THE GAMIFIED LEARNING ENVIRONMENT - PEDAGOGICAL POSSIBILITIES AND PITFALLS

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ABSTRACT

Gamification can be a powerful educational tool, and has shown potential to increase student motivation and engagement. A large majority of today's children and youths spend hours focused on solving complex problems in the realm of digital games. The possibility of transferring that kind of flow into the educational sphere through gamification is intriguing. This research aimed to elucidate how students experience the gamified learning environment, and especially the possible connection between commercial gaming experience and the effect of using gamification in education. By conducting an iterative case study consisting of observation and interviews with ICT teachers and students participating in the gamified classroom system Heimdall's Quest, this study found that the gamified learning environment affects the student at three levels: the student, classroom level and society level. The specifics of these results can give valuable insight to other educators in developing and implementing gamification as a pedagogical and didactical tool for future ICT education.

1. INTRODUCTION

Motivation and engagement is a struggle in many classrooms and lecture halls, yet we know some students can spend hours in front of their games in high concentration. A survey conducted by the Norwegian Media Authority (NMA) in 2016 revealed that 96% of boys and 76% of girls between the ages of 9 through 16 years old play digital games (2016). The use of gamification in an educational setting is one possible way to utilize the powerful elements of digital games to enhance motivation and improve learning. Although, the gamified learning environment has formidable potential, it also has its pitfalls. A case study conducted during the spring of 2017 on a class of ICT vocational students with extensive gaming experience, examined the learning environment created by gamification, and the various implications related to motivation, learning and self-perception. This paper uses the findings from this Master's thesis project to enlighten some of these possibilities and explore some of the pitfalls found with the use of the Heimdall's Quest motivational system (Lorås, 2017).

2. THEORETICAL PERSPECTIVES

The fascinating world of games and learning is vast, and filled with important terminology, descriptive theories and informative research. The research inquiry underlying this study concerned two main topics: learning environments and gamification. Accordingly, this relates to the various elements of a well-functioning gamified learning environment, exemplified in this case by Heimdall's Quest, and what role commercial gaming experience may have. In the following section, definitions, theories and previous research on learning environments and gamification that are relevant to these topics will be presented and discussed.

2.1. Learning environments

Learning environments traditionally includes physical components, such as chairs, desks and computers, as well as psychological and social factors experienced by the students (Skaalvik & Skaalvik, 1996). In this paper, the focus is on the social, cultural and pedagogical components that surround the learner. In regards to these components, previous research has found that the students' experienced learning environment often affects their motivation, self-perception, sense of accomplishment and behavior (Skaalvik & Skaalvik, 1996). Motivation is defined as the extrinsic and intrinsic factors that drive a student to learn (Ryan & Deci, 2000; Schunk, 2008). Accomplishment and behavior are more or less self-

explanatory; however, self-perception needs further clarification. According to Skaalvik and Skaalvik, self-perception is defined as the awareness, assessment, expectation, belief and knowledge a person has towards him-/herself (1996). The students' self-perception is important because it often affects their expected achievement, which in turn affects motivation and behavior (Bandura via Skaalvik & Skaalvik, 1996). In other words, the students' self-perception and experiences in the learning environment are inevitably linked to each other.

The pedagogical components, on the other hand, relates to the learning theory or theories that creates a basis for the educational activities within the classroom. Various learning theories have been developed over the years, and they give a broad outline of different views on knowledge, learning, motivation and the role of the teacher. Behaviorism, cognitivism (cognitive constructivism), and constructivism (social constructivism) are the three main theories educators subscribe to, although more recently, new perspectives such as connectivism are gaining traction to (Schunk, 2008; Siemens, 2014). In this context, motivation and the role of the teacher are most interesting, although everything is connected. On the topic of motivation, the main difference apparent in these theories is the value and effect of extrinsic contra intrinsic motivation, where behaviorism is the only theory which relies solely on the former.

2.2. Games and gamification

To further understand gamification's effect on a learning environment, we need to understand games in general and what position games can have in people's lives. The discussion on games and gamification is divided into sections defined by context. Games at home concerns games in general, and what we know about students' gaming habits in the private sphere. Games in education discusses the various ways in which games are used for educational purposes, including gamification. Lastly, games as a technology have a position in society that becomes relevant when discussing gamification in a broader perspective.

2.2.1. Games at home

A game can be many things, and it can have many different mediums, however it is important to distinguish game from play (Ask, 2016; Deterding, Dixon, Khaled, & Nacke, 2011). A common way to separate the two concepts is by describing gaming as activities with defined rules and goals, whereas play has more freedom. According to game researcher Kristine Ask *gaming* is restricted to the interaction with and consumption of games, while *play* additionally includes the production of meaning, knowledge, culture and artifacts (2016). Ask emphasizes that play is hard work, and not always fun. Furthermore, playing a game involves more than just navigating through the steps of the game. A game in this situation refers to everything in the gaming spectrum from a board game to a computer game, to a game made up spontaneously by two children. However, in this paper the focus is on digital games, hereby understood as any form of game that uses a digital medium.

