky explains the basic function of the ZPD as: "*The distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers*" (Vygotsky, 1978).

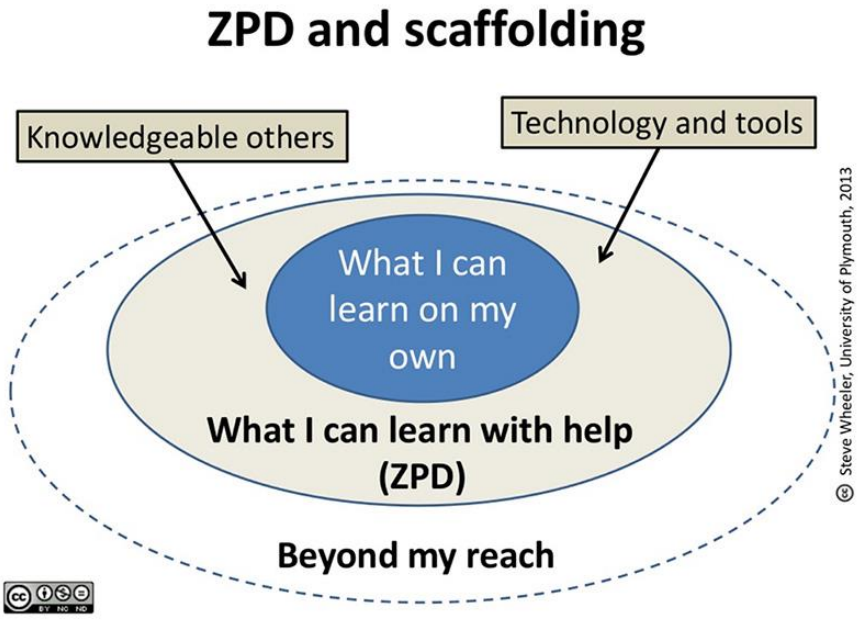


**Figure 11: The zone of proximal development. Note that this model includes scaffolding which was a later derivation of the zone of proximal development (adopted from Steve Wheeler, university of Plymouth. 2013).**

Scaffolding is a highly important concept related to ZPD. First derived by Wood, Bruner, and Ross (1976) and paralleling in meaning to the Vygotskian concept of the zone of proximal development. Scaffolding is a process for assisted instruction whereby a teacher or instructor assists a learner in achieving a goal or solve a problem that without scaffolding would be difficult or impossible. The scaffolding process takes place between a tutor and a learner and

is reliant on the tutor "controlling" the elements of the task or problem the learner is not yet capable of handling by themselves (Wood, Bruner, Ross. 1976). The goal of the scaffolding process is not only to assist the learner in completing a task, but to also develop their capacity for future problem solving. An important part of the scaffolding process is the "deconstruction" of the scaffold around the learner as the learner gets more experienced with the task, to further help in developing their individual problem-solving skills (Wood et al., 1976).

For scaffolding to take place there are several important factors that must be controlled by the teacher. Wood et al. (1976) identifies six such factors;

1. Recruitment*:* It's essential that the learner has interest in the task. The teacher needs to get the learner interested.
2. Reduction in degrees of freedom*:* The degree of freedom of a task can be explained as how many options, or how open-ended the task is. The task needs to be simplified so the learner can recognize when they are making progress with the actual task.
3. Direction maintenance*:* A learner might often switch aims during a task, whether that aim is finishing one part of a task, learning the actual contents of the task, or showing the teacher that they are able to complete the task. The teacher needs to keep the learner interested in the task by doing regular maintenance on the direction of the activity.
4. Marking critical features: The teacher highlights important features of the task and provides information to the learner about their results and the eventual discrepancy between their results and the wanted results.
5. Frustration control: The best environment for a learner to acquire knowledge is when they are invested in the task. Therefore, it is important that the teacher regulates the difficulty of said task to avoid frustration. At the same time, the teacher needs to remain wary about making the learner too dependent on their presence during the problem solving.
6. Demonstration: The teacher works as a "model" or example of how the task could be solved. Wood et al. (1976) explains that the teacher should work as an *idealized* solution to the task, in which the learner can try imitating.

Over time, the concept has specialized into various application domains, and different variations of scaffolding have emerged. Notably, Tabak & Kyza (2018) explains the concept of computational scaffolding, a type of scaffolding where software and computational artifacts are combined with the scaffolding process to further enhance it. The functions offered by a computer can in certain situations substitute for the teacher role in certain parts in the scaffolding process or for specific domains (e.g., technology, programming, scientific concepts) or as a supplement for the teacher to utilise to control the critical factors. As an example, software can take the teacher role to scaffold for multiple pupils at the same time in a classroom, where the teacher otherwise would be unable to assist all of them, where the pupils who are good at attracting the teacher's attention gets help first. For example, the software can provide prompts, or automatically open or further restrict the task to alter the learners needs to maintain the direction of the task, or to control frustration (Tabak & Kyza, 2018).

### 4.1.2. Artifacts

An artifact within learning is an object created by the learner to help with the learning process. Through interaction with the artifact, the learner can either facilitate learning that would not have been possible without the artifact, but the interaction can also significantly improve the already existing learning process. For the purpose of this thesis, I will need to introduce the concept of artifacts in the sociocultural perspective and how they interact with the learning process. In addition to sociocultural artifacts, I will describe how artifacts are defined in CSCL and used in this field.

### 4.1.3. Sociocultural artifacts

Vygotsky argues that what separates us from animals is humans can interweave the psychological and physical processes using speech in relation to practical activity. He names these processes as tools and signs. The tools mediate the external physical world, while signs mediate the internal, psychological world. (Vygotsky, 1978). This means that a tool could be the pen or keyboard used to write this text, while a sign could be the language used to write the text. An example of how the tool and sign would be used is that on one hand, our tool is a screwdriver, interacting with the physical screw to make a tangible difference in the physical world when assembling furniture. A sign on the other hand, could be an abstract representation such as a blueprint or drawing of the assembled furniture, or a discussion with

a partner for how to assemble the furniture, which is aimed at the verbal or symbolic activity of human work (Vygotsky, 1978). Both the tool and the sign are characterized by their mediating quality, which makes them both able to be related under the general concept of mediated activities (Figure 12).

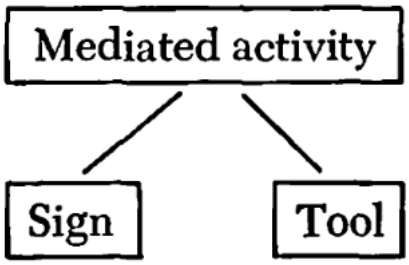


**Figure 12: The relation of the sign and the tool as mediated activities (adopted from Vygotsky, 1978).**

An important aspect to the sociocultural perspective of learning is the act of learning itself. As previously explained learning happens through social interactions making us part of a community, which sets a precedent for the assimilation or mastery of cultural tools or signs that are passed to us (Sfard, 1998). Where mastery is the act of knowing how to use the cultural tool passed to us, appropriation is the act of taking the tool and making it our own (Wertsch, 1998). This way of learning means that the cultural context of what tools or signs are valued is highly important when using artifacts in an educational setting. When it comes to learning, Sfard (1998) suggests two metaphors for learning: The acquisition metaphor and the participation metaphor of learning. As the sociocultural perspective sees learning as a process that requires social interaction, learning within the sociocultural perspective would fall under the participation metaphor of learning – where learning is participating and becoming part of a community and the cultural context (Sfard, 1998).

Another way cultural context becomes important is through the *symbolic artifact.* It is a specific type of artifact that has the properties of a physical object, but also a psychological, social meaning. An example could be a red traffic light which physically does nothing to stop us crossing the street but when assigned a cultural and social context, it has the power to stop us from crossing. It is a type of artifact that relies on our existing cultural and social knowledge for meaning (Tylén et al., 2016). This means that depending on context and culture, the same object may have different symbolic meanings or functions to different people. An example of this can be seen in different countries across the world, where certain

hand gestures might have a positive meaning in one country, but a negative meaning in another.

## 4.2. Spontaneous and scientific concepts in language

When starting out, a child will learn through experiences and trial and error. Vygotsky describes this learning as *everyday*, or *spontaneous concepts* (Vygotsky, 1978). They are concepts formed from experiences, rather than attempts at teaching them to the individual or attempts at mastering them. Seibt & Kjelling (2014) presents an example of a spontaneous concept in children:

> «Another example is how children develop a concept of time. In the early stages of life, a child may think that day and night is analogous to light and darkness. This is the spontaneous concept, which is saturated by experience. -»

Another type of concept Vygotsky suggests is *scientific concept*. These concepts are learnt through education. Rather than being understood based on experience, they are understood through scientific frameworks, related to other concepts and signs, and organized as a system of related ideas by the teacher (Vygotsky, 1986.). Elaborating on their earlier example, Seibt & Kjelling (2014) explains the scientific concept:

> «It is only later in life he learns the scientific concepts of the earth's rotation and its relation to the sun and the moon, which marks days and years. This information has not been appropriated by experience, as the child has not been to space to experience it, the information is constructed using different signs linked together by the instructor.».

*In sum*, spontaneous concepts are linked to concrete experiences, and scientific concepts being linked in conceptual frameworks. During teaching and learning they can interact with each other to help deepen the learner's understanding of the various concepts.

### 4.2.1. Transitions and relations between concepts and language

Vygotsky (1986) suggested how the spontaneous and scientific concepts are linked and reciprocally transform each other. He argues that both concepts can enrich each other,

however the scientific concepts rely on spontaneous concepts as their foundation for further understanding. The scientific concept would in turn transform the spontaneous concept, making it forever different from its previous state (Van der Veer, 1998). An example of this process could be a child entering the classroom with a pre-existing spontaneous concept of trees and how they produce air for people to breathe. This concept would work as the foundation for the scientific concept of photosynthesis, knowing that a tree takes $CO_2$ out of the atmosphere and in returns oxygen. Vygotsky notes that a spontaneous concept must be developed to a certain level before the scientific concept can mature, being within reach for the student (Vygotsky, 1934).

This dynamic process of relating scientific and spontaneous concepts can be visualised by an inverted pyramid model (Figure 13). This model visualises how spontaneous concepts (bottom part) are specific to a certain experience and concrete, while scientific concepts (top part) are abstract in the mind of the child. As indicated by the arrows, these two concepts move towards each other as the child acquires knowledge, spontaneous concepts being "bottom-up" concepts, and scientific concepts being "top-down". Spontaneous concepts slowly work towards the scientific concept and vice versa, meaning that through learning the spontaneous concept takes on "greater abstractness" and the scientific concept takes on "greater concreteness" (Vygotsky, 1986).

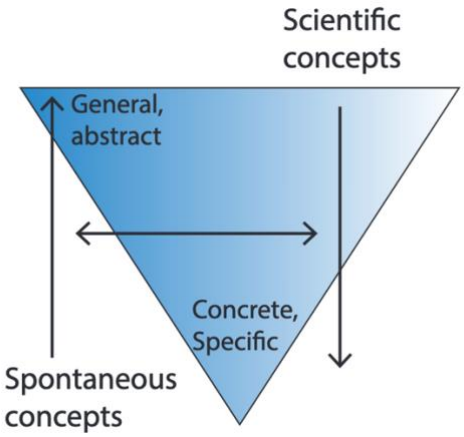


**Figure 13: A visualization of spontaneous and scientific concepts, and the process of them moving towards each other (adopted from Seibt & Kjelling 2014).**

The Vygotskian concepts and language have a lot in common when it comes to how they develop in children. The everyday language refers to language learnt through everyday

experiences, while the scientific language refers to language with an exact and scientific meaning, often taught within educational contexts (Blown & Bryce, 2016). As this is the case, spontaneous and scientific concepts can be used interchangeably when referring to everyday and scientific language. However, when it comes to language, there is no categorization in which certain words belong to a certain category of language, but rather about the *meaning* of the word the speaker assigns to it, or the *understanding* the speaker has of the word. Blown & Bryce (2016) refers to examples when explaining this concept:

> "For example, many young children take the word 'earth' to mean 'dirt' or 'soil' rather than 'planet Earth' which calls for caution when asking simple questions such as 'Tell me about the Earth?'"

This example underlines the importance of knowing what meaning someone assigns to a specific word, as the same word can have different meanings or qualities within the everyday and scientific languages. The everyday language forms a foundation for the pupil to understand the scientific language, and that through education the pupil will gradually move more and more towards the scientific language, it often "overwriting" earlier meaning a word might have had in the everyday language (Blown & Bryce, 2016).

The concept of *language switching* describes how a pupil can *switch* between the two "modes" of language in situations where they see it as beneficial. For example, a pupil might utilize the everyday language in a more social setting where the exact and metaphorical nature of the scientific language is not needed as often, while in an educational context they may forgo the "easier" everyday language in favour of the more exact scientific language (Blown & Bryce, 2016). As the pupil gets more comfortable and skilled at using language and the act of switching between the different modes, they can start experimenting with using words from one mode in another, to attempt to further grow their knowledge of the language. Also worth noting is the fact that even if in a setting where one mode of language is used, one can still learn skills to utilise in the other mode. This can often be used by teachers as a way of scaffolding – they ask the pupil a question using terms from both everyday and scientific language to help form a relation between the words, helping the pupil understand the meaning of the word in the scientific language using everyday language (Blown & Bryce, 2016).

## 4.3. Generic skills

When individuals start their formal education as a child, they traditionally won't enter the labour market in many years. Therefore, what pupils are taught in school must be skills and competencies that are needed in the future (Erstad & Voogt, 2018). These skills and competencies are often defined and put within learning frameworks or listed as key competencies for learning over a span of multiple years during education. These important skills are called "generic skills" (also known as 21st century skills) and are skills a person can possess which stretches across multiple areas of application, fields, and types of work which is needed in the labour market (Erstad & Voogt, 2018). Domain-specific skills in contrast, are skills that specialize in a single field, area, or type of work (Mørch et al., 2018). Examples of generic skills are skills such as problem-solving, collaboration, critical-thinking, decision-making, visualization, group-effectiveness, and several academic basics such as writing, reading and computational skills (Mørch et al., 2018). A Norwegian White Paper recommends various generic skills to be taught in education for the" school of the future" being communication, interactivity and participation, abilities to explore and create (NOU 2015:8). In addition, the Australian National Training Authority (NCVER) lists generic skills as highly important for future employment and higher education, as well as the fact that generic skills should always encompass individual thinking skills as well as teamwork essential skills (NCVER, 2003). Generic skills are important for later learning domain-specific skills; for example, the basic academic skills are needed to further learn through books and various computer tools and learning the domain-specific skills later down the line will be a much more laborious process without a strong foundation of generic skills.

