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Using game elements to increase students' motivation for providing peer assistance

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Abstract

Peer assistance is a support system where people of equal status help each other solve problems. It is also a recognized method within education where students support each other with their assignments. The positive effect of peer assistance is well known, and it would be favorable if more students participated and took on the role as peer-teachers. To increase the activity of peer assistance, several incentives can be used, including game elements. In "Using game elements to increase peer assistance among university students", (Nordengen & Brinch, 2016, p. 1) tried to predict which game elements would provide the best solution in a peer assistance application. By introducing game elements in a mobile application designed to facilitate peer assistance, and measuring the changes in peer assistance frequency, this thesis has made an attempt to validate this prediction. In the course of this study, there was a significant increase in peer assistance among the participants, but the only probable cause found for this increase is the added focus this study has put on peer assistance itself. To uncover other causal relationships, further studies are required.

Keywords
peer assistance, game elements, gamification, motivation, mobile application, 21st century skills

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FOREWORD

This thesis was written by Jostein Nordengen (jostein.nordengen@uia.no) and Sigurd Brinch (sigurd.k.brinch@uia.no), to be delivered as our Master Thesis in the Multimedia and Educational Technology Master's Programme at the University of Agder.

The field study is registered with Norwegian Centre for Research Data (NSD) and has been approved with regards to "personopplysningsloven §31". The registered project is: 52656 - Effects from gamifying peer assistance.

We would like to thank or supervisors Assistant Professor Rune Andersen and Assistant Professor Christian Robere Simonsen at the University of Agder for good help during the writing of the thesis. We would also like to thank the second-year students at the Multimedia Technology and -design bachelor program at the University of Agder for participating in the field study related to the thesis.

Jostein Nordengen and Sigurd Brinch

1 INTRODUCTION

This Master thesis is the culmination of 2.5 years of intensive work, following the Master programme Multimedia and Educational technology at the University of Agder. In this master study, there is a lot of focus on different learning theories and game mechanics. The students are introduced to and exposed to several styles of pedagogy, where social constructivism, connectivism and 21st century skills play a central part. Being a part of this environment unveiled an untapped potential for increased learning in the student body of the university. The idea was, that it should be possible to create an arena where students could ask for and receive help from each other, while at the same time keep both the givers and receivers engaged and active, it should be possible to tap into this resource. In an article produced as part of this study (Nordengen & Brinch, 2016, p. 1) predicted that a "combination of pervasive gaming, teams and communities, and PBLs stand out as the most promising solution". This thesis attempts to verify this prediction by performing further literature studies and a field study. The thesis deals with motivational and pedagogical aspects of peer assistance, and the goal was to find results that could be used as a basis for implementing more effective systems for peer assistance. Both a quantitative and a qualitative survey was carried out in the attempt to answer the research questions. In addition, a mobile app was developed to be used as a tool in the surveys.

1.1 HYPOTHESIS AND RESEARCH QUESTIONS

Based on previous work by (Nordengen & Brinch, 2016), the starting hypothesis is that the introduction of game elements will increase a student's motivation for providing peer assistance. This work was a forerunner for developing an app with game elements that could help and motivate students to participate more in peer assistance. In an attempt to confirm the potential in using such and app, this thesis focus on how the frequency of peer assistance can be influenced by different factors. To gather more evidence to strengthen or weaken this hypothesis, the thesis will attempt to answer the following research questions.

1. Will increased focus on peer assistance increase the frequency of peer assistance?
2. Will the introduction of a mobile application for organizing peer assistance increase the frequency of peer assistance?
3. Will the introduction of game elements to this mobile application increase the frequency of peer assistance?

1.2 THE REQUEST APP

The reQuest mobile app was originally developed as part of a previous course in this master programme, but was almost completely remade for use as a research tool in this master thesis. It provides a simple user interface where a student can log in and ask for, receive and provide help in the courses he or she is registered to. When a request is entered, the backend system sends a notification message to every student registered as active helpers in that course. The first student to accept the request gets the opportunity to give aid. Once provided, the receiving student must confirm that aid has been given and the providing student receives a reward in the form of skill-points in the respective course. This score is also added to the team's total score, and is shown on the landing page of the app and the backend website.

1.2.1 Application design

The mobile app was designed following a human-centered design process. As shown in Figure 1, this is an iterative process where user testing is performed at several stages, starting early with the conceptual design, and continuing through to the final product. Figure 2 shows some screenshots from the prototype of the application.