When studying people who play digital games there is a need to discuss gamer types, especially time spent on games and the relationship between the gamer and the game. It is common to distinguish gamers on a scale from hardcore to casual gamers (Ask, 2016). Hardcore gamers play a lot and put a great deal of personal meaning into the game, whereas casual gamers play more occasionally and thus have less personal investment in any particular game. This is a somewhat generalized description, bordering on stereotypes; however, it is relevant to understand that while different categories of players have distinctive gaming habits, they are all still considered gamers. The common factor here is enjoyment, and the two groups need different things in order to achieve that. It is a common misconception that people who "only" play Wordfeud and Candy Crush on their smartphones are not considered gamers. However, for this purpose anyone who semi-regularly plays any kind of digital game is considered a gamer. Additionally, the various gamer types take part in different cultures and play many different games. According to NMA the most popular game among Norwegian youths is Minecraft, regardless of gender (2016). Other than that, girls seem to play more simulation and puzzle games, and boys play more shooter, action and adventure games. A central part of any kind of gaming culture is talking about and socializing outside of the game, where the level of commitment directs the amount of participation and the various types of games create different kind of cultures.

2.2.2. Games in education

When it comes to the topic of using games in education, a distinction is often made between using games made specifically to teach a certain topic and games made commercially, solely for entertainment purposes (Deterding et al., 2011; Ready, 2016). Games designed for learning purposes are known as serious games, while pure entertainment games are referred to as commercial games. In addition to serious and commercial games, there is the notion of gamification, which is a relatively new concept in the education sphere. A study of the term gamification and its origin from 2011 proposed a definition of gamification as "the use of game design elements in non-game contexts" (Deterding et al., 2011, p. 11). In this definition, gamification is seen as individual parts, rather than an entire game, and as gaming rather than playing. These distinctions are important in order to separate gamification from regular games and toys.

Gamification as a concept and methodology also exists outside the realm of education, and can be both part of a larger game and a game in itself. The gamified system examined in this paper is Heimdall's Quest, which will be thoroughly presented and discussed in section 2.3; however, it is worth mentioning some other examples of gamification. In general, gamification can be found in various technologies and applications, often in the form of a level system or badges. The popular beer-tracking app Untappd for instance, gives you badges for trying many different beers or being social. This is an example of gamification because it uses the game element of giving recognition in the form of a badge, in the non-game context of drinking beer. In the educational sphere, variations of badges and levels are common, as well as individual competitive components such as Kahoot (Denny, 2013; Hamari, Koivisto, & Sarsa, 2014).

Research done one the effectiveness of gamification and the reasons behind conclude that gamification can indeed have a positive effect on behavior, motivation and attitude under certain circumstances (Hamari et al., 2014; Kapp, 2012). Hamari et al. found that the context being gamified and the quality of the users were of importance to the success of gamification. Additionally, the design of the gamification elements is important in the same way game design is essential for a commercial digital game (Gee, 2007; Kapp, 2012). Consequently, gamification has received some criticism, mainly related to the use of competition, behavioristic fundamental and the commercial exploitation (Bouça, 2012; Kapp, 2012).

2.2.3. Games in society

The public debate on digital games and education tends to be very positive or very negative. Either digital games are the end of organized education, or games will be the revolutionizing technology that saves the modern educational system. This kind of polarized public debate about a technology is an example of technological determinism. Technological determinism is one theory explaining the role of technology in society, highly criticized by academics, but very common in politics and media (Ask, 2016; Chandler, 2012; Sørensen, 2006). Technological determinism describes technology as a driving factor of society, and that technological development is pre-determined and cannot be affected by any other circumstances (Berg, 1998; Sørensen, 2006). This perspective on technology is problematic because it does not consider how people interact with technology and how technology's role in society affects that same technology. The theory of domestication counteracts technological determinism by considering the integration of technology into everyday life (Berg, 1998; Sørensen, 2006). The pessimism and optimism that characterizes this debate on the use of games in education is a sign of determinism. For the younger generation, games are becoming a culturally and practically integrated part of their daily lives; however, the educational system has not yet domesticated games.

When discussing everyday life, culture is central. Today's culture is in a great many ways very different than it was a century ago, among other things when it comes to the *ludification of culture* or culture of play. According to several games and technology researchers, games have become a cultural medium and a source of formative experiences, in the same way literature, movies and television have been for previous generations (Ask, 2016; Deterding et al., 2011; Raessens, 2006; Zimmermann, 2015). Gaming has become a phenomenon of cultural importance, and technologies such as smartphones and the internet are generating playful identities (Raessens, 2006). The 21st century is being called "the ludic age", the same way the 20th century was "the information age" (Zimmermann, 2015). Concurrently, Ask

emphasizes that the notion of play and games is not something newly created; it is the renewed interest and re-evaluation we are seeing now that is important. However, as we have seen earlier, society does not yet fully recognize and value games as a medium in the same way as Ask, Raessens, Zimmerman and Deterding et al. does.

2.3. Heimdall's Quest

Heimdall's Quest (hereby referred to as HQ) is a gamified classroom system developed by teachers at Heimdal Upper Secondary School in 2013 to stimulate student motivation, responsibility and participation in school. HQ creates a gamified school environment where students, among other things, experience increased motivation, higher attendance and positively modified behavior (Ready, 2016).

The HQ game takes place in a Norse universe where the teachers are Gods and the students are mortals. As Gods, the teachers have universal powers, and act as game masters. The most basic rules of the game are that players are always playing, and all players must respect decisions made by the Gods. In practice, this means that the game is always "on", and the teacher can use it in any way he or she sees fit. This provides the teacher with various pedagogical possibilities to activate, motivate and customize the education. The goal of the game for the student is simply to reach the highest level possible, and the game is never actually won by anyone (much like commercial online role-playing games).