### 4.3.1. Generic skills and digital tools

When interacting with different tools the learner utilises different sets of generic skills. For example, the learner needs the required computational skills to partake in learning in a digital environment. To make effective use of a computer during the learning process the user needs a certain level of skill using a keyboard and a mouse pointer, as the basics of computational skills. Another example would be the technical knowledge to successfully navigate a computer-interface. The ability to navigate and utilise digital tools is a very important skill in modern education, as these tools are often required to learn the subject matter of an activity (NOU:2015:8).

If the learner were to use Minecraft as a learning tool, meaning that the activity within Minecraft has some subject-matter the learner is supposed to learn (e.g., history, mathematics, biology) – the learner would need to be technically familiar with Minecraft to successfully learn the subject matter. For instance, if the player is to interact with objects in Minecraft they would need to know how to interact with elements in the game (e.g., left/right mouse click, breaking and placing blocks, movement). Minecraft in this instance would work as a "toolbox", allowing users to partake in an activity in the virtual space and using their generic skillset to interact with the virtual world and learn domain-specific knowledge and skills through subject tasks being held in the game by teachers (Mørch et al., 2018). This shows that through using generic skills, the learner can take part in the learning activity and gain knowledge of domain-specific subject matters.

## 4.4. Computer supported collaborative learning (CSCL)

Computer Supported Collaborative Learning, or CSCL, is a relatively new research field which aims to gain knowledge on collaborative learning using computers. It arose in the 1990s, with the popularisation of the internet and the possibilities it presented, in conjunction with the fact that computers would become more widespread in both homes and classrooms over the decade (Stahl et al., 2006). However, at the same time it was created as a reaction to computers and software being used to further make students learn as "isolated individuals" (Stahl et al., 2006). When describing CSCL as a way of learning, Arnseth et al. (2018) highlights that CSCL have been proven to facilitate task orienting and reflective practice, support collaborative knowledge building, and help establish shared understanding as a part of the collaborative problem-solving process. However, CSCL has also been found to in some cases reduce the amount of discussion around topics when students engage with it, but mostly in settings where CSCL practice have been brought into an *ordinary* classroom setting, where activities are focused on reproducing knowledge rather than build it (Arnseth et al., 2018).

According to Andersen, Mørch & Litherland (2021), the premises of CSCL consists of people learning together using computers – and that this way of learning result in the individuals learning more together than they would individually. To meet these premises CSCL would need to be designed in a way to promote these processes, in which Stahl et al.

(2006) describes the goal of CSCL design as; “create artifacts, activities and environments that enhance practices of group meaning making”.

### 4.4.1. The core features of CSCL

The core features of CSCL as presented by Andersen, Mørch, Litherland (2021) are: 1) Interaction between learners, 2) information sharing, 3) joint meaning making, and 4) developing common artifacts. To further explain each core feature:

1) *Interaction between learners*: As one of the premises of CSCL is collaboration between the learners, interaction is key as a part of the learning process. Learning happens through questions, inquiry, observation, and imitation and therefore it is important that the computer artifact supports these interactions (Stahl, et al., 2006).

2) *Information sharing*: As part of the social interaction that happens between two collaborating learners, information is shared between them. This feature can be related to the sociocultural perspective on learning, where learning happens during social interaction, also creating intersubjectivity (Stahl et al., 2006). Information sharing can also be related to the MKO, and their role in sharing pre-existing knowledge with the group about the subject or even their technical skills when interacting with a computer or object.

3) *Joint meaning making:* When a group of learners interact with the same object or artifact, they will exchange interpretations of that artifact. It is through this exchange that they establish a joint meaning in the group. The joint meaning making process seems to be more affected by the amount of group interaction, rather than the strength of individual opinions or utterances (Engen et al., 2018).

4) *Developing common artifacts*: Using CSCL, learner will be situated in groups, often utilizing the same knowledge object – for example an iPad or computer with specific software for the group activity. This knowledge object determines the group’s goal, and even if the university or provider of this object has a goal in mind, it is ultimately up to the group to interpret and determine the goal (Stahl et al., 2014). When the group is working with the knowledge object, they all collaborate, discuss, interpret,

and share opinions on the subject matter, creating a common artifact between the members of the group.

### 4.4.2 CSCL artifacts

As CSCL bases itself on interactions between learners and computers, it is important to explore what artifacts exist within CSCL that learners might interact with, and how they are utilized in both the digital and physical space. Arnseth et al. (2018) explains that artifacts within CSCL help structure and the discursive practice in a CSCL setting, with discursive practice being defined as the conversations being had during the collaboration, both through oral means and text. When studying artifacts in a CSCL setting researchers can observe and analyse how the artifacts the students interact with and mediate their interactions with objects in a digital setting, or how the artifacts mediate their communication in different settings, whether it be face-to-face, synchronous, or asynchronous, or utilizing in-game avatars as a form of digital face-to-face communication (Stahl et al., 2014).

Stahl et al. (2014) defines exactly what an artifact is within the CSCL perspective, based on the earlier work of Koschman:

> "An "artifact" is defined as a physical object created by people and embodying human meaning – thereby overcoming the old distinction between what is in the mind vs. in the world".

In addition to this definition Stahl and colleagues. also argues that meaning may be projected by the creator of the artifact into the artifact itself, but that this does not mean that the artifact has meaning inherently. It is important that the user of the artifact enacts upon this meaning to utilize the artifact (Stahl et al., 2014). When talking about artifacts within CSCL it is important to remember that collaboration and joint meaning making is an important aspect of CSCL. Meaning making while interacting with these artifacts is a social process, and it creates meaning defined by intersubjectivity. In addition, this meaning is not created through an unobservable mental process, but through joint activity, able to be observed and analysed by the researcher (Stahl et al., 2014).

There are many examples of artifacts within this definition that we use in our daily lives. These artifacts could be objects such as the device they are interacting with, the program they are utilizing, or the peripherals being used such as a mouse, trackpad, or touchscreen. These are artifacts in the way that they extended the human ability to complete tasks through interaction, while also being external objects Vygotsky would classify as tools (Verenikina, 2010).

This definition of artifacts within the CSCL perspective explains how artifacts function. However, they are defined separate from an actual *CSCL-artifact.* What separates the artifact and the CSCL artifact is the fact that CSCL artifacts are more specialized as *computer* or *digital artifacts,* with a focus on *collaborative interaction* (Stahl et al., 2014). They can be technological tools that mediates collaborative interaction between learners, as an example linked to this project, a CSCL artifact could also be an object the users interact with inside the virtual world of Minecraft, or a shared construction effort at building within this world that mediates interaction between the learners.

## 4.5 Conceptual framework

Based on the theoretical perspectives and literature presented in the last chapter, I will now construct a conceptual framework for the purpose of this thesis, consisting of the central concepts and perspectives that I have surveyed above, which will be utilised later during analysis and discussion.

Central to this thesis is the sociocultural perspective on learning and its central tenets: ZPD, scaffolding, and artifacts. Spontaneous & scientific concepts will also be important, and I will examine how these concepts emerge and change during the project observation through collaborating with other students in Minecraft. The sociocultural perspective is highly important to this thesis because of the nature of our data set. The data consists of multiple students in an educational setting who learn through interaction and collaboration with each other, while also assisting each other during the process. The CSCL field also has a central role in this thesis, with a specific focus on CSCL artifacts, especially how they emerge and mediate the collaborative learning process. The SMILE project utilizes CSCL as it's observation basis, such as the core features of collaborative learning, and therefore CSCL becomes important when analysing the data set.

Generic skills are a final important topic for the conceptual framework. Through examining what generic skills are identifiable and how they manifest within Minecraft I can further examine how Minecraft functions as a learning tool within social studies.

# 5. Methods

In this chapter I will explain what methods and tools were utilized during the data collection phase of the SMILE project, and the research design and methods utilized in my own project. Something to note is that the data I am using for this thesis is secondary data, and that I was never involved in the actual process of gathering the data. Therefore, this chapter will include a discussion about the challenges of using a secondary data source.

## 5.1. SMILE Research design

A research design is the framework used during the process of gathering and analysing data (Bryman, 2014). Design-based research is a research design focusing on an iterative data-driven process, as well as making an actual scientific contribution (McKenney & Reeves, 2013). By using this definition, the SMILE project can be described as using a Design-based research (DBR) framework, as it is described as iterative (Eielsen, 2020). More in-depth, Design-based research is a framework that features an iterative process that slightly changes the design of the context with every iteration, making it a useful tool for observing how the experimental adjustments would play out in a naturalistic setting (Barab & Squire, 2004).

There are multiple differences that set the design-based research method apart from others. Some of these differences are what it includes in its contextual design – it's natural noise, confusion, and "messiness", it includes multiple dependent variables, and a focus on the collaboration between learners. A challenge that comes with DBR is the complexity and messiness of the naturalistic context, but it is argued that this helps research "transcend the environmental particulars of the context they were generated, selected or refined" (Barab & Squire, 2004). This makes DBR a useful methodical framework for studies looking to ex. research classrooms, where there exists a natural context of social interactions between pupils and teachers, groups, and the physical factors of the room. Barab & Squire (2004) notes that DBR research on a classroom setting could be seen as impoverished, lacking the overall context pertaining to the rest of the school or university, and what really sets the boundary for a naturalistic context. However, it is a method that gives valuable data for that single context, which can be used to further iterate on the design and gather valuable data for further research in the field

In practice, this means the researcher enters the classroom with a learning design for the project. When in the classroom, there are many variables that cannot be controlled, and the natural context plays out while the researcher observes and notes interesting data. Next the researcher alters or revises the design, making a new iteration and then starting the process again, noting what interesting differences the iteration led to. The challenges to DBR comes from the unpredictable and natural context of the experiment, which also leads to the researcher getting large amounts of data, which can be very time consuming and resource intensive to analyse.

### 5.1.1. Research design

As I was not part of the iterative process during the study and my data set comes from two groups observed during a single day of the study with no focus on the iteration of the study, the iterative process falls outside the area of relevance for this thesis. In addition, the project entails the use of computers and games in the classroom in a collaborative setting, which as previously stated is a relatively new and unknown field. Therefore, I would classify my project as having an exploratory research design. An exploratory design entails researching fields with relatively small amounts of previous research and formulating research questions based on your own earlier experiences, or through the analysis of the data set (Befring, 2015). Like DBR, exploratory research designs work well for establishing a knowledge base in relatively unknown fields, which can then help future research further explore the themes of the study.

When it comes to the choice of research method within the design, it needs to complement the research questions asked in the study. It also needs the means to understand interactions between humans and computers. As this project aims to understand the process of collaborative learning, joint meaning making, and language, the qualitative method is the method of choice.

## 5.2. Qualitative method

The qualitative method is a method of data gathering focused on understanding a phenomena, situation, or interaction. It is described as a *data-intensive approach*, gathering large amounts of data about a subject or a group (Befring, 2015). What differentiates the qualitative method from the quantitative method is the fact that the qualitative method often concerns itself with

*words, language,* and *interactions,* while the quantitative method prefers numerical values to gather and analyse data (Bryman, 2014).

In the pedagogical and social sciences, the qualitative method is widely used to gather data about social interactions and learning. A big difference between the social studies and the natural sciences is the fact that in natural sciences there is a bigger focus on atoms, DNA, neutrons and the objects that make up our world, while in the social studies we focus on humans as thinking and social creatures, meaning the method used needs to be able to focus on the interaction between the human and other humans or objects as a process that's not made up of chemical reactions, but as a process of the mind (Bryman, 2014). Befring (2015) describes the aim of the qualitative method as gathering data which should be able to give insight in experiences, personal traits, intentions, and attitudes. This makes the qualitative method a good fit for this project, as its primary focus is the human processes, both in the mind and in social interactions with other individuals or computers.

Within qualitative research there are a plethora of methods to utilize, however for this thesis I will be presenting the two relevant methods for this project - observation, and interviews.

### 5.2.1. Observation

Using observation as a data gathering method is one of the most well-known ways to gather qualitative data. Observations can be done in many ways during research; and can be categorised in two different types of observation. *Participant observation* requires the researcher to be present in the environment they are researching, making them part of the social context. This may give the researcher more data as they can personally observe the processes happening, however a big challenge using participant observation is the fact that the presence of the researcher may influence the natural context of the environment, for example the classroom (Befring, 2015). The other category of observation is *non-participant observation*, meaning the researcher is not present in the observed environment, only gathering data through other means such as video or livestreamed camera feeds. This reduces the risk of influencing the environment but might also give less detailed data as the researcher cannot be physically present (Befring, 2015). One may also use *structured observation*, in which the observer has explicit rules for what they should be observing, often stating what behaviours to focus on. They also utilize strict timetables for the observations. Unstructured

observation relies on collecting large amounts of data about the participants behaviour, not focusing strictly on a few of them (Dalland, 2013).

The choice of observation method will vary depending on the aim of the project. The SMILE-project largely relied on non-participant structured observation as the method of choice. During the project two groups were separated from the rest of the class and individually observed, each consisting of four pupils. The task given was to reconstruct industrial buildings situated next to a river in Minecraft (Eielsen, 2020). Cameras were utilised to capture both the pupils and their screens, giving a perspective on social interactions both in-and-out of the digital space, in addition to capturing what additional tools the students used (OneNote and the web searching were used by pupils to help constructing an accurate building). Even though researchers were present, they were largely not interacting with the setting, only taking notes, and moving the cameras every thirty minutes to change perspectives and capture the activity happening on different pupils' screens (Eielsen, 2020). Using cameras to record video during observation is a method of observation that has many advantages. Derry et al. (2010) highlights the fact that researchers can observe the video recordings freely as many times as needed during analysis, and that the recordings from different settings or at different points of time during the project can be compared to find points of interest. The videos can also be viewed from different perspectives by different researchers, which in turn might strengthen the research (Derry et al., 2010). Video recordings can also make movements, body language and interaction between the participants more observable, as the researcher can observe different parts of the group on multiple viewings, as well as rewind or change the speed of the video playback to make observing easier (Derry et al., 2010).