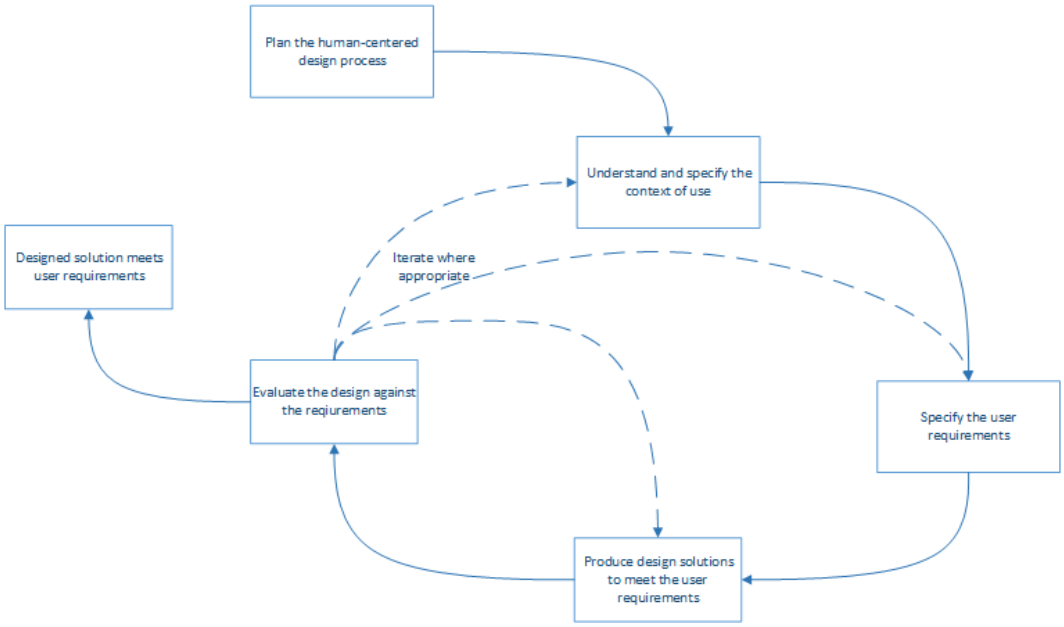

Figure 1 - Human-centered design process (ISO, 2010)

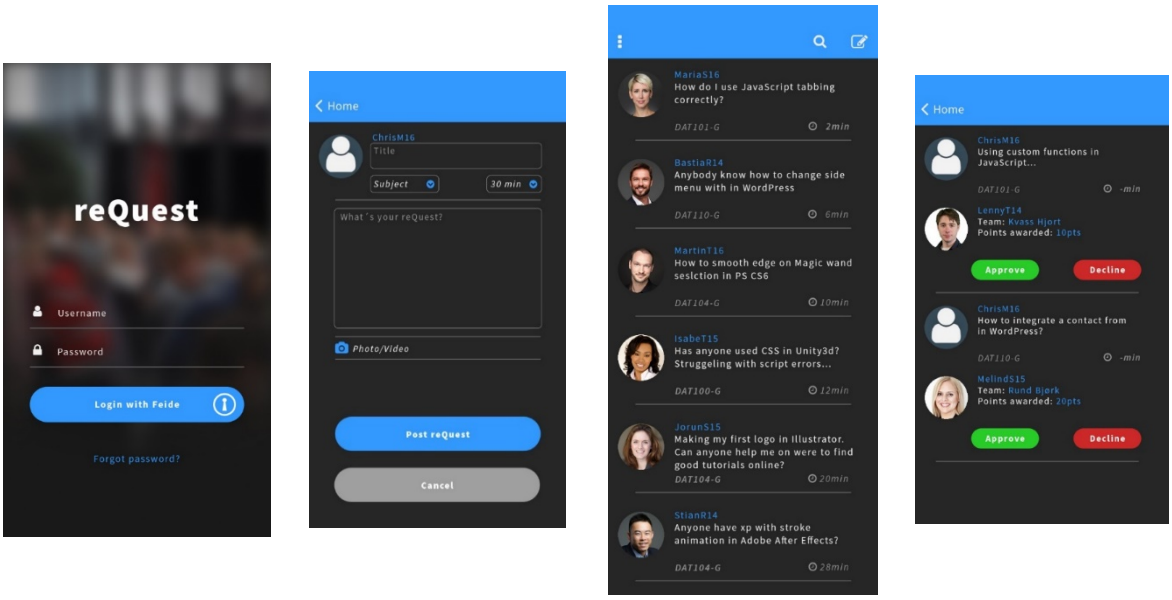

Figure 2 - Screenshots of the prototype of the reQuest mobile application.

1.2.2 Application development

The reQuest mobile application was written in C#[1] using Microsoft Visual Studio[2] with Xamarin[3] and run on the currently most prominent platforms, Android and iOS, thereby covering 99.6% of the market share (Gartner, 2017). The backend services were also written in C#, but using Visual Studio Code[4], it provides a REST API and is hosted on Microsoft Azure[5]. The service uses the services of Dataporten[6] to authenticate users and retrieve the students' course registrations. The source code for both the mobile application and the backend are included with the delivery of this thesis (Appendix A - Source code).

1.3 LIMITATIONS AND RESTRICTIONS

Several factors, mostly related to the survey, contributed to some limitations and restrictions in the study. The sample in the survey was based on one single class at the Multimedia Technology and -design bachelor programme at the University of Agder. This lead to small sample with no control group. In addition, it was difficult to generalize the results beyond students in higher education. The survey was also limited by the timeframe for the courses where the students attended.

One of the most important limitations in the study was the time and resources available to implement a production version of the reQuest mobile application that was used as a tool in the survey. The app had to be used when it was still under development and the first large scale testing of the app was done during the survey. This may have led to some instability and bugs that made the students less willing to use the app.

All in all, the limiting factors made it difficult to obtain results with a high level of validity. The results from the study should therefore be understood as indications and not hard truth.

1.4 STRUCTURE OF THESIS

Chapter one covers the background of this thesis. It explains why it was initiated and introduces the hypothesis it is attempting to substantiate. Additionally, it contains the organizational and managerial information needed to fully appreciate this report.

Chapter two holds the theoretical content necessary to support the research, field study, discussions and conclusions of this thesis. It covers relevant motivational theory, concerning why people act as they do, and learning theory, focused on conditions that promote learning.

Chapter three describes the methods used to gather and process the data collected during this project.

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[1] C# is a strongly typed, object-oriented programming language developed by Microsoft.

[2] Visual Studio is Microsoft's Integrated Development Environment (IDE) (https://www.visualstudio.com/).

[3] Xamarin is cross-platform development software, owned by Microsoft, that enables the creation native mobile applications with a shared codebase written in C# (https://www.xamarin.com/).

[4] Visual Studio Code is a free source code editor developed by Microsoft for Windows, Linux and MacOS (https://code.visualstudio.com/).

[5] Azure is Microsoft's cloud service (https://azure.microsoft.com).

[6] Dataporten is a service delivered by Uninett where several datasources related to educational management are made available (https://www.uninett.no/tjenester/dataporten).