The complex system of gaining and losing points and using powers ensures the students' curiosity and engagement. This system of gaining, losing and using different types of points are similar to most role-playing games. In HQ, every activity or action by a student results in an action in the game. Positive behavior such as punctuality, academic improvement and cooperation will result in receiving points, which the students can use to gain rewards. Negative behavior such as absence without leave or coming late, eating in the classroom or playing other games in class decreases the students' points in the game, ultimately resulting in "death" with a subsequent "death penalty".

In the beginning of the school year, the students are divided into groups, which lasts the entire year. Within these groups, all the students must create a character in the game from a certain class, and create a nickname (often inspired by Norse mythology, or their regular gaming name). There are four classes to choose from: Viking, Narr, Seid and Druwid. The different classes are assigned their own strengths and weaknesses, so the group as a whole need to consider which classes each student chooses. Each class has a power tree containing powers only that class can achieve. In addition, players can choose to buy powers within six different professions, which all give associated freedoms such as drinking and eating in the classroom or being able to listen to music during class. In short, the students develop a complex character over the course of the school year. Each player has some powers linked to their class, and some they can choose individually. The main difference between powers obtained through class and profession, is that class powers involve game mechanics such as points, whereas profession powers only concern classroom freedoms. This means that class abilities are focused on progression, while professions are more about individually based freedoms in class.

2.3.1. How HQ is used

In some schools, HQ is used in all subjects, and is therefore in play throughout the school day, but it is also possible to use it only in one specific subject. The game is in no way used to assess academic performance and grading (since the Norwegian educational law prohibits grading students based on effort), however, there has been shown a possible correlation between performance in the game and grades (Ready, 2016). In the class examined in this study, teachers and students use HQ throughout the entire school day. A typical day starts with giving attendance points to all students who are present and giving damage points to those who are late. Often, the school day consists of teacher instruction and project work in groups. During instruction, the teacher can give points to students who participate in class discussion, or who ask questions and give responses. With group work, the whole group can earn points by doing well or working efficiently. The teacher as a God is free to give out points and damages to encourage participation or discourage bad behavior. Throughout the day, students who break the classroom rules can be assigned damages. For instance, if a student is caught playing a computer game in class without activation of the gaming power, he or she will receive a damage of minus 12 points. This is

all done through a web application, for instance a teacher who observes behavior that may break the rules; he or she can check the web application to see if the student has activated that specific power. During the course of the school year the teachers use various approaches to gamify teaching activities with HQ. One example is giving out points to students who volunteer for presentations, leading groups or extra credit work, which after the first event has an effect on the engagement in the next. A different example is how some teachers give students with concentration issues powers to take breaks as needed.

3. THE RESEARCH PROCESS

The design of this research project was based on a constructivist research paradigm, where ontology and epistemology are intertwined. Within this understanding, reality is alterable and relative, and the acquisition of knowledge comes from interaction. Following this view the qualitative research approach is a natural choice when exploring student experiences in a gamified learning environment. A different approach could have been to conduct a qualitative survey, however, since the aim of this study was to gain insight into students' interactions, views, beliefs and values, as well as their behavior and motivation, a qualitative approach was more suitable (Corbin & Strauss, 2014; Guba & Lincoln, 1994; Robson, 2002). Within the qualitative direction however, there are many design possibilities and this project was structured as a case study with a grounded theory based analysis. In the following, this terminology will be explained, the choice of data collection methods justified and the process of collecting and analyzing data described in detail.

According to Robert Yin and his research on the use of case studies, the case study methodology is a good way to describe, explain or explore a "contemporary phenomenon in depth and within its real-life context " (Yin, 2009, p. 18). The contemporary phenomenon in this study is the use of gamification. The context is mainly the school environment; however, the home environment is also of importance. Furthermore, Yin's definition requires a case study to be bound in time and space, and that the research is conducted in a naturalistic setting (Robson, 2002). In this situation, the study was conducted within a short time frame (four months), and within the same group of students in their regular school environment. Specifically, a class of upper secondary students in a ICT vocational school.

Additionally, Yin emphasizes that case study research is an iterative process, where the researcher should base decisions on what needs to be done during the research process on the various steps of the research. Following the nature of the iterative process, review and reflection was done at each step of the data collection, and some form of either interpretation and/or analysis was completed before continuing. At each step, the work and plans were assessed in light of the research inquiry, which included continuously revising and adjusting the questions.

3.1. Data collection

The research inquiry consisted of two dimensions: *the gamified learning environment* and *students' commercial gaming experience*. In order to gain insight into the *students' commercial experience* dimension, interviews with students was chosen as the data collection method. The students are the only direct source of information about their habits, beliefs and experiences. Considering that these were young people and strangers to the researcher, extensive participatory observation was also done, in order to build a relationship of trust with the interviewees. In addition, this allowed the participant selection to be based on acquired knowledge about each student from this observation. For the second part, *the gamified learning environment*, interviewing teachers in addition to the student interviews was chosen. According to the iterative nature of the research design, teacher interviews were scheduled at a later time than the student interviews, so that the initial findings could be used in the development of interview guides.