A weakness in observation as a method during this project is that the presence of the researchers during the observation has the potential to disrupt the natural interactions, both pupil-to-pupil interactions and the pupil-to-computer interactions. A disruption can happen even if the researchers stay non-participant, called the Hawthorne-effect. This occurs when a participant alters their behaviour because they are being observed, and might feel pressured to perform their best, or do better in fear of doing something wrong (Eriksson, Zetterquist et al., 2015., Dalland, 2017. Cited in Eielsen, 2020). In addition to this effect, the participants may also be influenced by the presence of the researcher because they are a "new" element to the setting, and because the participants know they are being observed. Dalland (2013) Describes

this as the "researching-effect", and notes that the longer a researcher is present in the setting, for example over multiple lessons or multiple days of observation, the effect gradually subsides.

### 5.2.2. Interviews

Interviewing the subjects participating in a research project are often essential to any project seeking to gather qualitative data. Kvale & Bekkman, cited in Dalland (2013) underlines the importance of the interview, describing it not as a normal conversation, but as a process where the interviewer and the interviewee produces knowledge together. The interview is important to qualitative methods because it seeks understanding through verbal discourse with the research subject (Dalland, 2013). There are multiple types of interviews a researcher can conduct – the *structured interview*, the *unstructured interview*, and the *semi-structured interview*. In addition to this, one may also conduct interviews with multiple interviewees, such as a *focus group interview* (Bryman, 2014). The structured interview stands outside the qualitative method, and as such will not be a focus. Both the unstructured and semi-structured interviews are viewed as *qualitative interviews* and share many traits. They are both flexible when it comes to the interview schedule – the interviewer can ask follow-up questions not originally in the schedule when the interviewee talks about interesting topics, they encourage going on tangents so the interviewer can get deeper insight into what the interviewee thinks about topics, and they both have a goal of acquiring detailed answers for further study (Bryman, 2014). To describe these two types of interviews, the unstructured interview can often take the form of a conversation about different themes or topics with very open-ended and general questions, aiming to get the interviewee to talk around these. The semi-structured interview may utilise an interview schedule just like a structured interview but favours open-ended answers. They can also consist of the interviewer talking about or presenting a topic, and having the interviewee talk around these (Befring, 2015).

The focus group interview consists of the interviewer interviewing multiple interviewees at the same time in a group setting. These types of interviews are used when the researcher may be interested in how the individuals discusses the topic or theme as part of a group instead of as an individual. The group will often build on each other's' statements and views, making the group interaction visible to the researcher (Bryman, 2014). These interviews are often unstructured, making space for the group to discuss and answer questions about a topic, they

also differ from group interviews by focusing on a single topic or theme, instead of multiple ones.

The SMILE-project utilised focus group interviews as their interview method after the learning activity was conducted, aiming to learn about domain general skills practice during the activity. According to Eielsen (2020), the project group used a middle road approach when structuring the interview, trying to steer the conversation to the specific topic, but not restricting talk. The nature of the focus group interview made it possible for pupils to elaborate on their own and other group members' answers, even without taking the initiative themselves, creating natural conversations in the group. A challenge when conducting focus group interviews is the fact that these groups encourage talk, meaning the researcher will need to be able to keep control of the group and steer the conversation where they want it (Bryman, 2014). Another challenge is the different levels of skill in the pupils – in every topic there will be pupils with different levels of experience and knowledge, meaning not everyone is as active in the conversation (Bryman, 2014). In combination with video recordings and observations, the researcher can observe the interviewee's level of skill during the learning activity, making an otherwise unobservable statement of skill during the interview visible (Eielsen, 2020).

## 5.3 Data analysis

There are multiple ways to approach the data set when researching. The three main approaches, or types of reasoning, used in social studies are *inductive, deductive,* and *abductive* reasoning. These types of reasoning represent different relations between theory and data (Bryman, 2014). Having an inductive approach to the data would mean to observe the data set and then develop theories based on the findings made during observation, an example of the inductive approach could be a researcher reading through a data set and coming up with theories or thought about something in the data set, which would then prompt them to research this further to reach some sort of result or conclusion. The researcher forms an idea from the data, rather than using the data to answer a previously existing idea or theory.

The deductive approach can be seen as an opposite to the inductive approach – here the researcher starts out with an existing theory and aims to test this using the data set (Bryman,

2014). An example of a deductive approach to research could be a researcher wanting to test the results of an earlier study, using this study as their *theory*. They would then formulate a hypothesis from this theory, collect new data and analyse it to make finds. At this point, the hypothesis is either confirmed or rejected. The relationship between data and theory is what separates these two ways of reasoning, and they are often named after how they approach the data – the deductive approach being called "*top-down"*, and inductive "*bottom-up"*.

Abductive reasoning is a third, relatively new approach to data. It is based on the researcher finding interesting observations or facts in the early phase of the research, then do further research to find the best possible explanation for this observation or fact. The observation made may also come from the researcher's earlier experience (Bryman, 2014). It is often used when the observation made cannot be answered with existing theories or knowledge, meaning this is a more exploratory way of reasoning that deductive and inductive approaches, but it still features a heavily inductive way of doing research.

For my project I have chosen a deductive approach to data analysis. When I started this project, I knew *what* I wanted to research, being learning through games and collaboration in virtual worlds. I then approached the SMILE project and got access to the data set that was gathered during their earlier research about the development of 21st century skills using Minecraft. I approached this data set using thematic analysis to find aspects of the data which were relevant to my theory.

### 5.3.1. Thematic analysis

The analytical approach I utilized when approaching the data set gathered from the SMILE project is thematic analysis. Thematic analysis is a method that helps identify central t*hemes* throughout the data set. It is described as a flexible method, not existing within an established framework, nor tied to any specific method (Braun & Clarke, 2006). A theme within this approach to analysis is something within the data set that appears as a central reoccurring *pattern*, and something that helps answer the projects' research question (Braun & Clarke, 2006). A theme is also described as not needing to have a certain number of occurrences or be of any specific size, but rather is something that the researcher deems central, with some amount of flexibility (Braun & Clarke, 2006). However, Braun & Clarke (2006) argues that

the thematic analysis lacks consistent form, and they outline six phases that gives the process a more structured form:

1) *Familiarizing yourself with your data:* Regardless of whether you're using self-generated data or secondary data, an important point is to go through the data thoroughly and getting familiar with it. The researcher can already start thinking about potential patterns and themes when reading through and take note.
2) *Generating initial codes:* This phase starts once the researcher has the prerequisite notes of potential themes and have started generating potential ideas of what parts of the data set are interesting. This is where the generation of *codes* happens, meaning "*a feature of the data that appears interesting to the analyst, and "refer to the most basic segment, or element of the raw data […] that can be assessed in a meaningful way regarding the phenomenon*" (Braun & Clarke, 2006). During this phase the researcher must pay attention to every data item, as they are the basis of repeated patterns.
3) *Searching for themes:* When the data set has been coded, the researcher will have a list of different codes found within the data. In this phase the researcher will sift through these coded data items and attempt to sort these data items into overarching identifiable *themes.* Some items may form a main theme for the project, whereas others may form sub-themes or be discarded.
4) *Reviewing themes:* After forming codes together into themes during the last phase, the researcher must review these to see if the themes are supported enough in the data set to be considered themes. Other themes might be too big and broken up into multiple other themes. This phase consists of two levels – the first in which the themes are reviewed to contain actual patterns, and the second where you review the validity of the selected themes in relation to the data set – meaning the themes must represent the data set accurately.
5) *Defining and naming themes:* Braun & Clarke (2006) describes this phase as "*define & refine"*, meaning the researcher must identify the core of the themes – write detailed analyses about each theme, and what it tells the researcher. Find out where he themes fit in, in relation to the research questions. The aim of this phase is to be able to explain what the themes are, and what they are not.
6) *Producing the report:* This is where the researcher writes their final analysis. This analysis must provide enough evidence for the themes to exist. It includes excerpts,

examples and often illustrations and tables. The most important aspect of this phase is providing enough data in the analysis to make an argument for your research question.

These six phases within thematic analysis gives researchers a more structured plan for when utilising thematic analysis. However, Braun & Clarke (2006) still highlights that there are potential challenges to be aware of when utilising thematic analysis. A failure to present a theme throughout the data, failure to provide convincing examples, or mismatching the theoretical perspectives with the analytic claims from the data set will lead to the claims made using the thematic analysis seeming very weak or void. Braun & Clarke (2006) further presents what a good thematic analysis should include (Table 1). Even though these phases give the researcher a more structured plan forwards when doing the analysis, Braun & Clarke (2019) would later highlight that these phases are flexible and not a concrete plan forwards, mentioning that researchers should utilise them flexibly by fluidly moving back and forth between the phases.

**Table 1: Braun & Clarke's 15-point checklist for good thematic analysis (Braun & Clarke, 2006)**

| Process | No. | Criteria |
|---|---|---|
| Transcription | 1 | The data have been transcribed to an appropriate level of detail, and the transcripts have been checked against the tapes for 'accuracy'. |
| Coding | 2 | Each data item has been given equal attention in the coding process. |
| | 3 | Themes have not been generated from a few vivid examples (an anecdotal approach), but instead the coding process has been thorough, inclusive and comprehensive. |
| | 4 | All relevant extracts for all each theme have been collated. |
| | 5 | Themes have been checked against each other and back to the original data set. |
| | 6 | Themes are internally coherent, consistent, and distinctive. |
| Analysis | 7 | Data have been analysed – interpreted, made sense of – rather than just paraphrased or described. |
| | 8 | Analysis and data match each other – the extracts illustrate the analytic claims. |
| | 9 | Analysis tells a convincing and well-organized story about the data and topic. |
| | 10 | A good balance between analytic narrative and illustrative extracts is provided. |
| Overall | 11 | Enough time has been allocated to complete all phases of the analysis adequately, without rushing a phase or giving it a once-over-lightly. |
| Written report | 12 | The assumptions about, and specific approach to, thematic analysis are clearly explicated. |
| | 13 | There is a good fit between what you claim you do, and what you show you have done – ie, described method and reported analysis are consistent. |
| | 14 | The language and concepts used in the report are consistent with the epistemological position of the analysis. |
| | 15 | The researcher is positioned as *active* in the research process; themes do not just 'emerge'. |

## 5.3.2. Validity

Validity is about the quality of the conclusions and results from a research project. A high degree of validity is wanted for any piece of research, and this is measured through the project data and looking for correlation between the actual data and the results of the project (Bryman, 2014). For example, Bryman outlines external and internal validity within

qualitative studies – being to which degree one can generalise the results, and if the ideas being developed during the project matches can be correlated with the observations being made. To best increase the external and internal validity of a project it is important to employ methods that gives data most likely to answer the research questions asked by the project. This can be done through triangulation, a method in which the researchers utilise multiple methods during data gathering to cover for each methods' weaknesses (Bryman, 2014).

During the SMILE project, both observation and interviews were used as data gathering methods, which gives the data a higher degree of validity through the fact that observations can tell us about the potential displays of skill or interaction the pupils experienced during the Minecraft building process, and the interviews can give insight in otherwise unobservable experiences or processes the pupils had during play. However, it is also worth noting that even though triangulation of methods is a powerful tool, a research project can rarely gather all available data and secure a guaranteed degree of validity in the data (Bryman, 2014).

### 5.3.3. Reliability

Reliability regards itself with the repeatability of the research project, meaning to which degree the results of the study are reproducible (Bryman, 2014). This is the definition of reliability within quantitative research, when it comes to qualitative research, this definition needs to be followed with some flexibility within qualitative research, as LeCompte and Goetz states: "*You cannot freeze a social setting and the circumstances of an initial study to make it replicable".* (LeCompte and Goetz, 1982. Cited in Bryman, 2014). Qualitative research aims to understand the why's and how's of a phenomenon instead of the quantitative size of it, but reliability of the data is still just as important as within quantitative research – a method of reproducing a study within qualitative studies can for example be that the researcher needs to be in the same social role in the study as the first researcher was.

When looking at the data gathered for the SMILE project with validity and reliability in mind, there are challenges to consider, especially when the data is of a secondary nature for my project. As the data needs to be gathered using methods that complement the asked research questions, the methods of choice can pose a challenge when researching my research questions. For example, if the observational video recordings contain something of interest to my research questions, I have no occasion to ask about this theme further during the

interviews – this also goes for follow-up questions during the interview. This can be a danger to the validity and reliability of this project, however by using deductive reasoning and thematic analysis approach to the data set, I have formed the research questions from the available data which in turn can help reduce the potential risk.

### 5.3.4. Challenges of utilizing secondary data

Secondary data is defined as utilizing data collected by someone else for a project with a different purpose than the data originally was intended for (UCL, 2022). In this thesis I am using data from the SMILE project but using it to answer different questions from what the project originally had in mind, making this set of data a secondary data source. There are dangers and challenges related to the use of secondary data sets that might impact validity and reliability, which I will examine further.

When using secondary data there is a risk of the data not actually answering the questions asked, as the data was never meant for that purpose in the first place. When using a deductive reasoning this is a risk to watch out for as the theory was not inductively formulated using the data set, meaning the researcher must be careful not to choose the wrong data set for their theory (UCL, 2022). A secondary data set might also prove to be insufficient to answer some questions, as the researcher have no experience with the set before analysing it (UCL, 2022).

Another challenge when using secondary data is the fact that I was not present when the data was gathered. Therefore, some details or challenges encountered when gathering data may not be evident in the data set. This data set primarily consists of video however, meaning the data gathering process – at least in front of the cameras – is visible to me, even though I was not present. As presented earlier in this chapter, I made additional transcripts from these video recordings to use for my analysis, meaning there are no unknown factors in the process from video to transcript, reducing the risk of unknown factors during the data gathering process having an influence on the analysis.

### 5.3.4. Ethical considerations

Ethical considerations permeate every step of a research project, from planning to eventual publishing. These are both decided by law and are needed for good research practice, meaning we are obligated by society and the people we are researching to follow certain

ethical guidelines, and consider whether what we are currently doing is right (Dalland, 2013). As my project utilises both video-recorded observations and interviews, it is important to make sure that the participators cannot be linked back to the data. This can be done by anonymizing names and personal data that might show up during the group's activities, and by editing the recorded video material to make both the participants and their surroundings unrecognizable (Dalland, 2013). Data must also be stored according to NSD (Norsk Senter for Forskningsdata, from 1.jan 2022 called SIKT) guidelines – which for this project entails the data being stored securely with encrypted access.