Chapter four presents the results of the field study. In addition to the results, it contains descriptions of the rationale behind and the processing done to achieve the presented results.
Chapter five discusses the results from the study, attempts to explain them and provides the links from theory to conclusion.
Chapter six summarizes to what degree the research questions have been answered, concludes whether or not the hypothesis has been strengthened, and suggests possible future avenues for increasing peer assistance among university students.
Chapter seven contains an overview of the appendices.
Chapter eight holds the references to the sources used throughout the thesis.

2 THEORY

Here follows a review of the core theoretical concepts used to substantiate the hypothesis and answer the given research questions.

2.1 MOTIVATION

> *"Orientation of motivation concerns the underlying attitudes and goals that give rise to action—that is, it concerns the why of actions." (Ryan & Deci, 2000, p. 54)*

Motivation concerns the why of actions, why people perform in particular ways. According to Richard M. Ryan and Edward L. Deci, there are two main types of motivation named intrinsic and extrinsic. They define intrinsic motivation as: *"the doing of an activity for its inherent satisfactions rather than for some separable consequence"* (Ryan & Deci, 2000, p. 56). They attribute this to the assumption that humans are born inquisitive, curious and playful, and that even without any external incentives, people will seek to explore their surroundings. Certain conditions, such as feeling competent to perform a task and being able to decide how and when to perform it, have proved conducive to this type of motivation. However, it is only possible to trigger intrinsic motivation for tasks that hold an intrinsic interest to the individual. Today, people experience that many of their regular activities no longer hold any intrinsic interest. More often, we rely on external incentives to sustain their activities. Ryan and Deci define extrinsic motivation as: *"a construct that pertains whenever an activity is done in order to attain some separable outcome"* (Ryan & Deci, 2000, p. 60), but at the same time emphasize the fact that the degree of autonomy involved in performing the task plays an important role in whether an individual will internalize or integrate the instrumental value of the activity.

2.1.1 Self-determination theory

The degree of autonomy involved in performing a task is central to self-determination theory. It looks at the range from autonomous motivation to controlled motivation. On one end of the scale is autonomy which is *"… acting with a sense of volition and having the experience of choice"*(Gagné & Deci, 2005, p. 333). On the opposite end, being controlled is *"… acting with a sense of pressure, a sense of having to engage in the actions"*(Gagné & Deci, 2005, p. 334). Intrinsically motivated behavior is autonomous by its definition. It is something you do because you enjoy doing it. The core concept of self-determination theory is that extrinsic motivation can vary along this range from controlled to autonomous. Often an extrinsically motivated activity starts out being dependent on control to be performed. In the context of self-determination theory, the behavior is being externally regulated. Then, through a process where a person adopts the external regulations as his or her own, the activity transforms into an internally regulated behavior and thereby more autonomous. The degree of autonomy is dependent on the level of integration (Deci & Ryan, 2008, p. 16).

2.1.2 Community spirit

Montola et al. states that: *"Once a player feels part of a community, she is likely to continue to play"* (Montola, Stenros, & Waern, 2009, p. 184) and further defines a game community as: *"a group of people (players, spectators, and other kinds of participants) doing something together with a shared purpose"* (Montola et al., 2009, p. 183). Members of such communities often form groups that interact outside the game. There they discuss strategies, teach beginners how to play and decide when next to play. This interaction extends the presence of the game beyond the play sessions. To some players, it is not even necessary to participate in the community for it to be meaningful. They

only need to be aware of the existence of other active players. It is necessary for a game to attract and maintain a critical mass of players in order to benefit from this community spirit(Montola et al., 2009, p. 185).

2.1.3 Influence

People are influenced by their environment and, according to (Cialdini & Garde, 1987, p. 11), tend to act in predictable patterns based on certain criteria. Because of the extremely complicated stimuli people are surrounded by on a daily basis, human beings are unable to recognize and process all this information within a useful timeframe. To overcome this, people often employ automatic stereotyped behavior. Situations are catalogued based on a few key criteria and when one or more of these conditions occur, it triggers people to act mindlessly with a predetermined response. The triggers most relevant to this paper are listed in Table 1.

TRIGGER NAME	DESCRIPTION
COMMITMENT AND CONSISTENCY	People tend to be more confident about decisions they have done in the past. By inducing a person to perform a small action, it will increase the probability that he or she will do a bigger action later. It is important that the initial action is intrinsically motivated so that the person does not see himself as influenced by external elements. If so, the effect will be substantially reduced (Cialdini & Garde, 1987, pp. 57-113).
SOCIAL PROOF	In situations of uncertainty, people have a tendency to base their choice of action on other people: *"…one means we use to determine what is correct is to find out what other people think is correct."* (Cialdini & Garde, 1987, pp. 114-166)
LIKING	Most of us tend to be influenced by people we like, first family or friends, but also people with favorable attributes like good looks and people that are like ourselves. An important aspect with Liking is the effect of proximity and cooperation with someone you don't know. When people work together to achieve a common goal, they will also be more inclined to like each other, and have more tolerance and respect for each other (Cialdini & Garde, 1987, pp. 167-207).
AUTHORITY	People tend to follow an authority figure and thereby avoid responsibility. If the authority of a person is unquestionable, and at the same time he or she is trustworthy with no hidden motives, it may be justifiable to follow the authority (Cialdini & Garde, 1987, pp. 208-236).
SCARCITY	If something is scarce it becomes more attractive. The principle of scarcity also involves things that is "off-limits" or "forbidden" (Cialdini & Garde, 1987, pp. 237-272).