3.1.1. Observation

Unlike formal structured observation, where the researcher deliberately does not interact with the situation, informal participatory observation is defined as observation of a situation where the researcher participates in the activity (Robson, 2002). Since the main goal of the observation was to establish a relationship of trust with the students, informal participatory observation was the natural choice. In

addition, because of the researcher's previous work at this particular school and the established relationship with the teachers, the researcher was able to participate in a natural, accepted way. A total of three days observing was completed, during which the researcher alternated between walking around the class, sitting in different areas of the classroom and talking to all the students, continually making notes.

3.1.2. Interviews

In the research context, interviews are commonly categorized into structured, semi-structured and unstructured interviews (Robson, 2002). For both student and teacher interviews semi-structured interviews was the preferred method. A set of topics and questions had been drawn up beforehand, however, the flow of the conversation determined the order of the interview. When preparing the interview guide, topics and questions were based on the research inquiry. The teacher interviews followed the same structure, however, initial findings from the student interviews were presented and discussed as well. The teachers were emailed the questions and a summary of the findings beforehand in order to give them some time to consider their responses (Robson, 2002).

The interviews were audiotaped, in order for the researcher to have the freedom to listen and participate in the conversation. These audio recordings were anonymized and transcribed shortly after the interviews were conducted. The study followed the ethical guidelines of research in education and was approved by the Norwegian Centre for Research Data.

3.2. Method of analysis

The method of analysis in the research project was based on the grounded theory methodology. Grounded theory is an established inductive research approach where theory is constructed though systematic analysis of data (Corbin & Strauss, 2014). It is important to clarify that grounded theory can be both a research paradigm of its own, and a method of analysis (Postholm, 2010). In this project, grounded theory was used as a method to analyze the data, rather than an underlying ideology. The aim of a grounded theory analysis is to generate theoretical ideas, explanations and understandings from the collected data (Corbin & Strauss, 2014; Robson, 2002). There are two main orientations within grounded theory, developed by Glaser & Strauss in 1967 and Corbin & Strauss in 1994 (Corbin & Strauss, 2014). These orientations disagree on the role of previous knowledge, where Corbin & Strauss argue the "need to build theory from concepts derived, developed, and integrated based on actual data" (2014, p. 6). In other words, there is room for including existing theories and the researcher's knowledge in the analysis process, which was considered most suitable for this project.

The reason this approach was chosen, was partly because the nature of this study was to find new connections between known phenomena. In addition, grounded theory is advantageous when analyzing several data sources, in comparison to a phenomenological approach. Lastly, Corbin & Strauss have developed a structured and reliable process that is consistent and manageable to implement, which in turn validates the qualitative research methodology (Shenton, 2004; Yin, 2009). This analysis is subsequently based on doing constant comparisons in three phases, thus creating codes and categories which in turn can be theorized (Corbin & Strauss, 2014; Robson, 2002). The three phases are referred to as open, axial and selective coding.

3.2.1. Open, axial and selective coding

The goal of open coding is to find codes and categories which summarizes the data in a satisfactory way (Corbin & Strauss, 2014). Codes are concepts that stand to meaning, and categories are a collection of codes that closely relate or depend on each other. After three rounds of reading and coding the transcripts, a large set of labels and abstractions had been collected, which in turn were organized using the qualitative data analysis program NVivo. For student interviews, all codes that were in relation to the research question were added. This process reduced the amount of data substantially. For teacher interviews, the existing codes were used as a basis. This confirmed and enlightened the codes already found. However, not all codes from the teacher interviews fit within the existing codes, and in those cases, new ones were created.

A hierarchy of NVivo-codes were used to categorize these codes. After careful review and editing, there were 53 codes to be categorized. NVivo is a powerful tool, and it is important to not rely on the software to do the analysis (Robson, 2002). In order to maintain this, a system of post-it notes was utilized to categorize the codes. Each code was written down on a post-it, by comparing each note to the others and placing them on a table at suitable distances following that comparison, a system of clusters emerged. This phase of the analysis process was directed by the iterative nature of the research design, in the way codes and categories were constantly revisited and reviewed. In the end, the codes clustered into nine categories as shown in Figure 1.

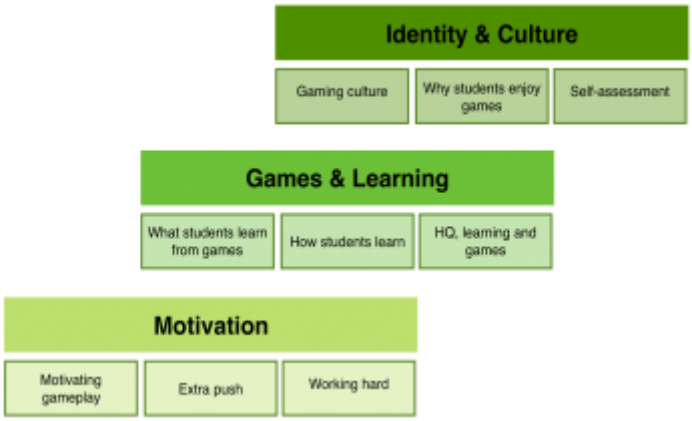

Figure 1: Final theme with underlying categories.

After the open coding phase was saturated for each of the steps, the axial coding phase begun (Corbin & Strauss, 2014). During this the researcher explored the relationships between the categories, making connections and hierarches (Corbin & Strauss, 2014). After the open coding of the interviews, the clusters of post-its illustrated a clear hierarchy between categories, which have been given the name themes. The themes were *motivation, games and learning* and *identity and culture* (also evident in Figure 1).