As for my project, the transcripts from both the video recordings and the interview will be anonymized by using falsified names for the participants and by only transcribing relevant excerpts from the data set. This makes sure the project follows guidelines for anonymity. As for the SMILE project where this data set originates from, every participant received information about the project and what it seeks to research, the option to resign from the study at any point making participation optional, and parents of the participants also received information about names and sensitive data being anonymised for transcripts, and deleted (Eielsen, 2020).

# 6. Data and analysis

In this chapter my collected data will be presented. I will start by introducing the central themes found during the thematic analysis process, then introduce the data set and groups participating in the project, before moving on to analyse excerpts pertaining to the central themes.

## 6.1. Themes

The data will be presented in order of themes determined by the thematic analysis, and occurrences from both groups will be presented. Note that even though the excerpts are classified within four different themes, some excerpts will show characteristics from other themes. The central themes that emerged during the thematic analysis of the data set is the following:

**Table 2: The themes that emerged during the thematic analysis**

| | | | |
|---|---|---|---|
| Generic skills | Interaction & information sharing | Joint meaning making | Development of a common artifact |

The generic knowledge and skills theme is defined as an event where pupils engage with Minecraft or other pupils using generic knowledge or skills previously learned from experience or interaction. This can be knowledge or skills the pupils have that enables them to engage in the activity of constructing the building more effectively and playing out a role-play in Minecraft, such as having fluid movement skills, technical know-how, or other displays of generic knowledge and skills.

The Interaction & information sharing theme is defined as an event where pupils engage in behaviour linked to the corresponding core feature of CSCL, while being active participants within Minecraft. The core features interaction & information sharing have been put together within this theme as they often occur within the same conversations. An example of these two features could be the pupils engaging in dialogue where questions are asked and a pupil provides an answer to them, or if a pupil explains something to another pupil to teach them.

Joint meaning-making is another theme based off one of the core features of CSCL The joint meaning-making core feature of CSCL happens when two (or more) learners engage in the same activity, with the same object, or in a discussion where the learners share their interpretations of the subject, and the learners then reach an interpretation together they are satisfied with as a group. For example, two pupils can exchange interpretations of an object, and they can then slightly alter their interpretation based on the other pupils' interpretation and reach a satisfying interpretation for both participants.

The development of a common artifact happens when multiple students interact with the same knowledge object and together assign a meaning to the object, creating a common artifact to help the group reach the set goal. These artifacts can take many shapes and during analysis we will find out what artifacts emerged during the learning activity.

## 6.2. Data set and groupings

Within the data set I primarily focused on the video material gathered from a single iteration of the SMILE project. These groups consist of four pupils collaborating to construct historical buildings in Minecraft, then formulating a roleplay inside the locale. These video recordings in total consisted of approximately 6.5 hours of video material – split between 186 minutes for group one, and 206 minutes for group two. Provided with my data set was pre-transcribed excerpts from these video recordings, however I chose to watch the video material and generate my own transcriptions from potential moments of interest, containing patterns or themes. This is because my project and research questions have a different area of focus from the SMILE project.

During this analysis the groups will be referred to as "Group 1" and "Group 2". Each group consists of four pupils working on the same construction project and roleplay. As should be noted, more groups were present on the same Minecraft world and were visible to each other, each group working on a different project. However, this data set will only refer to group 1 and group 2, which consists of:

**Table 3: The groups, participants and what building the group was constructing.**

| Group 1 | | Group 2 | |
|---|---|---|---|
| | | | |

| Hans | Oscar | Oliver | Emma |
|---|---|---|---|
| Olivia | Frida | Sofia | Haider |
| Building: Logging facility | | Building: Wooden furniture factory | |

In addition, teacher students were present to work as the teacher in this activity, which will be referred to as "Teacher" in the excerpts. If a pupil from another group interacts with the group, they will be addressed as OP (Other pupil). Non-verbal actions will be conveyed via text in clamps, e.g., "[Hans jumped up and down].

## 6.3. Generic skills

**Excerpt 01:** Elaborating given knowledge

Group 1

| Time | Speaker | Interactions |
|---|---|---|
| 00:07:23 | Teacher | *"Har dere hatt om disse byggene i undervisningen eller?"* |
| 00:07:26 | Hans | *"Nei."* |
| 00:07:27 | Olivia | *"Ehhhm, nei, ikke egentlig … for to uker siden ellernoe fikk vi noen eksperter som kom og fortalte litt om de forskjellige tingene … så det er det vi har hatt. Ellers har vi jobbet med vanlig skole., Så det er det vi har hatt til nå."* |
| 00:07:45 | Teacher | *"Ja … Men husker dere litt av det de sa eller? Om de greiene deres?"* |
| 00:07:48 | Olivia | *"Ikke så mye. Men vi prøvde å skrive ned litt."* |
| 00:07:52 | Hans | *"Ja."* |

In this excerpt, the teacher asks the pupils of group 1 if they've been taught about the buildings they are constructing in class before starting the learning activity. Hans and Oliva reply no, however, Olivia further elaborates on how they were visited by experts two weeks ago who told them about these things. The teacher inquires if they remember any of it, to which they both agree that they don't remember a lot, but that they tried to write it down.

Note that this is the subject knowledge the pupils have acquired, which is not part a part of the generic skills, but rather the domain-specific skills the pupils are learning through utilising their generic skillset within Minecraft to reconstruct the building and perform a roleplay. The next excerpts highlight displays of generic skills that emerged during the activity:

**Excerpt 02:** Applying generic knowledge in a new setting

Group 1

| Time | Speaker | Interactions |
|---|---|---|
| 00:19:05 | Olivia | [Olivia attempts to find logs and opens the search bar in Minecraft]. |
| 00:19:09 | Olivia | [Olivia types "tømmer" which yields no results]. |
| 00:19:16 | Olivia | [Olivia then removes "tømmer" and searches "stokk", which shows the selection of available logs]. |

Olivia attempts to find the logs available in-game for construction, and to do so she uses the search bar (figure 14a). She tries writing out *"tømmer"* (timber), which yields no results on the search screen. Olivia then deletes the word and tries *"stokk"* (log) instead, which shows her the selection of available logs in Minecraft (figure 14b).

**Figure 14a: The search screen in the creative mode inventory**


**Figure 14b: Olivia searching for "tømmer" and getting the results.**

**Excerpt 03:** "Regular" wood

Group 2

| Time | Speaker | Interactions |
|---|---|---|
| 00:55:11 | Oliver | *"Se her Haider. Hva slags tre vil du ha? Sånn vanlig tre?"* |
| 00:55:15 | Haider | *"Mmhm, vanlig."* |
| 00:55:16 | Oliver | *"Også bjørk ikke sant?"* |
| 00:55:17 | Haider | *"Ja, sånn der tregreie."* |
| 00:55:20 | Oliver | *"Sånn der tregreie" (laughter)* |

During this exchange, Oliver asks Haider what kind of wood he wants, and follows up by asking if it is regular wood, he wants. Haider confirms he wants regular wood - Oliver then asks if he also wants birch (bjørk) as well. Haider answers yes, then adds that he wants "that tree thing", which makes Oliver laugh and repeat the line for himself.

**Excerpt 04:** Displaying technical skills

Group 1

| Time | Speaker | Interactions |
|---|---|---|
| 00:11:47 | Hans | *"Skal vi gå på andre sida kanskje?* |
| 00:11:48 | Oscar | *"Ja."* [Both Oscar and Hans float across the river and lands on the other side] |
| 00:12:09 | Frida | *"Har dere gått over elva?"* |
| 00:12:11 | Hans | *"Du må fly over."* |
| 00:12:16 | Teacher | *"Hvis du trykker på mellomromstasten to ganger."* |
| 00:12:19 | Frida | *"Ojaa, Okey."* [Both Frida and Olivia attempt to cross the river, one of them manages to fly across, and the other one ends up jumping up and down in the river, before finally flying up and landing on the other side.] |
| 00:12:27 | Olivia | *"Der ja!"* |

Hans and Oscar are placing down the first blocks of the building, when Hans suggests moving the construction site to the other side of the nearby river. Oscar agrees and they both float up in the air and cross it effortlessly. Frida later asks if they both crossed the river when seeing them on the other side, Hans replies that they are going to have to fly across it to reach them. The teacher then instructs the girls on how to activate flight in Minecraft, by pressing the space bar twice. Frida and Olivia both attempt crossing the river, however Frida falls into

the river (figure 15b) while the Olivia manages to fly across (figure 15a). She spends some time jumping up and down in the river before managing to activate flight and land on the other side.

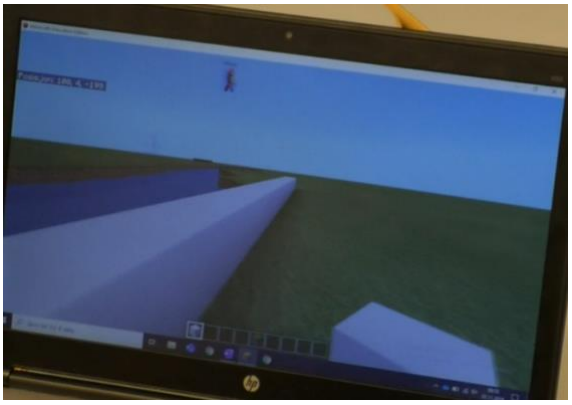

**Figure 15a: Olivia flying across the river.**

**Figure 15b: Frida stuck in the water.**

**Excerpt 05:** Cobblestone roofing

Group 1

| Time | Speaker | Interactions |
|---|---|---|
| 00:27:41 | Oscar | *"Skal vi bruke sånn knust stein eller vanlig stein?"* |
| 00:27:45 | Hans | *"På taket?"* |
| 00:27:46 | Oscar | *"Ja."* |
| 00:27:47 | Hans | *"Brostein."* |
| 00:27:48 | Oscar | *"Brostein, ja. Det er knust stein det?"* |
| 00:36:13 | Frida | *«Hva heter den taksteinen dere bruker?»* |
| 00:36:16 | Oscar | *«Brostein.»* |
| 00:36:17 | Hans | *«Brostein.»* |

Oscar asks the group whether they will be using "*knust stein*" (crushed stone) or *"vanlig stein"* (regular stone). Hans then asks if he means as material for the roofing of the building, which Oscar clarifies. Hans then replies *"Brostein."* (cobblestone). Oscar then repeats the name of the block and agrees. He then questions Hans if cobblestone is the *crushed stone* block, to which Hans doesn't reply. After starting the construction of the roof some time passes by, when Frida asks what the stone they are using to build the roof is. Oscar and Hans reply, overlapping each other while saying "brostein" (cobblestone).

## 6.4. Interaction and information sharing

**Excerpt 06:** Construction supervision

Group 2

| Time | Speaker | Interactions |
|---|---|---|
| 00:07:26 | Emma | *"Sånn … sånn inne på bildet er det på en mate litt sånn veranda her nede …* [Emma moves the cursor on her screen over an empty patch of grass outside the group's building to show Oliver where to construct a balcony.] |
| 00:07:34 | Emma | *"… Fordi her er det jo vinduer ikkesant … og sånn veranda her nede … Og en liten hage …"* [Emma continues to highlight the areas being talked about to show Oliver where to start constructing.] |

Emma is explaining to Oliver where to construct the balcony. She says that according to the picture, there's a balcony in the area she's pointing her cursor at, while Oliver watches her screen. She then moves her cursor further up the side of the house explaining where the windows and balcony are supposed to be, then mentions a small garden on the plot of grass just outside (figure 16).

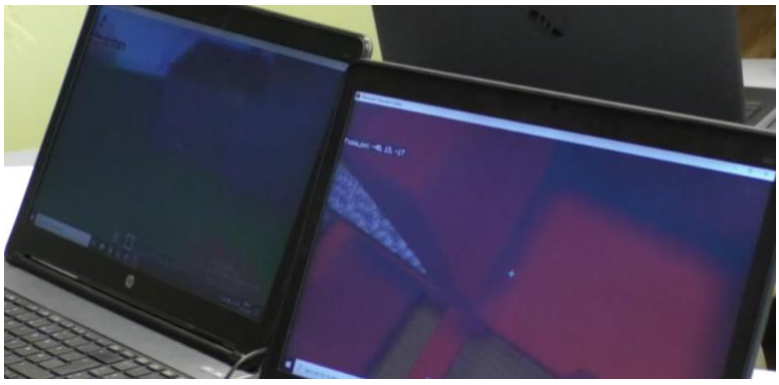

**Figure 16: Emma (left) and Oliver's (right) screens situated next to each other while Emma points to different areas of the building.**

**Excerpt 07:** Construction supervision 2

Group 2

| Time | Speaker | Interactions |
|---|---|---|

| | | |
|---|---|---|
| 00:45:47 | Oliver | *"Også- også-?"* [Oliver leans over to Emma's screen to look at a picture of the building.] |
| 00:45:50 | Emma | *"Ja d- det skal en på hjørnet der."* [Emma points at Oliver's screen, and Oliver proceeds to place fences on top of each other as a strut supporting the roofing over the balcony.] |
| 00:45:53 | Emma | *"Ja, der! ... Det er sånn at i det der er det bare glass … så liksom-"* [Emma points at the picture of the building on her screen.] |
| 00:45:58 | Oliver | *"Åja jeg kan fikse det."* |
| 00:46:01 | Emma | *"Sånn mellom der …"* [Emma points between the strut made earlier and the wall of the building.] |
| 00:46:02 | Oliver | *"Er det tre eller to?* |
| 00:46:03 | Emma | *"Tror det bare er to."* |
| 00:46:05 | Oliver | *"Bare to ja."* |

Oliver starts by leaning over to Emma's screen to look for the next step in the building process. Emma points to the corner of the balcony and adds that it needs another strut that supports the roof as pictured in the picture of the building (figure 17a). She elaborates that it seems to be made of glass. Oliver replies, affirming he can fix it. Emma further assists Oliver by pointing at Oliver's screen where to put the glass (figure 17b). Oliver then asks if he's supposed to make it two or three blocks in width, whereas Emma suggests using two blocks, to which Oliver repeats and agrees to.