Table 1 - Influence triggers with descriptions

2.1.4 Gamification

According to (Deterding, 2012, p. 14), the rise of gamification was enable by the convergence of the ability to track everyday activity with cheap sensors, a bigger focus on individual behavior on the web and the fact that video games have become a socially acceptable activity. Gamification, as defined by Sebastian Deterding et al., is explained as *"the use (rather than the extension) of design (rather than game-based technology or other game-related practices) elements (rather than full-fledged games) characteristic for games (rather than play or playfulness) in non-game contexts (regardless of specific usage intentions, contexts, or media of implementation)"* (Deterding, Dixon, Khaled, & Nacke, 2011, p. 13). It is a design strategy intended to increase the motivation of participants by tapping into the same mechanisms that sustain people playing their favorite games. Rather than creating full-fledged games, the core idea of gamification is to use elements of game design to motivate desired behavior

in non-game contexts, products and services. In the words of You-Kai Chou: *"…you can gamify anything that involves human motivation, as long as it is not already a game…"*(Chou, 2015, p. 49). You-Kai Chou has developed a design framework to analyze and create gamified systems called "Octalysis". Here he identifies eight core drives that provide a basis and rationale for the game elements used in gamification today. To create a well-designed gamification strategy, all eight core drives should be considered (Chou, 2015, pp. 23-32). As an overview of the "Octalysis" framework, Table 2 presents You-Kai Chou's list of core drives of gamification(Chou, 2015).

CORE DRIVE	DESCRIPTION
EPIC MEANING AND CALLING	Motivates people into action when they believe they are engaged in something greater than themselves. Providing a storyline or connecting goals to a higher purpose are possible ways to evoke this drive.
DEVELOPMENT AND ACCOMPLISHMENT	Covers the most commonly used part of gamification and concerns people's need for making progress and overcoming challenges. Points, badges and leaderboards belong to this category.
EMPOWERMENT OF CREATIVITY AND FEEDBACK	Allowing people to explore, discover new ways of doing things, receive feedback and adjust are the core of this drive. It is the one most closely linked to intrinsic motivation, it is something people do because they enjoy doing it.
OWNERSHIP AND POSSESSION	On an abstract level, this is related to peoples' investment of time and effort into making something more to their liking. The more resources put into something, the more valuable it becomes.
SOCIAL INFLUENCE AND RELATEDNESS	Incorporates all social elements that motivate people and the fact that people tend to like people, places or events they can relate to. It covers, among others, mentorship, social acceptance and competition. It is closely linked to the concepts of social proof and liking as described by (Cialdini & Garde, 1987)
SCARCITY AND IMPATIENCE	Wanting to have something simply because it is not immediately available. This is related to Cialdini's concept of scarcity, emphasized by the similar naming.
UNPREDICTABILITY AND CURIOSITY	Engages people because they do not know what is going to happen next. This is the reason for the spoiler alert warning on forums discussing games, tv series and movies. Knowing what happens hampers the motivation in this category.
LOSS AND AVOIDANCE	The motivation to avoid something negative from happening.

Table 2 - You-Kai Chou's list of core drives of gamification (Chou, 2015).

Done correctly, gamification will motivate the participants to increase their efforts and contributions. However, as with most strategies, done poorly it can prove decremental to the intended objective (Chou, 2015, pp. 13-22).

2.1.5 Emotions

In her research into why we play games, Nicole Lazzaro found that *"A game's value proposition is how it makes its customers think and feel."* (Lazzaro, 2004, p. 1) To be able to design games which actively target the players emotions she conducted a research study to identify the emotions experienced during gameplay and what game elements trigger these. Table 3 is a combination of similar lists in (Lazzaro, 2004, p. 6) and (Bateman, 2009, p. 29) with some additions to the text. While not every emotion is relevant for the focus of this paper, the list is included in its entirety for the sake of completeness.

EMOTION	COMMON THEMES AND TRIGGERS
FRUSTRATION/ANGER	Working to reach goals on the upper limit of the player's capabilities. Playing to beat the game
SADNESS	Loss of someone or something with an emotional attachment
AMUSEMENT	Being happy, having fun
CURIOSITY	Experimenting, wanting to know what happens.
FEAR	Threat of harm, object moving quickly to hit player, sudden fall or loss of support, possibility of pain
SURPRISE	Sudden change, the briefest of all emotions, does not feel good or bad, after interpreting event this emotion merges into fear, relief, etc.
DISGUST	Rejection as food or outside norms. The strongest triggers are body products such as feces, vomit, urine, mucus, saliva, and blood.
NACHES/ KVELL (YIDDISH)	Pleasure or pride at the accomplishment of a child or mentee. (Kvell is how it feels to express this pride in one's child or mentee to others.)
FIERO (ITALIAN)	Personal triumph over adversity. The ultimate Game Emotion Overcoming difficult obstacles players raise their arms over their heads. They do not need to experience anger prior to success, but it does require effort.
SCHADENFREUDE (GERMAN)	Gloat over misfortune of a rival Competitive players enjoy beating each other especially a long-term rival. Boasts are made about player prowess and ranking.
WONDER	Overwhelming improbability. Curious items amaze players at their unusualness, unlikelihood, and improbability without breaking out of realm of possibilities.

Table 3 - Emotions observed in gamers playing computer games

2.2 PERVASIVE GAMES

> *"A pervasive game is a game that has one or more salient features that expand the contractual magic circle of play spatially, temporally, or socially." (Montola et al., 2009, p. 12)*

Pervasive games tend to blend with real life. It is often impossible to distinguish whether actions, players or the environment are part of the game or not. (Montola et al., 2009, pp. 12-17) use the terms spatial-, temporal- and social expansion to describe the different aspects where pervasive games blur the edges of the magic circle. Pervasive games typically embrace their environment, both physical and virtual. The spatial expansion allows gamers to inhabit a game world that exists within the ordinary world, bringing along the magic circle wherever they go. As the game progresses, it is impossible to predict where the next part of the game will play out, adding both surprises and unexpected possibilities to the gameplay. Rather than being in the center of focus the entire duration of a game, temporal expansion allows a pervasive game to fade to the background while the player is performing unrelated activities. This enables the merging of everyday life and gameplay to extend over days or weeks. When a game is extended either temporal, spatial or both, players will eventually or intentionally have to interact with people who are not initiated. This social expansion can draw outsiders into the game, participation ranging from spectatorship to full participation.