With the final themes identified, it was time to do selective coding. The purpose of selective coding is to identify central codes (Corbin & Strauss, 2014; Postholm, 2010; Robson, 2002). By abstracting and summarizing the data, the researcher can isolate the essential findings. The themes identified during axial coding summarized three important dimensions in the students' and teachers' descriptions of the gamified learning environment. In order to examine how these themes related to the research inquiry, the themes were examined in light of concepts, theories and previous research. This revealed a model of the gamified learning environment describing the students' experiences in different situations and levels as illustrated in Table 1.

Level		**Theme**	**Situations being affected**
1	Student level	Motivation	The motivating gameplay
2	Classroom level	Games and learning	The gamified classroom
3	Society level	Identity and culture	The students position in society

Table 1: Relation between themes and model.

3.3. Validity and reliability

Validity and reliability are terms used to describe the quality of a research project. Within qualitative research the description, interpretation and theory of the data collection and analysis are the main threats (Robson, 2002). In order to ensure validation of the data collection process (description) this study used the techniques of prolonged involvement over several months, triangulation of different data sources and member checking by allowing the interviewees to read and comment their interviews. Validating the process of analysis (interpretation) in this study, involved discussing the results with the teacher participants to ensure believable and trustworthy findings. Nevertheless, as Corbin and Strauss emphasizes, these findings provide one of many possible plausible interpretations of the data (2014). There will always be some researcher bias present during analysis. The researcher's experience, beliefs and views will color the perception of the data. This is also an important aspect of reliability (theory).

Therefore, to counteract this, the research process has been thoroughly documented in this paper, and a description of ontological, epistemological and methodological views has been given. In regard to the amount of data collected, this study was guided by the need to collect information from a set of persons representing various groups of students, and after observation five students and two teachers seemed sufficient for this need.

4. RESULTS AND ANALYSIS

By following the methodology previously described, three central themes were found that enlightened the overall research inquiry, which in turn produced a model of the gamified learning environment. In this section, these results will be described and exemplified further.

The participants in this study consisted of a ICT vocational class of students and their teachers, where five students and two teachers were selected for interviews. As Tables 2 and 3 indicates, both what kind of games played and time committed to gaming varied, however; all participants had extensive experience with playing commercial games even though they did not currently play games that often.

Student	**HQ points**	**HQ character**	**Current games**	**Average time spent on gaming per week in hours**
Mikkel	24625	Narr	Minecraft	2
Hans	29821	Seid	World of Warcraft	40
Arne	23226	Viking	GTA, Battlefield	5-50
Tore	16000	Seid	Counter Strike	50
Richard	18276	Seid	Counter Strike, League of Legends	10-20

Table 2: Summary of student attributes.

Teacher	**Years as a teacher**	**Gaming experience**	**Remarks**
Peter	16	Regards himself as a gamer, and has been playing all kinds of computer games his whole life. Games as much as he has time for, wishes he had time for more.	Has been involved in the development of HQ and is the contact teacher for this class.
Truls	3	Regards himself as a gamer, and has been playing all kinds of computer games his whole life. Permits himself to game as a reward, avoids very time-consuming and demanding games.	Was a student of Peter himself, and has experience with the level system (HQ predecessor).

Table 3: Summary of teacher attributes.

4.1. Motivation

The motivation theme concerns all references, direct and indirect, regarding the use of games and gamification as motivating. This theme includes three categories; motivating gameplay, working hard and extra push.

Motivating gameplay includes all descriptions of the HQ gameplay being motivating, inspiring and encouraging. Gameplay in this context refers to the different game elements of HQ, and this category concerns the way students seemed to be positively affected by the elements alone. Some of the students

talked about their characters, powers and game events with great enthusiasm, and it is striking to see how engaged the students became in everyday activities such as eating and drinking.

> *"Yes, I have food. Ehh. I can eat for one hour if I use 10 mana. Also, I have drink. For drink I have endless, so I can drink as much as I want. Also, I have music, where I can, let me check… I can listen to music for 35 minutes for 5 mana. And I have toast, and horn. For those I can bring either one of my group members, so they also can drink for half an hour, or everyone can drink for a half hour."* *Arne*

The second category within the motivation theme is the extra push. The extra push terminology is used in the context of the HQ gameplay and arises from the element of competition. An example of the former is Tore's depiction of how gaining XP (experience points) works as an extra push:

> *"Let's say there is 1000 XP to finish this assignment. Like, I want that XP. Also, I want to finish the assignment. So, at least I get it finished."* *Tore*

The third category within the motivation theme is the students' descriptions of the inclination to work harder for some reason relating to HQ. This differs from the extra push category in regard to the inner-outer perspective. Where an extra push acts as an outer force, the inclination to work hard is something that comes from within. The difference is subtle, but as discussed later, this inner-outer perspective is theoretically justified. Hans, for instance, talked about how HQ made him work more than usual.

> *"We kinda do more assignments than we would regularly do if we did not have something to motivate us. Because, the more we do, the more points we get. And the more points we get, the more powers we get, that gives us more freedoms."* *Hans*

4.2. Games and learning

The games and learning theme concerns all descriptions of how students view their own learning, regarding both HQ and games in general. When discussing the connection between games and learning during interviews, we touched upon both learning in general, the educational aspects of commercial games and the gamification of HQ. This theme includes three categories; how students learn, what students learn from games and HQ, games and learning.