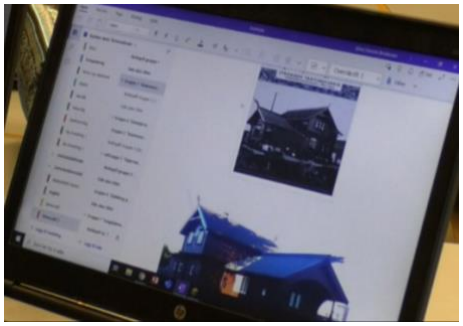

**Figure 17a: The OneNote document contains pictures of the building.**

**Figure 17b: Assisting each other while building.**

**Excerpt 08:** Unexpected visitor interaction

Group 2

| Time | Speaker | Interactions |
|---|---|---|
| 00:52:37 | Haider | [Haider turns around and sees a pupil from another group slide up towards their building in a boat on land.] *"Hva er det OP gjør! Han kom med en båt! ... Åååååå"* |
| 00:52:53 | Haider | *"Nei! Jeg hoppet i båten, fader hvordan kommer jeg ut?* |
| 00:52:55 | Oliver | *"Haider du må ikke skrive noe på skiltene da!"* |
| 00:52:58 | Haider | *"Men hvordan går jeg ut nå … der ja. Jeg var borti båten og skulle knuse den, men det funka ikke."* |
| 00:53:10 | Haider | *"OP driver og lager masse båter her!* [Oliver walks up to OP who is sitting in a boat and continually hits them, breaking the boats. Oliver keeps following them for a while.] |
| 00:53:30 | Oliver | *"Gåååå!* |

Haider spots a player from another group approaching him and his group's building in a boat sliding across the grass (figure 18a). Haider then accidentally sits in the boat and struggles to get out. Oliver then instructs Haider to not write anything on the signposts they were busy putting down as decoration before getting interrupted. Haider continues to struggle to get out, but finally manages to exit the boat, saying he was trying to break them by hitting them but sat in it instead. OP (other pupil) keeps spawning in boats at their door, which Haider exclaims to his group. Oliver then walks over and stars hitting OP's avatar and boats to make them leave (figure 18b). He follows them for a while before yelling "Gåååå!" and writing it in the in-game chat so OP can see it.

**Figure 18a: Another player approaching the group in a boat.**

**Figure 18b: Oliver hitting the other player.**

**Excerpt 09:** Wooden floors

Group 1

| Time | Speaker | Interactions |
|---|---|---|
| 00:22:22 | Oscar | *"Hvilken greie skal gulvet være?"* |
| 00:22:25 | Hans | *"Sånn vanlig tre kanskje?"* |
| 00:22:28 | Oscar | *"Vanlig tre? Sånn oak tre, er det vanlig tre?"* |
| 00:22:31 | Hans | *"Ja."* |
| 00:22:47 | Olivia | *"Men, skulle vi ha sånt tregulv?"* |
| 00:22:49 | Oscar | *"Ja."* |
| 00:22:54 | Olivia | *"Hvilket tre da?"* |
| 00:22:56 | Oscar | *"Eiketre."* |
| 00:22:57 | Teacher | *"Men hvis jentene kanskje får bygge tregulvet da, i og med at de ikke er like erfarne som dere, så begynner dere med taket og sånt?* |
| 00:23:03 | Olivia | *"Eiketre?"* |
| 00:23:04 | Oscar | *"Ja."* |

Oscar starts by asking what the floor should be made of. Hans suggests using regular wood, to which Oscar responds with asking what regular wood is and suggesting that it might be oak wood. Hans confirms that regular wood is oak wood. After a short period of silence Olivia asks if they were supposed to build wooden floors for their building, which Oscar confirms. Olivia further asks about what type of wood they should be using, and Oscar repeats oak wood from earlier. The teacher then joins the conversation and suggests that the group delegates the girls to build the floor and the boys to build the roof, as they are more experienced. While the teacher is speaking Olivia repeats "*eiketre*" (oak wood) to Oscar, to

which he replies yes. The girls can then be seen starting construction on the oaken floor later (figure 19).

**Figure 19: Oaken logs are being placed on the floor.**

## 6.5. Joint meaning-making

**Excerpt 10:** Placement of doors

Group 2

| Time | Speaker | Interactions |
|---|---|---|
| 00:20:53 | Sofia | *"Men er det her baksiden og det der forside da? Eller er det her samme side?"* [Emma stands next to Sofia, and they are both working on the same screen, looking at the pictures of the building.] |
| 00:20:55 | Oliver | *"Det er derfor jeg syntes det var så merkelig!"* |
| 00:20:57 | Haider | *"Det var Emma som sa at det var her den skulle …"* |
| 00:21:00 | Sofia | *"Jeg er litt usikker …"* |
| 00:21:01 | Teacher | *"Det må nesten være det, at hvis det er forskjellige sider, at den utstikkeren er der."* |
| 00:21:04 | Sofia & Emma | *"Ja det er det."* |
| 00:21:06 | Emma | *"Fordi det her er forsiden, men døra er der! Det er inngangsdøra selv om det er baksiden."* |
| 00:21:10 | Sofia | *"Ja."* |

Sofia starts by questioning which side of the building they are looking at on the image, compared to their Minecraft construction. Emma stands next to her, and they are looking at the images of the building. Oliver exclaims that that's the reason why the placement was feeling strange (in relation to the doors). Haider adds that Emma had stated the doors should be placed where he is situated, and Sofia replies that she's not sure. The teacher points at the screen and says that it's very probable that a certain part of the building is located somewhere they are looking on the screen. Sofia and Emma agree in unison, and Emma exclaims that this part of the building is the front side, but that the entrance is located on the backside of the building. Sofia agrees.

**Excerpt 11:** Writing the script

Group 1

| Time | Speaker | Interactions |
|---|---|---|
| 00:22:37 | Hans | [All pupils in the group are gathered around one computer and writing the script.] *"Det burde være- "* |
| 00:22:38 | Oscar | *"Gå ned, gå ned, gå ned …"* |
| 00:22:40 | Hans | *"Siden det står … ehmmm… "Astrid og Sigrid løper rundt og letter etter doktoren men når de finner han.." ehm… "…Ikke finner han i tide så Kåre dør…" Der burde det være "dør Kåre".* |
| 00:22:50 | Olivia | *"Dør, ja. "Kåre dør", ja."* |

Hans starts suggesting something but gets cut off by Oscar asking to scroll further down the script. Hans continues, repeating a part of the script before suggesting a change to make it more grammatically correct. Olivia agrees to the suggestion.

**Excerpt 12:** Positioning and placement

Group 2

| Time | Speaker | Interactions |
|---|---|---|
| 00:08:57 | Emma | [Emma is looking at an image of the building, while sitting next to Oliver.] *"Nei hvis du er her, går ikke den sånn!"* |
| 00:08:59 | Haider | *"Tror det bare går ett opp ..."* |
| 00:09:00 | Emma | *"Nei, den går faktisk fem ut … Jeg vet ikke!"* [Emma walks over to Haider's screen to watch.] |

| | | |
|---|---|---|
| 00:09:03 | Haider | *"Neinei du må se på vår her, vinduene og terrassen går her ... Du må bygge vinduene så man kan se de."* [Haider points repeatedly at the screen while talking.] |
| 00:09:13 | Emma | *"Men de der er foran ... der hvor det skal være sånt vindu."* |
| 00:09:18 | Haider | *"Her, her! Skal de være. Du må bygge de så man kan se ut da."* |
| 00:09:23 | Emma | *"Ja ... Neinei, Gå litt lengre ned ... Det er her."* |
| 00:09:26 | Haider | *"Oja her kan man se ut vinduet ... Da begynner jeg å jobbe her."* |

Emma is looking at the image of the building while questioning the height of the windows and balcony on their Minecraft reconstruction. She states that it's not supposed to look like it does, and Haider adds that he thinks it's only supposed to go one block up. Emma then says that the balcony goes five blocks out from the building, before adding that she doesn't know. She gets up and walks over to Haider's screen, who says that she should look at their screen, explaining what the windows and balcony looks like. Haider then says to Emma that she should build the windows so you're able to see them. Emma asks about some windows on the front of the building (figure 20), to which Haider replies and points to where they should be located – and adding that the windows should be built in a way that makes you able to look out through them. Emma then slightly corrects the positioning of the windows by pointing out that they should be a bit further down, and guides Haider to the correct position. Haider then agrees on that spot, and states that you should be able to look out the window from there, and he says he will starts working on it.

**Figure 20: Windows on the front of the building.**

**Excerpt 13:** Old furniture

Group 2

| Time | Speaker | Interactions |
|---|---|---|
| 00:31:19 | Haider | *"Ååh vi må ha trapp opp her! Jeg lager trapp, jeg lager trapp!"* |
| 00:31:22 | Oliver | *"Nei ta stige, Haider, Haider!"* |
| 00:31:24 | Emma | *"Vent, vent- "* |
| 00:31:27 | Haider | *"Stige er fra gamle dager!"* |
| 00:31:35 | Sofia | *"Haider hva gjør du?"* |
| 00:31:37 | Haider | *"Jeg bygger trapp."* |
| 00:31:38 | Oliver | *"Nei, nei, nei, vi skal ha stige."* |
| 00:31:41 | Haider | *"Vi skal ikke ha stige, det er for gamlinger!"* |
| 00:31:43 | Oliver | *"Ja nettopp, dette er gamle dager!"* |

Haider exclaims that the group needs to build a set of stairs, and then promptly states his intention to start constructing one. Oliver then disagrees with Haider, suggesting a ladder instead. Emma tells Haider to wait a little. Haider then replies to Oliver and states that ladders are old fashioned. Sofia then joins the conversation and asks what Haider is doing, to which he replies he's building a staircase. Oliver again denies the construction of a staircase, repeating the desire for a ladder inside the building. Haider replies by saying ladders are for old people, to which Oliver agrees and informs Haider that the building is supposed to be set a long time ago, which is why they should use ladders.

## 6.6. Development of a common artifact

**Excerpt 14:** Red wool

Group 1

| Time | Speaker | Interactions |
|---|---|---|
| 00:31:18 | Oscar | *"Hva med sånn rød ull som blod?"* |
| 00:31:50 | Olivia | *"Har vi blod snart? Hva skjer?"* |
| 00:32:09 | Oscar | *"Okei … Vent jeg skal ikke ha noe i hånda.* |
| 00:32:11 | Olivia | *"Ikke?"* |
| 00:32:12 | Oscar | *"Nei."* |
| 00:32:13 | Olivia | *"Ikke jeg heller …"* |
| 00:32:18 | Oscar | *"Og når jeg blør kan jeg ha den røde ullen foran."* |

| | | |
|---|---|---|
| 00:32:20 | Olivia | *(Laughter) "Ja. Da kommer jeg."* |

Oscar suggests using a block of red wool as a substitute for blood when he cuts his arm off during the roleplay (figure 21). After some other preparations Olivia asks if they've got blood yet and asks what's happening. Oscar talks aloud and mentions he's not supposed to have anything in his hands and puts away the block of red wool. Olivia inquires, and Oscar replies no – Olivia then agrees and puts away her own block of red wool. Oscar then says that when he's supposed to bleed, he will pull out the block of red wool, to which Olivia chuckles and affirms that she will come to him when it happens.

**Figure 21: Oscar holding a block of red wool during the roleplay**

**Excerpt 15:** Suggestions

Group 1

| Time | Speaker | Interactions |
|---|---|---|
| 00:18:16 | Hans | *"Vi skal ha rødt på toppen her."* |
| 00:18:18 | Oscar | *"Ja …. Bare søk på rød."* |
| 00:18:23 | Oscar | *"Skal vi bruke … rød terrakotta?"* |
| 00:18:26 | Hans | *"Rødt tre."* [Hans searches the term "rød" in the search bar.] |
| 00:18:28 | Oscar | *"Eller rød betong?"* |
| 00:18:35 | Hans | *"Er det noe rødt tre her?"* [Hans searches the term "tre" after looking at the results for "rød".] |
| 00:19:14 | Teacher | *"Dere kan jo bruke rød ull også?"* |
| 00:19:18 | Oscar & Hans | *"Ja. Mmhm."* |

Hans states that the building should be red at the top part. Oscar then agrees and tells him to search for "*rød*" (red) in the search bar. He then suggests using red terracotta as a red block. Hans responds with "*rødt tre*" and then searches for "*rød"* (red) in the search bar (figure 22a). Oscar then further suggests "*rød betong*" (red concrete) as the material of choice, while Hans is searching for red items. Hans then asks if there is any red wood in the game while searching for it (figure 22b). The teacher then asks if they could use red wool as building material, to which both players agree.

**Figure 22a: Hans searches for "rød".**

**Figure 22b: Hans searches for "tre" instead.**

## 6.7. Summary of findings

Using the themes from the thematic analysis as an outline for the summary, starting with generic skill, both groups had gathered information about the subject matter in a OneNote document created before the learning activity taking place when historical experts visited the class. They also searched for various images during the learning activity which were used as reference. When it comes to Minecraft skills some students had previous experience with the game and others did not, creating a visible expert/novice dynamic in both groups which also made peer-scaffolding possible during the activity. This applies to both technical skill and knowledge required to utilise the game as effectively as possible as a learning tool. Throughout the excerpts instances of generic skills such as vocabulary, creativity and problem-solving are visible.

Findings made in the interaction and information theme suggests that pupils often interact and share information between each other while participating in a learning activity within Minecraft, however most of the interactions and information is not pertaining to the subject matter, but rather the process of creating a building in Minecraft. The pupils use the OneNote

document as a powerful tool for peer-scaffolding and information sharing, while also interacting with each other's screens to instruct on the building process through pointing or observing. There were some in-game avatar interactions, such as group 1 using it as a tool during the role-play, and group 2 interacting with another pupil through their avatar.

Joint meaning-making happened mostly in instances when the pupils were problem-solving and trying to locate or place specific elements of their building. It emerged when multiple pupils discussed various decisions in the building process and scriptwriting. They often asked each other questions about whether something seemed right or wrong, and they then together figured out how something was supposed to work, both through their own ideas and skills, and through using various tools such as the pictures of the buildings.

As for developing common artifacts, Throughout the learning activity multiple discussions took place that ended up with the pupils reaching a decision together, and this decision or understanding between the pupils influenced what the physical artifact would be. Both groups did develop common artifacts, however they were different types of artifacts, e.g., group 1 developing a symbolic artifact, while group 2 developed a CSCL-artifact. There were also finds that indicate provided artifacts did indeed mediate the pupils' actions in different ways, such as mediating the activity of choosing where to place and orient the building.