2.3 JUST PRESS PLAY (CASE STUDY)

The "Just Press Play" project at the School of Interactive Games and Media at Rochester Institute of Technology is an example where they successfully gamified peer assistance. Adrienne Decker and Elizabeth Lane Lawley wanted to find out if they could "*umbrella the undergraduate experience and support it*" (Decker & Lawley, 2013, p. 233). They created a gaming-layer where the students could identify opportunities, collect recognition for achievements, and connect with others through social and creative activities. While most of the achievements targeted extra-curricular social activities, one was designed to increase the percentage of freshmen passing the introductory programming course. This is also one of the reasons this project is relevant to the use of gamification in peer assistance. The *Undying* achievement would be granted to all players if the freshmen had a passing level of 90% for the first course. Historically, no more than 85% had ever accomplished this. When the finals got closer, students organized study sessions for their fellow students to help more pass the exam. While the study does not claim to prove any direct causal relationship between the game and the record breaking passing percentage of 91%, they can show a direct link between the game and the number of peer tutoring sessions, which have already been shown to have a positive effect on student performance (Goldschmid, 1976, p. 12). Another interesting result of the *Undying* achievement is that the students running the study sessions found the experience intrinsically rewarding, and wanted to continue to provide peer assistance in advance of midterms and finals (Decker & Lawley, 2013, p. 236).

2.4 LEARNING THEORY

> *"(all the generations of learning theories) …can and should be effectively used to address the full spectrum of learning needs and aspirations of 21st century learners." (Dron, 2011, p. 1).*

Methods or systems where fellow students help each other, also called *peer assistance*, *peer support* or *peer teaching*, have long been used in education. Organized use of peer assistance often sprung out of necessity. Only a few generations ago, peer assistance was an important method for handling the lack of teacher resources. In rural areas, there was often only one teacher covering several schools. The most talented pupils were therefore given the task to teach the other pupils when the teacher was away. Although peer assistance has grown from practical needs, it has long been recognized as a pedagogical method that is favorable not only for children and youths, but also for adults and higher education. It is worth noting that peer assistance is not exclusively related to education. It is also used in therapy for overcoming a variety of psychological conditions, like anxiety, addiction and post-traumatic stress. Peer assistance can be related to several learning theories. Anderson and Dron classifiy current learning theories into three generations: Cognitive Behaviorist, Social Constructivist and Connectivist. Even though this classification was done in relation to distance learning, it can be applied to campus based education (Dron, 2011, p. 1).

2.4.1 Cognitive-Behaviorism

The Cognitive-Behavioristic theory deals with how the behavior of a subject changes in response to stimuli and pedagogy based on cognitive-behavioristic ideas is often described as teacher centered and with one-way communication: *"Behavioristic pedagogy is a method…where the teacher channels 'objective truths' from the information source to the students. A good teacher dishes out the information in well structured 'chunks', using didactive skills. The main way of communication is one way. When students communicate with the teacher it usually is in response to control questions posed by the teacher"* (Bjørke, 2014). The behavioristic pedagogy avoids the complexity of humans

learning to be. Instead it focuses on *learning to do* (Dron, 2011, p. 3). Whilst this type of pedagogy is often considered outdated by many theorists, it is commonly used in *training* where the learning outcome can be easily demonstrated and measured as behavioristic properties (Dron, 2011, p. 2). Because peer assistance is often used in settings where training plays an important part, a behavioristic approach is generally the preferred choice, especially for novice peer-teachers. With more experience and guidance, the method of teaching can shift, utilizing elements from other learning theories.

2.4.2 Social constructivism

The constructivist theory is centered around how people construct new knowledge based on what they already know. This process of learning consists of actively solving authentic problems and not just passively receive information. Pure constructivism deals with the individual learner and his or her responsibility to participate in the learning process. *"The knowledge is seen as more subjective, dynamic and expanding rather than objective and static. The main tasks here are processing and understanding of information, making sense of the surrounding world. The learner has a clear responsibility for his/her own learning"* (Bjørke, 2014). Social constructivism deals with a group of learners where the teacher acts like a guide, facilitator or master, and not an instructor. *"(The teacher) … assumes the critical role of shaping the learning activities and designing the structure in which those activities occur"* (Dron, 2011, p. 3). An important aspect of social constructivism is the *Zone of Proximal Development* (ZPD) defined by Lev Vygotsky in his significant work on the potential for development of cognitive functions. Vygotsky claims that the potential for development is greater when problems are solved with help from more skillful peers. He defines the ZPD as *"The distance between the actual developmental 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). The concept of the ZPD was originally aimed at children, but has later been acknowledged as valid for learners of all ages. As shown in Figure 3, it can be illustrated as a circular layer between independent achievements and achievements that are not yet possible.