The first category in the games and learning theme contains descriptions of how the students learn, including their own learning patterns and how they think they learn best. The most prominent view in this case was that the students are different, and learn in different ways. When asked to describe how they learn best the students mentioned theoretical, practical and relevant learning activities, as well as combinations. Richard's description is very representative:

> *"I'm more, like, practical. I learn best by doing things. But if he [the teacher] does not explain it to us first, I don't stand a chance to get it. It's way too advanced to just test it out, and figure it out. So, he has to explain it to us first, then we can test it ourselves."* *Richard*

The second category in the games and learning theme concerns reflections on what students can learn from games in general. This includes both specific facts, topics as well as various skills. When asked what they learn from playing commercial games, some students focused on factual aspects of computers, knowledge about different cultures and historic events or improved English proficiency. Hans reflected on how different war games had taught him some useful knowledge in social science and history.

> *"There are some things in school, like social sciences and history. I have learned a lot about World War II by playing games from that time. I learned a lot… and it's also helpful in school."* *Hans*

The third category in the games and learning theme concerns student descriptions of their experience with HQ, including their opinions on the game and how it affects their learning. Their overall opinion was positive, although there were some negative statements regarding how HQ was implemented. The students described the presence of HQ as fun, engaging and a way to make the school day more enjoyable. The way some students compared school with HQ to previous school experiences without HQ is remarkable.

> *"You learn a little more. At least more than regular school."* *Hans*

> *"I would say that I learn more by using it [HQ]. Like, at least compared to previous school years, there I've had problems with certain assignments."* *Mikkel*

4.3. Identity and culture

The identity and culture theme concerns references to students' identity as gamers, including their self-assessment as to why they like to play games and their position in the gaming culture. This theme differs slightly from the other themes because many of the categories described earlier, appear here as well. For instance, the social aspect recurs in many categories, and self-assessments closely relate to aforementioned categories. The theme includes three categories: self-assessment, why students enjoy games and gaming culture.

The first category within the identity and culture theme is the students' self-assessment of their gaming habits, learning and behavior. Notably, they all play games regularly, and some quite a lot of time. For some of the students, gaming is a major interest, while for others it is just a pastime activity or hobby. In addition, they state that they have played different games in the past, and most of them say they used to play more before. Consequently, when asked about their own gaming habits, they were quick to start comparing themselves to others. It could be a subtle statement, like Arne's:

> *"I haven't played that many games myself."* *Arne*

Or a more direct description such as Richard's:

> *"And if I master a game, then I want to keep on playing. But I'm not like the rest of the class. They play like 20 times as much as I do."* *Richard*

The second category within the identity and culture theme concern the students' reasoning for why they enjoy gaming. The most prominent reported motive for playing games is because it is fun. Hans summarized this well:

> *"Well, it's fun to play games because… you have the competitive aspect, that you want to get better and better. Like, you get powers. And it gets easier with reaction time and stuff. Also, you have the story, like, games have so many good stories. So much lore and stuff like that. So, because of that it is fun and interesting to see so many different stories. And you have games where you just walk around and have fun. Have fun finishing stuff, or just… yeah, walk through different worlds that people have created. Look at their creativity."* *Hans*

The third category in the identity and culture theme is gaming culture, which includes descriptions concerning the students' role in gaming as a modern culture and the effect that has on the teachers and the educational environment. Truls gives an example of this:

> *"There has not been a lot of gaming, except when we sometimes talk about and connect stuff we are working on to a game, by connecting it to group accomplishments and team work."*
>
> *Truls*

4.4. Model of a gamified learning environment

The analysis of these themes led to the development of a model of the gamified learning environment. The different themes describe situations at different levels of the students' school experience. The model and the way these situations interact is illustrated in Figure 2. In the center, you have the gamified classroom. This environment is on one side affected by the motivation of the student. On the other side, it is affected by society, and how the student views him/herself in the world. The motivation theme describes the student level, and how the students' motivation is affected by the playful and competitive elements of gamification. The motivation of the student is at the student level because motivation is something that exists within the student. The identity and culture theme describes the students' position in the gaming culture, and the importance of identity and self-worth. The identity and culture theme is at a different level, because it is about how the student relates to the rest of the world, at society level. The games and learning theme describes the gamified classroom, how the students learn in school, in games and in this classroom.

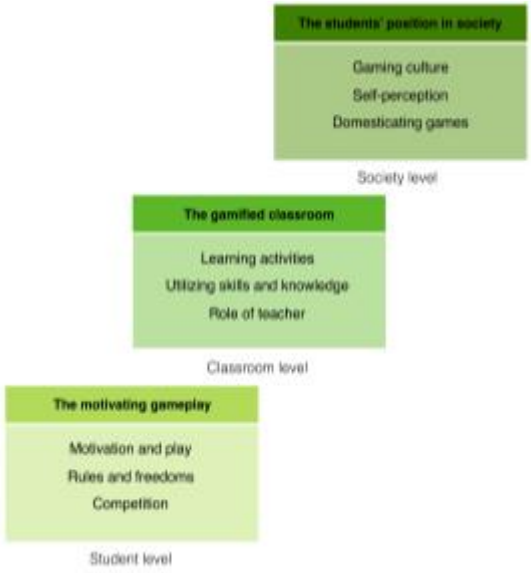

Figure 2: Model of the gamified learning environment.