# 7. Discussion

In this chapter I will use the results provided by the analysis to discuss the research questions. I will discuss the findings based on the theoretical approaches and conceptual framework from chapter 4, as well as previous findings from the literature review in chapter 3. The research questions are as follows:

1. What common artifacts emerged in the pupils collaborative learning and design efforts and what artifacts were provided?

2. What relations between everyday concepts and scientific concepts could be identified in the pupils' conversations?

3. What are generic skills in Minecraft and how are generic skills manifested in domain-specific learning?

During this chapter I will be referring to the excerpts presented in the last chapter and will be doing so by referring to their number. The research questions will be answered by discussing different aspects of the questions that help further understand the findings made during analysis.

## 7.1. Research question 1

**"**What common artifacts emerged in the pupils collaborative learning and design efforts, and what artifacts were provided?"

### 7.1.1. How did collaborative learning help develop artifacts?

In the sociocultural perspective of learning, learning is a social process that occurs through interaction and mediated by artifacts (Vygotsky, 1978). A part of this interaction is collaboration, in which the learners share and negotiate information between each other before internalizing it individually on their own (Vygotsky, 1978). In this case the learning activity took place Minecraft and organized as an CSCL activity, which uses collaboration as its primary way of interaction. The Core features of CSCL describe ways in which the learners collaborate and develop intersubjectivity and shared knowledge while developing

common artefacts through collaboration (Stahl et al., 2006). These common artifacts are created when members of the group share their individual perspectives and knowledge, then assign a shared meaning to an object and by creating things together (Stahl et al., 2014).

Aspects of the core features of CSCL could be identified during the learning activity. Interaction between the learners were often characterised by information sharing, Examples of this are excerpts 6, 7 & 9, which are all interactions between two or more members of the groups where information is being exchanged between the pupils. Stahl et al. (2006) states the importance of inquiry, observation, and imitation, which are all part of this process. In excerpt 7 for instance, Oliver asks about the position of a strut, in which Emma shares the information with him by pointing at his screen. He later asks about the amount of glass, to which she also shares information with him.

Next, Joint meaning-making was also a prominent during the learning activity. This would occur after the pupils had exchanged individual interpretations of an object to establish a shared meaning (Engen et al., 2018). This process is visible in excerpts 10-13. For example, in excerpt 12, Emma and Haider discuss the placement of the various windows in relation to the balcony. They exchange viewpoints on where they should be placed, e.g., “I think it just goes one up…” & “No, it goes five out… I don’t know!”. After a while they agree where the windows should be placed, by adjusting their individual perspectives until they agree. The function of these CSCL features help to understand the learning activity as reaching the goal of CSCL, which according to Stahl et al. (2006) is to create artifacts and environments that enhances group meaning making.

During the learning activity there are multiple instances of peer-scaffolding which in turn helps the groups towards their goal of reconstructing the building. In excerpt 6, Emma instructs Oliver the balcony and garden should be located. Throughout this process Emma uses the cursor on the middle of the screen in Minecraft to point Oliver to the right location. She circles her cursor around focal areas while explaining to Oliver what part of the construction should be placed there, starting with the balcony, then the garden. In a sense, Emma’s instructions to Oliver about where he should build enabled him to start the activity, which is an instance of peer-scaffolding, according to Wood et al. (1976). It’s worth highlighting computational scaffolding as explained by Tabak & Kyza (2018), as the cursor could be considered an element inside Minecraft that provides scaffolding when used like

Emma did in excerpt 6. However, the cursor is not a piece of software developed for the *purpose* of scaffolding like e.g., a directed prompt would, however it does to a degree supplement Emma's explanation of the locations.

In sum, the goal of CSCL is to create common artifacts through a set of steps of sharing information toward a common artifact. These steps were to a large extent more observable during the reconstruction phase of the learning activity. Other collaborative behaviours which were observed were instances of peer-scaffolding and supplemental computational scaffolding (excerpt 6). Altogether, these organizational and technological features help pupils develop common artifacts together, i.e., through joint meaning-making, intersubjectivity, and through shared experiences within Minecraft.

### 7.1.2. What common artifacts emerged during gameplay?

Stahl et al. (2014) defined an artifact as follows: "*An "artifact" is defined as a physical object created by people and embodying human meaning*". This means that a tangible artifact must embody to become a CSCL artifact, and this meaning must be created through a social interaction process. Within the CSCL perspective these social processes are enabled through joint activity that is observable by the researcher in the virtual world (Stahl et al., 2014). Examples of such an artifact varies, as the sociocultural artifacts are both tools and signs. The tool artifact mediates the physical world, and the sign artifact mediate the psychological world (Vygotsky 1978). Together, these two types of artifacts can facilitate learning that would otherwise be impossible or help further improving the already existing learning process.

During the learning activity multiple common artifacts emerged among the pupils in the groups. In excerpt 15, where Hans and Oscar try to find red building material for the building, we can see how Oscar suggests multiple different materials to him. Throughout this exchange the two pupils continuously share their individual considerations. We can see Oscar suggesting different materials multiple times to try to reach a common understanding with Hans, before both pupils agree on using red wool as the material once the teachers suggest it as a potential material. Through this back-and-forth interaction between the pupils, and a suggestion from the teacher, the pupils have reached a common understanding that the wool can work as a substitute for the wooden walls the original construction had. This may sound

strange to someone who don't know Minecraft, for why would one want to use "wool" instead of "wood". This can be considered a symbolic artifact in Minecraft, as the physical object (wool) gets assigned a new meaning as a red wall because the social context agrees upon it (Tylén et al., 2016), highlighting one of the object's properties (colour) and suppressing others (durability). This is also an example of what Arnseth et al. (2018) found when researching games as tools for dialogic learning and teaching. They mention that when the pupils engage in dialogue related to the in-game experience, the teacher can identify different perspectives in each pupil through the dialogue and suggest a solution to the current task, which the pupils can reflect on and consider before they eventually agree on it or not. This interaction highlights teacher-pupil scaffolding where the teacher intervenes and suggests a building material for the group to use, an action which can be classified as direction maintenance by Wood et al. (1976). Wendel et al. (2012) states that a teacher must be able to observe and intervene when deemed necessary to promote interaction between learners, which this could be an instance of.

Each group assigned meaning to a collection of Minecraft building blocks that together makes up a (model of a) historical building. We can see from Group 1 in excerpt 13. Haider wants to build a staircase within their building, but Oliver wants to build a ladder. After some back and forth, Haider says that ladders are for old people, to which Oliver answers "Yes, exactly! This house is supposed to be old!". Haider then wants to build a bedroom within the building, to which the two other members of the group also responds negatively, as the furniture factory wouldn't have any bedrooms as it was a place of work. This exchange shows that the group has developed a common artifact tied the building, and even though their construction project is situated within the virtual world of Minecraft they have assigned meaning to it, making it represent the actual historic building. This common digital artifact is a result of a collaborative effort between a group of pupils, which mediated their actions throughout the construction phase to reach the result of a finished Minecraft building (Stahl et al., 2014). As Stahl et al. (2014) also stated about CSCL artifacts, is that they come from a social process, which creates meaning through intersubjectivity – and joint activity.

To *sum up* the emerging common artifacts; there are different types of common artifacts at play in the learning environment with pupils taking on different roles in mediating the pupils' activity within Minecraft. A symbolic artifact emerged when the pupils in group 1 agreed that they could use red wool blocks as their wall material, choosing it as it created the most

accurate colour to model the real (historical building). They used red wool as a substitute by assigning new meaning created by intersubjective meaning making within the group and aided by the teacher. Group 1 also developed a common CSCL artifact, which was the groups' building. This building mediated all their actions throughout the learning activity, and even though the reconstruction was situated within Minecraft, a virtual world, they still saw it as a representation of the original historic building by having a focus on keeping it "old-fashioned". The artifact created meaning for the pupils through intersubjectivity and joint activity which is also how it was constructed.

### 7.1.3. What common artifacts were provided during the activity?

In this chapter I will attempt to identify any provided artifacts present during the learning activity. However, I must first explore what different types of provided artifact can be present during the learning activity. As the pupils are present within Minecraft for the duration of the learning activity, the design of Minecraft could provide the students with artifacts present within the game that the pupils themselves did not create. In addition, the students had pre-existing knowledge of the subject matter provided by the experts who had presented the historical building the groups were constructing, which they had access to in OneNote, which could take the role as an artifact during the activity.

As the pupils were interacting with each other during the reconstruction and transformation phases of the learning activity (constructing the building and writing/performing the role-play) they often referred to the OneNote document they had previously written during the visit from the experts on the subject. The computers which had the OneNote document open would often be inspected by students sitting adjacent to it, or the pupils using the OneNote document would use the information from it to guide the adjacent pupils. In excerpt 7 Oliver and Emma is collaborating in the reconstruction process, building a part of the balcony based on a picture of the building. During this exchange Oliver starts by leaning over and looking at Emma's screen for information from the OneNote document. Later Emma would point at Oliver's screen to show him where to build, as well as pointing back to the picture in the OneNote document as a comparison to their Minecraft construction. The way the pupils are collaborating suggests that the computers they are using works as mediating CSCL artifacts by mediating their interactions within Minecraft by facilitating a social meaning-making process via the computer (Stahl, 2014). Other interactions such as the one in excerpt 7 are

present in excerpt 10, where Emma has moved from her own computer over to Sofia's, to collaboratively observe the pictures present in the OneNote document to work out the positioning of doors on their building. In this case, Emma and Sofia are looking at the same pictures but both arguing their own perspective as to where the door should be, before finally reaching a common understanding. The OneNote document in this case shows both pupils the exact same picture, but creates a discussion point on positioning which the pupils later agree on after discussing the pictures. The document therefore becomes a common artifact which was provided outside of Minecraft before the learning activity began.

Outside of artifacts provided by the teacher, experts or the researchers, Minecraft itself may also provide the pupils with artifacts to interact with during the learning activity. However, as I am exploring provided artifacts, this section does not encompass pupil-created artifacts such as the artifacts identified in the last chapter. When the pupils started the learning activity, they logged into a Minecraft server which had a pre-generated world set to be completely flat, with grass blocks as the foundations. The only scenery of note was the river which had been put in the area the groups were reconstructing buildings, as many of the actual buildings were situated next to a river (figure 23). This river may be considered a provided common artifact for the pupils, as it would mediate their actions as to *where* to start reconstructing their building. The river mediated the placement of the buildings through being an essential part of the buildings themselves – for example, group 1's logging facility were situated close to the river because of the building relying on the river for transporting the logs, which means it had to be build close, and the pupils also had to take the directional orientation of the building into consideration, as one specific side of the building was facing the river.

***Figure 23: Group 1 rebuilding a part of the logging facility facing the river, meaning the building had to be placed correctly.***

Throughout the activity the primary observed provided artifact seems to be whichever computer the pupils use to consult the OneNote document. As explained, it quickly becomes a focal point for attention and interaction, either by adjacent pupils leaning over to it while another pupil is interacting with it, or by one pupil taking the role of "supervisor" and

perfoming peer-scaffolding using the available information from the OneNote document. Within the Minecraft world a provided artifact that ended up mediating the actions of group 1 was the pre-made river. Because of the nature of their building, the river mediated the action of where to construct it, making it a provided artifact by the research group which provided the world the pupils were playing in.

## 7.2. Research question 2

"What relations between everyday concepts and scientific concepts could be identified in the pupils' conversations?"

The topic of spontaneous and scientific concepts being expressed or identified through learning within Minecraft requires some consideration. On one hand, a spontaneous concept is made up from experience, often in social settings. On the other hand, the scientific concepts use the everyday concept as a foundation for further understanding and consists of structured understanding and abstract scientific understanding learnt through formal education (Vygotsky, 1986). In a traditional educational setting, the pupil would bring their spontaneous concepts into the classroom and use these as foundations to learn the scientific concepts being presented by the teacher. How this process works within a virtual world setting such as Minecraft is less explored. Through a discussion of this research question, I aim to explore how the two concepts can be identified through conversations within a virtual setting, how they eventually evolve throughout social interactions, and how peers influence the development of concepts in each other. The question of whether something is a spontaneous concept or scientific concept is not decided by if a conversation is concerned about the subject matter of social studies, or if it is a conversation about Minecraft and the reconstruction effort. What exemplifies the concepts is the meaning the speaker assigns to the word in the conversation, and if possible, identifying the process of which the pupil learnt it (Blown & Bryce, 2016).

### 7.2.1. What concepts were identified in conversations?

In excerpt 3, Oliver asks Haider what wood-type they want, and he suggests "regular" wood. Haider agrees to "regular" wood – Oliver asks if he wants some birch wood as well, to which Haider responds "Yeah, give me that wood thing", and Oliver repeats the line to himself and laughs. This interaction shows that both Haider and Oliver have previous experience with the

game, by referring to oak wood as “regular” wood without questioning each other. In excerpt 9, Hans also uses the term “regular” wood to which Oscar asks if “regular” wood is oak, confirming that he too knows of this term from previous interaction with Minecraft. Oaks are the most common tree type within Minecraft, and at one point was the only type of tree available when the game first was released (Minecraft wiki, 2022f). It is possible that this is a spontaneous concept as described by Vygotsky (1978), formed over time from experience, where the pupils have observed that oak trees are far more common than others within Minecraft which in turn leads them to labelling them as “regular” trees. What is important to note however, is that students from different excerpts, from different groups (Haider and Oliver from group 2, Hans from group 1) use the exact same term for oak wood, being “regular wood”. As it is evident that these pupils have experience with Minecraft from before this learning activity, it could be possible that this is a taught concept, as it is shared between many students.

This term, or concept of “regular” wood is not exclusive to the pupils in this study, but a widely used term across the Minecraft community. By Haider understanding and agreeing to using “regular” wood as a material when asked by Oliver, we may link both Oliver and Haider to the community-created language used by many Minecraft players. Thorne et al. (2012) suggests in their study that exposure to a community based around a game will help the player create a vocabulary to engage with resources in and around the game. If the pupils have learned this term through interaction with the Minecraft community either in-game on another server, or through external resources such as other websites (e.g., a google search for “regular tree Minecraft” will bring up many pictures of oak trees) or the plethora of YouTube Minecraft creators, this term could be defined as a scientific concept (in this case scientific language), which is *taught* rather than created through experiences, as a part of the community framework around Minecraft (Vygotsky, 1986). As Thorne et al. (2012) also finds that the wikis and other community created content such as guides, overviews, and instructions can further the player’s knowledge about secondary language and functions within the game as part of a social knowledge construction that takes place in the community surrounding the game, which supports the possibility that Haider and Oliver has taken part in such a process to develop a scientific concept within Minecraft.