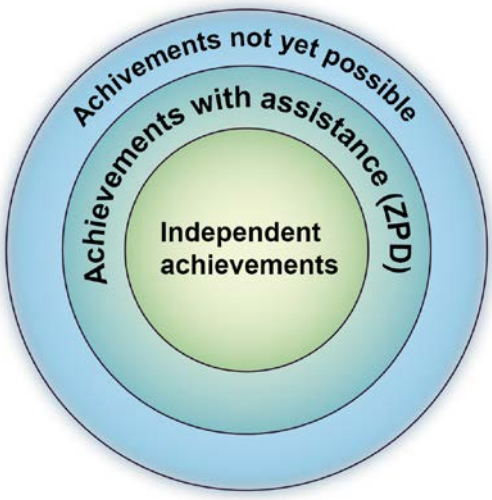

Figure 3 - The Zone of Proximal Development (Vygotsky, 1978)

While the learner is in the ZPD, he or she can receive assistance, also referred to as *scaffolding*, to solve tasks. The "scaffolds" can be removed later on when the learner can accomplish the tasks independently. As the learner is able to accomplish more tasks independently, he or she will also be

able to reach for increasingly more demanding tasks. The circles in the illustration are therefore not static, but increase in size during the learning process. Whilst in the ZPD, the learner is expected to join a *Community of Practice* where the learner solves authentic problems in collaboration with others. Learning is measured as the amount of participation in the community: *"(The more advanced peers and masters) … will meet the newcomer at various stages and make 'scaffolds' facilitating the newcomer to approach the center of the community. Learning is defined as increased participation."* (Bjørke, 2014). Peer assistance can be said to be related to social constructivism more than any other learning theory because it is directly addressed as a key factor in the definition of the ZPD and the Community of Practice. By implementing technology and tools that can facilitate networked communication between peers, the pedagogy moves into the next generation of learning theory; *connectivism*.

2.4.3 Connectivism and 21st century skills

The Connectivist theory, originally developed by G. Siemens and S. Dowes, deals with learning in a modern world filled with substantial amounts of easily accessible, and fast changing, information. Because of this abundance of information, it is impossible for an individual learner to know "everything" and it is therefore important to be able to search for, and find, relevant information and use it in the right context. The theory emphasizes *networked learning* and how people learn by using networks. *"The starting point of Connectivism is the individual. Personal knowledge is comprised of a network, which feeds into organizations and institutions, which in turn feed back into the network, and then continue to provide learning to individual. This cycle of knowledge development (personal to network to organization) allows learners to remain current in their field through the connections they have formed"* (Siemens, 2005). Consequently, networks are an important prerequisite in connectivism. *"Connectivist cognitive presence begins with the assumption that learners have access to powerful networks and, as importantly, are literate and confident enough to exploit these networks in completing learning tasks"* (Dron, 2011, p. 4). The learner must therefore possess a set of skills to be able to utilize the theory. These skills correspond to the *21st century skills* which deal with how learners should act in response to a rapid changing world, modern technology and digital societies and networks. The skills include information literacy, collaboration, communication, problem solving, responsible citizenship and using creativity and innovation to refine and improve original ideas. *"… people need to have the ability to communicate exchange, criticize, and present information and ideas, including the use of ICT applications to participate in and make positive contributions to the digital culture"* (Katerina Ananiadou, 2009, p. 10). Any information and communication technology that can be used to acquire 21st century skills are therefore deeply linked to Connectivism.

3 METHOD

Without a rational and reflective reasoning behind the choice of research method, the results can be seriously flawed. Most research tries to find a difference or pattern in an observed sample, and then tries to demonstrate that this difference or pattern also holds for a wider population. It is important to recognize that the second part is all but simple or trivial. This is especially noticeable in research on learning within the education system, where the samples are often small, and the timeframes are short. The research method must therefore include a strategy and design that adapt to these limitations and thereby achieve results with a desired level of validity and reliability, or at least give sensible information about the level of validity and reliability.

3.1 MEASURING MOTIVATION

According to (Touré-Tillery & Fishbach, 2014, p. 332), if proper precautions are taken, performance can be a reliable measure of motivation. The aspect of performance that is relevant to this study is persistence and is expressed as the number of times the individual student performs peer assistance. Possible sources of errors in the measurements are ability and capacity (Touré-Tillery & Fishbach, 2014, pp. 336-337). During this study, the students' ability to perform peer assistance has probably improved, and as the students have gotten to know each other better, it has gotten easier to ask for help. This should give a fairly linear increase in the number of peer assistances performed, which has to be considered when evaluating the results. On the other hand, the effects of capacity should not be an issue as it is related to the depletion of resources available to perform the given task. The resources available for the students to provide peer assistance have been relatively equal in all periods the study has been run.

3.2 RESEARCH STRATEGIES

The choice of research strategy will influence the choice of design, in addition to data-collection methods and analysis. The two main strategies, *quantitative* and *qualitative*, are commonly defined by the type of data that is collected and analyzed. In quantitative research, the data is numbers, usually collected by distributing various kinds of questionnaires to a sample. In qualitative research, the data is text, usually collected by interviewing or observing a sample. Some researchers in social science have traditionally been skeptical to a quantitative strategy and feel that the qualitative strategy is more adapted to a research field where the actions of human beings are central. In modern research, the two strategies are often regarded as complementary instead of being opposites (Ringdal, 2001, p. 104). In fact, to compensate for small and biased samples, a "mixed" model is often preferable. For example using a larger quantitative dataset to reveal a pattern, and then using a smaller qualitative subset from the same sample to explain the pattern (Gorard, 2012, p. 11). Additional information or insight can also be obtained by using a mixed model. For example, in a study about how fresh graduates in different professions acquired information in their daily work (Smeby, 2012, pp. 19-20), the results from the quantitative study showed that teachers used more time reading academic literature than nurses. On the other hand, the qualitative study showed that the nurses read more than the teachers. The reason for this contradiction was found by a more thorough analysis of the questions given in the two studies and gave new insight: The two groups read different kind of literature. The teachers read literature to prepare their teaching, while the nurses read information and instructions about specific tasks and did not define this as academic literature in the quantitative survey.