4.4.1. Limitations

The development of this model is based on one case study, with a relatively small number of participants, and needs further validation. Future work should examine different gamified learning environments, and explore the model further. However, within the qualitative approach the findings from a single case study is still valuable because it gives insight into that specific case, which can be valuable to other researchers and educators. Nevertheless, this study has some limitations regarding student demographics. There were no female participants, which is unfortunately somewhat representative for the ICT sector. Although, it would have been beneficial to have both genders present in this study, this was not possible considering the class participating did not have any. In addition, the topic of gender in relation to games is a widely discussed topic, demanding its own research focus.

5. DISCUSSION

The gamified learning environment is complex, and involves many dimensions. The focus if this paper is the pedagogical possibilities and pitfalls this study found. In that regard, the most noteworthy findings involve the relationship between motivation and play, the aspect of competition, the learning activities implemented and the impact the gamified learning environment can have on the students' self-perception as shown below:

- **Possibilities**: Learning activities, Self-perception
- **Pitfalls**: Motivation and play, The aspect of competition

5.1. Pedagogical possibilities

5.1.1. Learning activities

The various learning activities that constitutes a gamified classroom are the parts of the non-game context that are gamified by using HQ. Previous research on why gamification is effective revealed the importance of context, user quality and attitudes towards learning (Hamari et al., 2014; Kapp, 2012). These findings indicate that the students greatly appreciate that the context of school is gamified, and that it positively influences their attitude towards learning.

The findings from this study on the success of the various learning activities fits with most of James Paul Gee's summarized learning principles found in good games (2007). The way the students develop their characters with powers is a contributing factor to building strong identities, which is an important aspect of what Gee characterizes as "real learning" though games. In addition, the rules of HQ create a world within the school where the players (i.e. students and teachers) interact, where students are producers, rather than just consumers. Furthermore, customizing activities to fit the students' individual learning style is an important principle in HQ, and may have great pedagogical potential. In the class studied, the teachers used the powers system extensively, which allowed students to choose freedoms that fit their learning style. Additionally, teachers can potentially customize further by adding individual freedoms.

In the cases where HQ alone does not fulfill Gee's learning principals, the notion of context and user quality becomes essential. These learning principals are as follows: thinking in scientific cycles, lowering the consequences of failure and building skills to solve difficult problems. These are all achievable in HQ, but it depends on how the teachers use the game. Since the teachers and students largely create the narrative of the game, thinking in scientific cycles does not happen by default. However, the way the teacher structures the game can induce this. For example, the teachers can award points for completing steps throughout a project, rather than only upon completion of a project. The same can be said for building skills to solve difficult or complicated problems. An example of this for these particular students is that their biggest challenge is often the single, verbal exam covering the entire curriculum that is given at the end of the school year, for which the students are prepared iteratively throughout the year. Similarly, the teacher can lower the consequence of failure by allowing students a second chance at certain tasks.

5.1.2. Self-perception

Some of the most significant and important results from these findings is that a gamified learning environment recognizes and assigns value to the students' interest in gaming, and by extension improves their self-perception and identity as a gamer. The fact that the entire school day is gamified using concepts and terminology the students use in their activities outside of school, creates a familiar and safe learning environment where the student' can develop their identities without judgement and in turn build a positive self-perception. Research has shown that self-perception affects motivation and behavior (Skaalvik & Skaalvik, 1996), and considering that a gamified learning environment can improve these elements for many students, gaming experience can be considered significant in the sense that students with gaming experience may perform better in a gamified learning environment.

On the other hand, we must consider the opposite situation as well. This research cannot directly say anything about how a gamified learning environment may affect students with little or no commercial gaming experience; however, the assessment is that it should not be harmful as long as playfulness and repetition is in focus. Additionally, considering that the number of children who play games regularly is increasing, this may not be a problem in the future.

5.2. Possible pedagogical pitfalls

5.2.1. Motivation and play

The overall increased motivation found in this study is not surprising, considering the previous research on gamification done by Hamari et al., Kapp and Ready (2014; 2012; 2016). This analysis of the HQ learning environment revealed two driving forces of motivation: working hard and the extra push. The difference between the *extra push* category and the *work hard* category lies in the inner-outer perspective. This can be explained by intrinsic and extrinsic motivation, respectively (Ryan & Deci, 2000). The extra push described by the students, is an outer factor and can therefore be seen as extrinsic motivation. Likewise, the work hard category describes an inner drive as in intrinsic motivation.

These categorizations describe the motivational drive; however, it is interesting to examine the driving force and the desired goal surrounding these descriptions. The driving force behind both is the different parts of the HQ gameplay. The game mechanics involving receiving points and damage lead to extrinsic motivators, resulting in an extra push. On the other hand, game elements such as character powers and

professions, group dynamics, desire to progress, levels and competitions seem to cause intrinsic motivations. Consequently, the intrinsic gameplay elements are driven by the complex points system, and could not exist without it. Therefore, the extrinsic motivators in one way cause the intrinsic motivators. In other words, the whole gameplay design creates several "paths" towards a motivated student. Some students are motivated by the intrinsic aspects such as the groups and the characters alone, while others need an extra push to enter the flow of intrinsic motivation.