In these excerpts there were identifiable concepts such as “regular” wood, which was identifiable in multiple instances across both groups. It is possible that this is a spontaneous

concept the pupils have acquired through experience on their free time by playing Minecraft, as the usage of the word "regular" wood already shows that the pupils have some experience with Minecraft before the study. However, it is also possible that this is a scientific concept taught to the pupils through interaction with the online Minecraft community.

### 7.2.2. How did the concepts evolve throughout the activity?

According to figure 13, adapted from Seibt & Kjelling (2014), the spontaneous and scientific concepts move closer together as an individual acquires knowledge. As the pupil acquires knowledge, the spontaneous concept becomes closer to the scientific concept, being abstract, while the scientific concept comes closer to the spontaneous concept and acquires greater concreteness (Vygotsky, 1986). This process of evolution essentially means that the everyday language might gradually become more scientific as the pupil acquires knowledge during education and is able to explain a phenomenon more abstractly, and that as the pupil gains greater knowledge of the abstract, they can more fluidly and easier explain it as something more concrete (Blown & Bryce, 2016).

During the learning activity in Minecraft, the evolution of concepts was identifiable. In excerpt 5 Oscar asks Hans if they should use "knust stein" (crushed stone) or "vanlig stein" (regular stone) as building material for the roof. Hans then suggests using "brostein" (cobblestone), to which Oscar agrees and repeats to himself "Cobblestone, yes", then asks Hans the question: "That's crushed rock, right?". During this exchange Oscar starts out by suggesting using "crushed" or "regular" stone as building material, however none of these blocks are "real" blocks within Minecraft. Stone is often referred to as regular rock, however what Oscar means when he means "crushed stone" is cobblestone, which is textured as a cracked block of stone (figure 6). When Hans refers to it as "brostein" (cobblestone), Oscar repeats this to himself. After this exchange, he continues to refer to it a cobblestone throughout the reconstruction process for the rest of the learning activity. It is possible that this exchange functioned as an educational setting for Oscar, transforming his spontaneous concept of the block (which he acquired through experience, naming by how it looks) into a scientific concept (the actual name of the block, learnt through being taught by another). He also relays this concept to Frida which did not know the name of the block when she asks what the material, they are building with is called. By Oscar answering Frida's question using the actual name of the block instead of his previous nickname for it, he shows that he's

evolved his concept of this block through getting taught by Hans. As Blown & Bryce (2018) explained, Oscars' earlier everyday language has been "overwritten" by the scientific language used within a Minecraft learning activity. However, the spontaneous concept did serve a purpose as the foundation allowing the scientific concept to evolve.

On the other hand, I would argue that Frida did not develop a concept through this specific exchange. In this situation she is the novice within Minecraft and does not have experience with the various gameplay aspects and blocks of the game. An example which shows how Oscar had developed a spontaneous concept of the block previously is that he used to call the block "knust stein" (crushed stone), which from experience, that is what the block is. Cobblestone is gathered by smashing stone and collecting it, and the block looks like a cracked piece of stone. Oscar had attributed this name to the block because of how he had interacted and experienced it previously. Frida has yet to gain any of that experience and does not have a foundation to base the scientific concept upon in this situation, as the spontaneous concept must be developed to a certain point before evolving further (Vygotsky, 1986).

### 7.2.3. Did the pupils influence the development of concepts in others?

Continuing with excerpt 05, we can identify that Hans did influence concepts both within Oscar and Frida. When he taught Oscar that the block is called "brostein" (cobblestone) and not "crushed stone" as Oscar had previously said, it seems that Oscar internalised this and brought this with him, as when Frida later asks what the block is called, he replies with "brostein" (cobblestone). Without Hans' influence in this situation, Oscar would not have evolved his concept from a spontaneous concept to a scientific one (as before he only knew the experienced aspects of the block, such as its function and texture, but now he knows the only abstract thing there is to know about the cobblestone block in this situation, its name). This could also be a situation in which an expert and a novice interact with each other in a virtual space to further evolve their language, as Sundqvist (2016) suggested.

Excerpt 9 shows us an exchange in which Oscar, Hans and Olivia discusses what material to use for flooring in their building. Hans suggests "regular" wood, to which Oscar questions whether "regular" wood is oak wood, which Hans confirms. Olivia later asks what type of wooden floor they agreed on, and Oscar replies with oak wood. Olivia then repeats "oak wood?", which Oscar once more confirms. When Oscar asks if Hans' "regular" wood is oak

wood just to be sure, it is visible that Oscar already has a concept about "regular" wood just as Haider and Oliver had during discussion of chapter 7.2.1, and through asking he also identifies this same concept within Hans. This excerpt does not directly show the pupils influencing each other to develop concepts, however it does highlight how different pupils can identify similar concepts in each other, whether this comes from being part of a game community referenced by Thorne et al. (2012), or whether the pupils have experiences from previous interactions is unknown.

## 7.3. Research question 3

*"What are generic skills in Minecraft and how is it manifested in domain-specific learning?"*

### 7.3.1. What set of generic skills are identifiable in Minecraft?

When the pupils are participating in the learning activity, there are instantly some generic skills that are identifiable. The first set of generic skills that were easily observable was some aspects of computational skills, and the difference in skill levels between pupils. In excerpt 4, Hans and Oscar display their skills when it comes to *knowing* and *using* the controls in Minecraft. They both effortlessly fly across the nearby river, while the two other members of their group stays on one side. The teacher explains how to turn on flight, in which Olivia successfully crosses, and Frida fails to activate flight and ends up swimming across before activating it and flying out. This event shows that Hans and Oscar have developed the computational skills previously to know what buttons to use and how many times to press them (double tap spacebar). These skills can be considered generic skills within the setting of a virtual world as they are important for learning the subject-matter within the virtual worlds, more specifically in this instance, social studies within Minecraft (NOU:2015:8). As Mørch et al. (2018) states, Minecraft in this instance is the toolbox the pupils need to be able to interact with to learn the domain-specific knowledge. Nebel et al. (2016) and Lim (2020) also highlighted the importance of being able to master movement and interaction within a virtual world such as Minecraft, as the subject-matter cannot be learned without being able to interact with it.

In excerpt 2 Olivia needs to find logs for decorating a storage room inside the sawmill. In attempting to find the logs needed, she opens the inventory screen and uses the search bar. When searching for the logs she types out "tømmer" (timber), without it yielding any results

– she therefore attempts again by writing “stokk” (log) which turns out to be the correct name for the logs in Minecraft. In this instance she displays her generic skill of vocabulary – which can be seen as an extension of the basic academic skills such as reading and writing (Mørch et al., 2018). In this excerpt Olivia displays her vocabulary by using two very similar words that can often be construed as the same, to get the results she wants in an unfamiliar virtual world tool. Regarding this excerpt, one could also draw comparisons to Alavi & Gilakjani (2019), which suggests games work well as language teaching tools because of the motivating environment it provides learners. It is possible that in this instance, Olivia explored her vocabulary to a higher degree because of the activity taking place in Minecraft.

During the learning activity the pupils collaborate in many ways which can be defined as a generic skill. In excerpt 7 the pupils show communicative skills as part of the collaborative process while taking part in peer-scaffolding., as well as teamwork abilities by being able to share information between each other and act on it. Both are essential generic skills in modern workplaces (NOU 2015:8). In excerpt 8 a player from another group approaches group 2’s building while in a boat. As this pupil is physically separated from group 1, no amount of oral warning or reprimanding will help at all, as the other pupil is unable hear Haider and Oliver. However, Oliver attempts to communicate with the other pupil through in-game text chat, by writing “gåååå!” (get out), and proceeding to punch the player, even though in creative mode all players are invulnerable. This is an interesting exchange, as it displays both computational skills using the in-game text chat, and how non-verbal & text communication can work within virtual worlds. Through the action of punching the other player, Oliver emotes a disapproving reaction through the movements of his avatar, which through the understand that Minocha et al. (2010) presents, with communication through avatars in 3D environments (like Minecraft) being closer to face-to-face real-world communication suggests that through the Minecraft avatar Oliver was able to express an emotion or intent to the other pupil purely through virtual body-language.

Creativity has also been mentioned as an important generic skill. Throughout the learning activity many pupils utilised creative building solutions. In excerpt 5 the students agree to use cobblestone staircases to get a more sloped roof (figure 24).

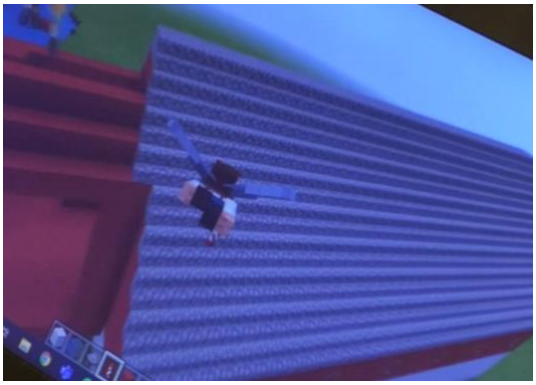

**Figure 24: The logging facility's roof made of cobblestone stairs. A player is flying over it using an Elytra.**

In excerpt 7 the two pupils working together to construct the balcony stacks multiple fenceposts to create a strut for supporting the roofing (figure 17b). In excerpt 8 we can see the pupils are in the middle of decorating the garden using stair blocks plus signposts on each side to simulate a garden chair (figure 18a), and lastly in excerpt 13 the pupils creatively substitute a blood effect with a block of red wool held in the hand of the player (figure 21). Ekaputra et al. (2013) and Mørch et al. (2018) highlights the creative learning potential of Minecraft, with Mørch et al. (2018) also explaining how Minecraft can be used as a tool for learning generic skills simultaneously as learning domain specific skills. These creative ways to create certain effects or objects could also be defined as problem solving skills within Minecraft. As no such object as a chair or sloped roof exists, the pupils must use the available resources to create something needed for the construction.

We may also not only identify what generic skills are identifiable in Minecraft, but what set of generic skills are *created* within Minecraft. Just as our modern society focuses on generic skills as skills needed to be successful within different domains and learn domain specific skills, so too does Minecraft. As an example, to *construct* a building a player will need to be able to place the individual blocks as part of a larger whole and depending on the size of the building, be able to navigate flight mode to place the higher-reaching blocks. Construction and building within Minecraft could then be looked at as one of Minecraft's own generic skills, seeing as constructing is needed to further interact with domain specific knowledge within a learning activity in Minecraft.

In sum, there are multiple identifiable generic skills in Minecraft. Computational skills are central to being able to utilise Minecraft as a means for learning because of the importance of movement and interactivity within Minecraft. Vocabulary, a part of the basic academic skillset required for further education is also a skill present within Minecraft, especially through a domain-specific subject matter, as the pupil is required to think of existing items and objects within the real world (such as logs in this case) and transfer this into the game to

get the wanted result. Creativity and problem solving gets displayed in Minecraft through the player having the freedom to create structures as they want, such as using stairs as chairs and roofing, while signposts work as armrests. As with generic skills often being used to describe what an individual will need as a skillset in the future when entering the labour market, within Minecraft there could also exist a set of generic skills (such as constructing) needed to further learn about domain-specific knowledge within Minecraft.

### 7.3.2. How are generic skills manifested during domain learning?

Mørch et al. (2018) writes the following in the conclusion of an earlier iteration of the SMILE project:

> *"[…] our current attempts to integrate generic and domain-specific skills practices are insufficient; the transitions between the two modes are not seamless, which indicates that we need to work harder to create a complementary/dialectic relationship between the two modes."*

These results later resulted in further highlighting the subject-matter within the learning activity taking place in Minecraft, as Minecraft is supposed to be the tool used to teach the domain-specific subject matter. During this latest iteration of the project, the pupils had classes hosted by historical experts on both the wooden furniture factory and the logging facility, meaning to increase their understanding and focus on the subject matter before starting the Minecraft reconstruction and transformation phases (Eielsen, 2020). However, during analysis it was clear, even though there might have been an increase in manifestation of domain-specific subject learning, most conversations held by the pupils ended up being about Minecraft and the process of reconstruction itself. In excerpt 13 when the pupils are discussing whether to build a ladder or a staircase inside their building, when Haider mentions how ladders are for old people, and Oliver as previously mentioned comments on why that's exactly why they need to use ladders, because it's an old building. This is a discussion rooted in the subject matter, being the age of the building, which then influences the construction itself (the construction aspect being a generic skill within Minecraft). Because of the groups' decision based on a domain-specific question, the way their generic construction skill would be expressed changed, as the building itself changed because of this decision. This is similar to the finds made by Mørch et al. (2019), when they noticed the interweaving of generic skills with domain-specific knowledge.

During the learning activity domain learning largely were not the focus of the groups, who rather had conversations and interactions rooted in Minecraft topics. However, the activity itself which was rooted in the subject-matter, made the groups collaborate when taking decisions during the reconstruction phase, such as choice of materials, size, orientation of the building vs. the river etc. All these interactions and construction decisions happened because the groups actively wanted to depict the buildings in an accurate manner to the material they had, making these decisions something that derived from the subject-matter. The creativity discussed in chapter 7.3.1 also derives from the domain-specific learning aspect of the activity, as the reconstruction effort required blocks or materials not available to the pupils, prompting them to find creative solutions.

### 7.3.3. Did pupils with less experience learn generic skills from the experienced pupils?

When doing studies or learning activities that puts pupils into groups to collaborate there will always be variations in knowledge and skills between the pupils, or pupils that are more proficient in some areas than others. During this learning activity there were some instances of pupils that were proficient at Minecraft helping the less skilled ones. Peer-scaffolding happened on multiple occasions as discussed previously, for example in both excerpt 6 & 7 where Emma assists Oliver in construction by telling him where and what to build. During the learning activity pupils which had less experience playing Minecraft were often assisted in carrying out a task, such as choosing materials (excerpt 5 & 9) or how to control the game (excerpt 4). Through collaboration the pupils with less experience got more familiar with the technical aspects of Minecraft, such utilising the search bar, learning how to activate flight mode, and using blocks as props during the roleplay. However, one can argue that these instances of learning lean towards recreation rather than creation as stated by Lim (2020), as mostly the pupils were doing what they were told by the more experienced pupils, and rarely created something they were not told to create.