3.2.1 Design

The focus of the study was to find a correlation between the level of gamification (cause variable X) and the frequency of peer support (effect variable Y) of students in higher education. The classic design to find a correlation between a cause and its effect is the *experiment*. In this type of design, the casual variable is manipulated to obtain the desired effect. Possible other causes to the effect is eliminated by having two groups of random selected test subjects: the experiment-group and a control-group which is not manipulated with the casual variable. Because the two groups are similar at the start of the experiment, any differences in the groups at the end of the experiment must be caused by the variable in question. The experiment design is seldom used in social science where it is usually more difficult to manipulate the casual variable (Ringdal, 2001, p. 53), but in this study the Request app could be used as an instrument to introduce and controlling the level of gamification. A field experiment was therefore a relevant choice of design based on quantitative data. Because of the small sample available, there were no separate control-group or randomization, and the design had to be reduced to a *quasi-experiment*. Three forms of quasi experiments are shown in Figure 4. In the simplest form (one shot) a single test is carried out after the experiment. This method is subject to low validity because numerous causes can give the observed result. An improvement to this method is to use a pretest before the experiment (Ringdal, 2001, p. 132). The chosen method in this study included two experiments and three tests during a time-period. The midway test was then a posttest for the first, and a pretest for the second experiment. Using posttests and pretests, and comparing results, corrected some of the weakness associated with experiments without a control-group.

One shot	$X_1 \rightarrow O_2$	O - observation/test X - experiment
Pretest-posttest	$O_1 \rightarrow X_1 \rightarrow O_2$	
This study	$O_1 \rightarrow X_1 \rightarrow O_2 \rightarrow X_2 \rightarrow O_3$	

Figure 4 - Used quasi-experiment design compared to traditional designs

The quantitative study was followed by a qualitative study and corresponds to a *multi-method* or *triangulation* (Ringdal, 2001, pp. 110-111) design and a mixed model research strategy. However, the qualitative study focused on extracting additional information about the subject matter. Because of this, the total design was twofold, i.e. one (quantitative) part focusing on frequency of peer assistance and another (qualitative) part focusing on peer assistance in more general terms, for example in relation to motivation, gamification and organization.
The total survey was carried out in 6 steps shown in Figure 5.

Time	Quantitative survey	February 2. 2017	Preliminary survey (establishing base levels)
		March 5. 2017	Preliminary interview (preparation to survey of frequency)
		March 20. 2017	Survey of frequency before using the reQuest app
		October 24. 2017	Survey of frequency after using the reQuest app without gamification
		November 21. 2017	Survey of frequency after using the reQuest app with gamification
	Qualitative survey	December 04. 2017	Final interviews (validating results from the quantitative survey and extract additional information)

Figure 5 – Overview of the data collection sequence

As one of the authors already were teaching a class at the Multimedia Technology and -design bachelor program at the University of Agder, it was natural to use this class as sample. A larger and more random sample was not available within the limits of the study. 40 students in all, were asked to participate in the quantitative part of the study (questionnaires), while a subset was asked to participate in the qualitative part (interviews). The quantitative study took place during two semesters where the students took courses that were favorable for implementing peer assistance. The students were informed about the study in relation to these courses. They were also asked to perceive peer assistance in a more general context, for example using the Request app in other courses, or in situations outside campus.
The scope of the study was students in higher education and this was therefore a natural choice of population. A generalization beyond this could not be justified because of the small and specialized sample. Also, any use of the results was intended for colleges and universities only.

3.2.2 Quantitative survey

A pilot study is often useful to obtain more knowledge about the subject matter, and to find elements that could motivate or prevent participation in the main study (Ringdal, 2001, p. 196). The quantitative survey was therefore initiated by a preliminary survey and a preliminary interview as a preparation to designing the questionnaires. The preliminary survey was carried out to identify relevant biases in the sample, and to establish the test subjects existing relation and attitude to peer assistance and the use of technology, like computers and smart phones. The test level was ordinal because of the focus on relations and attitude (Ringdal, 2001, p. 90). The design of the questionnaires was based on established guidelines, explicitly avoiding leading or multidimensional questions, using multiple question on same objects of attitude and applying a successive order of questions (Ringdal, 2001, pp. 203-208). Closed questions were selected to obtain coherent answers and reduce workload in the analysis. Also, any changes in the frequency of peer assistance should ideally be traced at an individual level. The most straightforward solution was to make the questionnaires non-anonymous, but this could reduce the participation. In addition, it was important to receive knowledge about how the students perceive the amount of peer assistance. Therefore, a preliminary interview of two small groups of students was carried out before the first survey of

frequency. The goal was to prepare the questionnaire in relation to anonymity and frequency scale. The groups were asked:

1. Do you remember how many times you have given and received help from peers the last month?
2. Are you willing to give out your name (or student identification number) to register changes over time, presumed that the name will not be used for any other purpose and the results will be anonymized?

The first group (two male students) answered yes to both questions. The second group (five female students) answered no to both questions, but was positive if they could specify the frequency as an average per week and in addition use a nickname instead of their real name. They also answered yes when they were asked if they would remember the nickname until the next survey. The following survey focused solely on the frequency of peer assistance and was tied to the implementation and use of different versions of the Request app with various levels of gamification. Because the purpose of the questionnaires was to detect the frequency of peer assistance, they comprised only two questions measuring values at relative level:

1. How many times have you provided help to your fellow students in the previous month?
2. How many times have you received help from your fellow students in the previous month?

The answer alternatives for each question were given with eight different frequencies, from 0 to 60 or more times per month. Each alternative also contained information about the equivalent frequency per week or per day. To trace any changes individually, the subjects were asked to provide a nickname. Both the scale of the answer alternatives and the decision to use nicknames were done by considering the results from the preliminary survey and interviews.