However, the use of extrinsic motivators is a controversial tool and is by many educators considered outdated (Ryan & Deci, 2000). Thus, the motivational aspect of a gamified learning environment may be a pedagogical pitfall, but these findings suggest play is important in this regard. The difference between gaming and playing becomes apparent when you compare the two categories to each other. Using Ask's definitions, the *extra push* category describes gaming, while the *working hard* category describes play (Ask, 2016). The students who focus on the freedoms and possibilities of the HQ-gameplay, rather than just the points, are playing the game because they put more meaning in the game than just navigating through the steps. This playfulness is essential in the effort to fight the possible negative effects of extrinsic motivations. This research indicates that introducing playfulness to the points system can influence the students to apply meaning to the points, and thus shift the motivational drive from extrinsic to intrinsic.

5.2.2. The aspect of competition

Competition is an important aspect of the HQ gameplay, however, competition in the classroom can be seen as a controversial motivator. Whenever there is a competition, there will often be a winner and inevitably be a loser. The findings of this study indicated that the students responded positively to the competitive nature of HQ. Concurrently, the students in this study are gamers, and the results imply that students' commercial gaming experience might be significant in relation to the effect of competitions. The students are used to being in a competitive environment, which might influence their experience in the classroom. In a sense, the students are used to winning and losing, and therefore are not necessarily negatively affected by the latter. On the other hand, research suggests that the playful nature of games is significant. If the students view HQ competitions as play, the consequence of failure is lowered, and thus the possible negative effects of losing. Either way, the competitive nature of a gamified learning environment may be a pitfall and needs extra attention from the educator.

5.3. Generalizability and applicability

The gamified system examined in this study was Heimdall's Quest; however, there are various other gamification systems and tools available to educators. To what extent these findings are applicable to other gamification systems, could be a question of how the results might be applied in those settings. HQ is a complex system developed for students with low motivation and attendance problems, and using the system in other contexts could provide different challenges. These findings suggest that the way the teacher implements the various gamification elements is important; additionally, that this is transferrable to other contexts. For example, using HQ in classes with high performing students struggling with stress and/or feelings of pressure might require modifying the system to be less competitive. A different example of context is the composition of students in a class. In this case, the class consisted entirely of male students with extensive gaming experience, and these results cannot conclusively say anything about how HQ might work in a classroom full of non-gamer girls. However, the findings on the students' perceived position in society, seen in connection with the rising number of male and female gamers, suggest that these results will become more generalizable with time.

In the end, it can all come down to what we define as success. In the case of HQ, the goal was to increase motivation and effort in a group of students with great personal potential. Using HQ or any other form of gamification in a different group and with the same goals would not necessarily provide the same positive results. However, the perception after this study was that the success of a gamified learning environment is not exclusively linked to increased motivation and learning outcomes, it is also about the needs of the students. These findings suggest that gamification can be an effective way to teach students how to take more responsibility for their own learning and for the teacher to meet them on their own level; gamification can additionally be an effective tool for preparing students for a more highly digitalized

future. In summary, the gamification baseline of HQ, and the overall findings of this study, can be transferrable, especially if the gamified elements are customized and adapted to the individual student's skills, knowledge and needs. In other words, there are many pedagogical possibilities, but also pitfalls.

5.3.1. Future research

This paper provides an overview of different aspects of a gamified learning environment. Each level of this environment can be studied in more depth to verify the findings in various contexts, in order to learn more about why these features may be effective. An interesting aspect on the student level where this data does not provide sufficient grounds for drawing conclusions, is the connection between playfulness and commercial gaming experience. Perhaps the students who play role-playing and adventurous games, may have a greater ability to impose meaning and culture around the gamified elements, than those students who play first person shooter games (or no games at all). On the classroom level, the effect gamification can have on group dynamics, and how that can be implemented, is an aspect that is worth further research. The advantage of avatars in the development of the students' self-perception and identity is also an interesting aspect for more study on the society level.

Additionally, more research is needed on the effect of a gamified learning environment in different contexts. For instance, looking at students in different age or gender groups would be interesting areas for further study. Especially the aspect of behavior modification, which is an important part of the educational system in lower grades, is another interesting dimension of gamification. Furthermore, examining how a gamified system functions in a class consisting of different gamer types, or non-gamers, or combinations thereof, could also provide some much-needed information.

6. CONCLUSION

By observing and interviewing students and teachers using the gamified system Heimdall's Quest, this study has examined how gamification affects the students' experienced learning environment. The research indicates that in order for extrinsic motivation and competitive features to have a positive effect, playfulness and repetition is important. Furthermore, the teacher has great importance in the development and implementation of effective gamified learning activities, where students are able to utilize their skills and knowledge from commercial gaming and take responsibility for their own learning. Lastly, the gamified classroom provides a learning environment where the students' gaming experience is valued, which can improve their self-perception. However, gamification is not a "quick fix" to any educational problem and has some pedagogical pitfalls. Those same pitfalls may be turned into possibilities with preparation and a creative approach.

In a time where more and more children as well as adults spend their time in adventurous universes, fighting monsters, meeting challenges, solving problems and winning battles, the educational system can harness these kinds of approaches in positive ways, in order to further motivate and teach students the skills and knowledge they need for an increasingly digitalized future. By using the powerful tool of gamification, the teacher has the opportunity to engage students in the wonderful world of learning.

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