The teacher also played an important role in the development of generic skill in pupils during the learning activity, such as in excerpt 4 where the teacher told pupils how to activate flight, and in excerpt 9, by delegating tasks for the pupils based on their skill-level. By making less experienced players build a simple construction like a floor would make them more familiar with the construction activity within Minecraft, which could be considered a generic skill

within Minecraft. This also reflects finds by Lim (2020), as they found that even through recreation or less creative construction, the players would still develop competency skills within the game, which in turn can help them acquire more knowledge during a later learning activity.

Through these finds I can summarise that the pupils do indeed learn some generic skills through a collaborative activity within Minecraft, such as collaboration itself, creativity, technical skills, and even generic skills needed within Minecraft to perform domain-specific learning within the game, such as construction. However, the role of the teacher is also important to further learn generic skills within a virtual space.

# 8. Conclusions and reflections

In this thesis I have explored how Minecraft functions as a tool for learning in Computer Supported Collaborative Learning settings. Through my research questions I put a focus on various aspects of learning through CSCL, being the development of common artifacts, the relations between spontaneous concepts and scientific concepts and how they evolve through collaborative play, and finally what generic skills are identifiable in Minecraft, as well as how they manifest themselves during domain-specific learning. Here I will summarise the key findings made during this project as well as reflect on the limitations of the study and recommend further research on certain topics.

## 8.1. Key findings

Important common artifacts were developed by the groups during the learning activity. The groups developed different types of artifacts, some being symbolic artifacts within the bounds of Minecraft which they used to successfully reconstruct their historical building. They also developed a common CSCL-artifact in the building itself, with it mediating their actions through the domain-specific learning context (as the building was historic, it needed to be built to look like a historic building). The artifacts were developed through joint activity in a collaborative setting, where students would exchange information from their own perspective to create joint-meaning and intersubjectivity. Some artifacts were also provided, such as the computers the pupils used to look up the OneNote document being an important part of their collaborative efforts, as well as the river that was placed in the world before the activity influencing where the pupils would place their building foundations, as well as the orientation of said building.

Interactions suggest that spontaneous concepts could evolve into scientific concepts through conversations with fellow pupils within Minecraft. Through interacting during the collaborative learning activity various concepts were identified, such as multiple pupils having the concept of “regular” wood within Minecraft despite there not being anything named as such, and the game featuring various types of wood. It is possible that these concepts were spontaneous concepts developed by pupils identifying this wood as “regular” because of its abundance within Minecraft. However, I would highlight the influence of external game-communities on individual within it, and how they can shape a players’ vocabulary through other player-created content, such as wikis and videos. As the scope of

the study were within classroom environments, such an influence cannot be determined by the data.

Generic skills such as technical skill, creativity, collaboration and problem-solving were identified, in addition to vocabulary as a part of the basic academic skillset. In addition, various generic skills were identified within the bounds of Minecraft, such as movement and construction abilities. These generic skills identified as being inside Minecraft further enables a player to interact with various subject-matters if they are familiar with the Minecraft generic skills, as they enable the player to move around more effectively and interact with the contents of the game. The importance of generic skill within Minecraft is much the same as generic skill outside of it, making the pupil able to interact with the subject-matter at hand through pre-existing skill. Peers during the learning activity did also to some degree teach each other generic Minecraft skills, such as orally explaining how to control the game, however the teacher also had an important role in instructing pupils about the controls, suggesting that the teacher is an important part of a collaborative activity within Minecraft.

## 8.2 Limitations of the study and further recommendations

As mentioned in chapter 5, there are certain dangers of utilising secondary data during a project. One such limitation I encountered was the fact that there was only a certain amount of data which I could analyse, being two groups with approximately 200 minutes of footage of each group. Within the video recordings there were certain limitations as well, such as only being able to see the screens of one or two pupils at a time. In many cases the pupils would move around to watch other pupils' screens, which I was not able to do as the camera was positioned on certain screens, potentially missing non-verbal interactions, or the context of their verbal interactions. As I was using secondary data and the SMILE-project asked different questions from mine, I could gather little relevant information from the interviews, as the questions were mostly focused on domain-specific learning. This weakens the triangulation of methods and overall creates weaker finds.

I was not able to explore the topic of language and games, discussed in the second research question, as much as I wanted. On this topic I recommend further studies into the evolution of the Vygotskian concepts through collaborative activities within a virtual world, and how participants influence the evolution of concepts within each other. I would also like to see

how Minecraft can be utilised as a collaborative learning tool within survival mode, and how players develop common artifacts, problem solve, delegate important tasks, and interact in an open sandbox environment without an overarching subject-matter. This however is outside of the relevance of this thesis, as this is based more around learning through the game itself, rather than use the game as a tool for learning.

# References


Andersen R., Mørch A.I., Litherland K.T. (2021) Learning Domain Knowledge Using Block-Based Programming: Design-Based Collaborative Learning. In: Fogli D., Tetteroo D., Barricelli B.R., Borsci S., Markopoulos P., Papadopoulos G.A. (eds), End-User Development. IS-EUD 2021. Lecture Notes in Computer Science, vol 12724. Springer, Cham.

Alavi, G & Gilakjani, A. P. (2019). The Effectiveness of Games in Enhancing Vocabulary Learning among Iranian Third Grade High School Students.

Arnseth, H. C. & Ludvigsen, S. Approaching institutional contexts: systemic versus dialogic research in CSCL. *Computer Supported Learning* **1,** 167–185 (2006).

Arnseth, H.C., Hanghøj, T. & Silseth, K. (2018). Games as tools for dialogic teaching and learning.

Barab, S. & Squire, K. (2004) Design-Based Research: Putting a Stake in the Ground, The Journal of the Learning Sciences, 13:1, 1-14

Befring, E. (2015). *Forskningsmetoder i utdanningsvitenskap* (1st ed.) Cappelen Damm Akademisk.

Blown, E.J. & Bryce, T.G.K. Switching Between Everyday and Scientific Language. *Res Sci Educ* **47,** 621–653 (2017). https://doi.org/10.1007/s11165-016-9520-3

Braun, V. & Clarke, V. (2006) Using thematic analysis in psychology, Qualitative Research in Psychology, 3:2, 77-101, DOI: 10.1191/1478088706qp063oa

Braun, V. & Clarke, V. (2019) Reflecting on reflexive thematic analysis, Qualitative Research in Sport, Exercise and Health, 11:4, 589-597, DOI: 10.1080/2159676X.2019.1628806

Bryman, A. (2014). *Social research methods* (4th ed.) Oxford University Press.

Ludvigsen S., Arnseth H.C. (2017) Computer-Supported Collaborative Learning. In: Duval E., Sharples M., Sutherland R. (eds) Technology Enhanced Learning. Springer, Cham.

Dalland, O. (2013). Metode og oppgaveskriving (5th ed). Oslo: Gyldendal Akademisk.

Derry, S., Pea, R., Barron, B., Engle, R., Erickson, F., Goldman, R., & Hall, R., Koschmann, T., Lemke, J., Sherin, M. & Sherin, B. (2010). Conducting Video Research in the Learning Sciences: Guidance on Selection, Analysis, Technology, and Ethics. THE JOURNAL OF THE LEARNING SCIENCES. 19. 3-53.

Defining generic skills: At a glance. (2003) Australian National Training Authority

(NCVER). Retrieved from: https://www.ncver.edu.au/__data/assets/file/0020/4457/nr2102b.pdf

Ekaputra, G., Lim, C., & Kho, I.E. (2013). Minecraft: A Game as an Education and Scientific Learning Tool.

Engen, B. K., Giæver, T. H., & Mifsud, L. (2018). 'It's a Fairy Tale': Using Tablets for Creating Composite Texts. Journal of Interactive Learning Research, 29(3), 301-321.

Eielsen, C.B. (2020). Learning through play: Fostering domain knowledge and domain general skills through the use of Minecraft in three classrooms. Master thesis, Faculty of Educational Sciences, University of Oslo.

Erstad, O., Voogt. J. (2018) Curriculum in the 21st Century: Issues and challenges.

Lim, Y., T., Kenneth. (2020) Redstone Jammin': Conversational analysis from a collaborative music-making activity in Minecraft. Yesha Sivan (Editor.), *Journal of virtual worlds research.* (2020,13).

NOU 2015:8. *Fremtidens skole – Fornyelse av fag og kompetanser.* Department of Education. Retrieved from: https://www.regjeringen.no/no/dokumenter/nou-2015-8/id2417001/?ch=2

McLeod, S. A. (2018). *Lev Vygotsky*. Simply Psychology.

Mckenney, S. & Reeves, T. (2013). Educational Design Research. Handbook of Research on Educational Communications and Technology, pp 131-140.

Minecraft Education Edition 2021. Retrieved from: https://education.minecraft.net/en-us/discover/impact Accessed 03.06.2022

Minecraft Wiki (2022a). Game modes within Minecraft. Retrieved from: https://minecraft.fandom.com/wiki/Game_mode

Minecraft Wiki (2022b). About Minecraft education edition. Retrieved from: https://minecraft.fandom.com/wiki/Education_Edition Accessed 14.05.2022

Minecraft Wiki (2022c). Chunks. Retrieved from: https://minecraft.fandom.com/wiki/Chunk Accessed 20.04.2022

Minecraft Wiki (2022d). Biomes. Retrieved from: https://minecraft.fandom.com/wiki/Biome Accessed 20.04.2022

Minecraft Wiki (2022e). An example of community created projects, calculator. Retrieved from https://minecraft.fandom.com/wiki/Tutorials/Calculator Accessed 02.06.2022

Minecraft Wiki (2022f). Oak trees. Retrieved from https://minecraft.fandom.com/wiki/Oak Accessed 02.06.2022

Minocha, S.T., Minh & Reeves, A. (2010). Conducting empirical research in virtual worlds:

experiences from two projects in Second Life. Journal of Virtual Worlds Research, 3(1), pp. 3–21.

Mørch, A., Mifsud, L. & Eie, S. (2019). Developing a Model of Collaborative Learning With Minecraft for Social Studies Classrooms Using Role-play Theory and Practice.

Mørch, A., Eie, S. & Mifsud, L. (2018) Tradeoffs in Combining Domain-Specific and Generic skills' Practice in Minecraft in Social Studies in Teacher Education.

Nebel, S., Schneider, S. & Rey, G.D. (2016). Mining Learning and Crafting Scientific Experiments: A Literature Review on the Use of Minecraft in Education and Research. Educational Technology & Society. 19. 355-366.

Piirainen-Marsh, A. & Tainio, L. (2009). Other-Repetition as a Resource for Participation in the Activity of Playing a Video Game. The Modern Language Journal. 93. 153 - 169.

Seibt, S. & Kjelling, M. (2014). Problems and opportunities in students' scientific inquiry with Monoplant.

Sfard, A. (1998). On Two Metaphors for Learning and the Danger of Choosing Just One. Educational researcher. 27. 4. 10.2307/1176193.

Stahl, G., Koschmann, T., & Suthers, D. (2006). Computer-supported collaborative learning: An historical perspective. In R. K. Sawyer (Ed.), Cambridge handbook of the learning sciences (pp. 409-426). Cambridge, UK: Cambridge University Press.

Stahl, G. & Ludvigsen, S. & Law, N. & Cress, U. (2014). CSCL artifacts. International Journal of Computer-Supported Collaborative Learning. 9. 237-245. 10.1007/s11412-014-9200-0.

Sundqvist, P. (2016). Gaming and young language learners. In *The Routledge handbook of language learning and technology* (pp. 472-484). Routledge.

Säljö, R. (2000) Lärande i praktiken: Ett sociokulturellt perspektiv [Learning in Practice: A Socio-Cultural Perspective]. Norstedts, Stockholm.

Tabak, I., Kyza, A, E. (2018). Research on Scaffolding in the learning sciences: A Methodological Perspective. Frank Fischer, Cindy E. Hmelo-Silver, Susan R. Goldman, Peter Reimann (eds), *International Handbook of the Learning Sciences* (3), 191-200 Routledge.

Thorne, S. (2012). Thorne, S. L., Fischer, I., & Lu, X. (2012). The Semiotic Ecology and Linguistic Complexity of an Online Game World. ReCALL Journal, 24(3): 279-301.. ReCALL.

Tylén, K., Philipsen, S, J., Roepstorff, A., Fusaroli, R. (2016). Trails of meaning construction: Symbolic artifacts engage the social brain. *NeuroImage,* 134. P.105-112.

Van Der Veer, R. (1998), *From concept attainment to knowledge formation*, Mind, culture, and activity, Vol. 5, Taylor & Francis, pp. 89–94.

Verenikina, Irina M.: Vygotsky in Twenty-First-Century research 2010, 16-25. Retrieved from https://ro.uow.edu.au/edupapers/1022

Wendel, V., Göbel, S., Steinmetz, R. (2012). Game Mastering in Collaborative Multiplayer Serious Games. In: Göbel, S., Müller, W., Urban, B., Wiemeyer, J. (eds) E-Learning and Games for Training, Education, Health and Sports. Edutainment GameDays 2012 2012. Lecture Notes in Computer Science, vol 7516. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-33466-5_3

Wood, D., Bruner, J.S. & Ross, G. (1976), THE ROLE OF TUTORING IN PROBLEM SOLVING. Journal of Child Psychology and Psychiatry, 17: 89-100. https://doi.org/10.1111/j.1469-7610.1976.tb00381.x

Vygotsky, L. (1978). *Mind in Society.* Harvard University Press. Cambridge.

Vygotsky, L. (1934). *Thinking and Speech.* Retrieved from: https://www.marxists.org/archive/vygotsky/works/words/Thinking-and-Speech.pdf

Vygotsky, L. (1986). *Thought and Language*. Cambridge, MA: MIT Press.

UCL. (2022) Secondary data analysis. Retrieved from: https://ethics.grad.ucl.ac.uk/forms/Secondary-data-analysis-file-note.pdf

Udir. (2021). Hvorfor har vi fått nye læreplaner? Retrieved from: https://www.udir.no/laring-og-trivsel/lareplanverket/stotte/hvorfor-nye-lareplaner/

University of Oslo. (2020). *Minecraft in Teacher Education: Developing 21st Century skills in Social Studies (SMILE).* Retrieved from: https://www.uio.no/for-ansatte/arbeidsstotte/forskningsstotte/forskpro/prosjekter/uv/iped/minecraft-in-teacher-education-developing-21st-century-skills-in-social-studies/index.html

Wertsch, J. V. (1998), Mind as action, Oxford University Press, New York.