3.2.3 Qualitative survey

The qualitative survey was carried out as two group interviews. An informal and unstructured approach was selected to extract additional information that could not be obtained in the quantitative survey, or in a more structured interview (Ringdal, 2001, p. 242). To avoid biased results within a group, the selection was based on the results from the questionnaires so that individuals with a broad spectrum of peer assistance frequencies were represented. A total of eight individuals were asked to participate with one dropout. The remaining seven individuals was divided into two groups with four in the first group and 3 in the second. Each group included people with both high and low frequency in peer assistance. The focus was to reach a collective agreement on if and how gamification can increase peer assistance as a correction or confirmation of the results from the questionnaires. The interviews lasted about half an hour each and were audio recorded. The interviews included a set of central questions and topics and had the form of a conversation where additional questions were asked during the interview to clarify previous answers (Kvale, 2001, p. 79). Because the qualitative survey had a wider and more general focus, the questions differed from the questions in the quantitative survey.

The main questions for the interviews were:

1. Could games be used as a tool to increase peer assistance?
2. What kind of incitements could be favorable to increase peer assistance?

For the last question a set of topics was introduced during the interviews. Table 4 shows the topics and their respective area of interest.

GAMIFICATION	MOTIVATION	INFLUENCE	EMOTIONS	PERVASIVE GAMES	ORGANIZATION
Receiving points for giving help	voluntary	Give something back	Sense of achievement	Introducing more games	How to better facilitate peer assistance
Rating of persons who give help	Own learning	Do as everybody else	The joy of helping others	Compete to give help	Dividing into teams
Awards/prices (money etc.) for giving help		Do as you are told	Pride of helping others to achieve more		
Individual vs. group awards		Limited resource			

Table 4 - Topics introduced during interviews

3.2.4 Observations

One of the authors had a participating role as an observer because he acted as a teacher for many of the students in the sample. He was therefore able to observe some of the peer assistance activity during classes. A downside to this is that an inside perspective and close relationship to the observed group can make the observer biased (Ringdal, 2001, p. 230). The observation done by the author was therefore highly informal and was only used as indications for properties that were not accounted for elsewhere. For example, he could observe what methods students used when they assisted their peers. There is also a risk that the studied group change behavior due to the presence of the observer (Ringdal, 2001, p. 230). In this study, this control-effect should be minimal because the role as a teacher was not intrusive or unfamiliar for the observed group.

3.2.5 Validity and reliability

Validity can be defined as to what degree the measurement corresponds to what we want to measure, while reliability is to what degree the same measurement gives the same result (Ringdal, 2001, p. 96). Different research designs are usually characterized with various levels of validity and reliability. In an experimental design the validity is often divided into *internal* and *external*. The internal validity is related to how certain we can say something about the causality. The external validity is related to how certain we can generalize the results to the real world. The relationship between the two is illustrated in Figure 6. A closed laboratory experiment will usually give a high internal validity and a low external validity. For a field experiment the opposite would be true (Ringdal, 2001, p. 128).

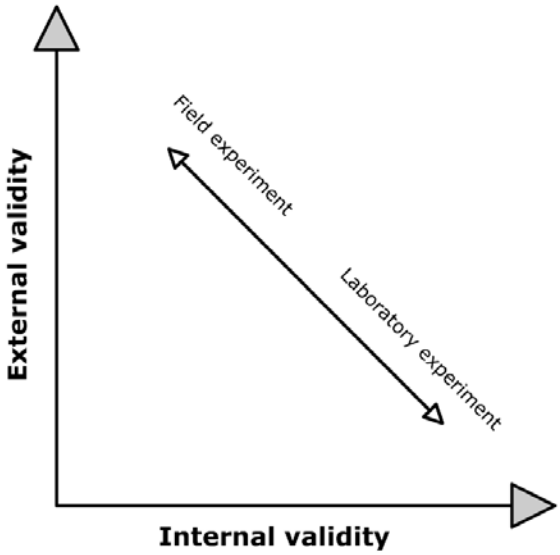

Figure 6 - The relationship between internal and external validity

In a quasi-experiment without randomization, the internal validity can be further reduced because of effects from non-measured factors as *history*, *maturation*, *instrument effects, sample* and *dropouts* (Ringdal, 2001, p. 130). Because this study focused on finding a causality and therefore required a certain level of internal validity, it was important to take these threats seriously. The question of interest was the change before and after the introduction of game elements in the Request app. Any instrument effects from the app, including placebo- and Hawtorne effects, would be included in both surveys and could be ruled out when measuring the difference. In addition, a survey before the introduction of the app, gave an indication of the quantity of the instrument effect. Being longitudinal, the study was sensitive for biases caused by maturation and interfering events (history) in the timespan between the first and the last survey. For example, positive or negative effects from the peer assistance itself, or familiarization with the app over time, could influence the frequency and had to be considered in the analysis. The same is true for a small and non-randomized sample which could compromise the external validity (Ringdal, 2001, p. 214). It was also important to determine if dropouts were random or not. If they were systematic, the dropouts would contribute to a lower external validity (Ringdal, 2001, p. 130). The reliability in an experiment is influenced by random measurement errors (Ringdal, 2001, p. 97) and the consequence of low reliability is the same as low internal validity. I.e. we are less able to say something certain about the causality between variables (Ringdal, 2001, p. 100). By implementing a sensible quality control in the design of the questionnaires, measurement instruments and data collection, it is possible to reduce these random errors and thereby increase the reliability of the study.

Validity and reliability are terms that are normally associated with a quantitative research strategy and it is debatable if they are applicable for a qualitative strategy (Ringdal, 2001, p. 248). If they are used, they will often relate to assessments that is vaguer in nature. Reliability can for example be related to inadvertently leading questions in an interview or transcription and categorizing answers. Validity can be related to whether questions are appropriate or the credibility of the persons that are interviewed (Kvale, 2001, pp. 164-165).

4 RESULTS

This chapter presents the results of the field study. Each subchapter contains a short description of the rationale behind and the processing done to achieve the presented results. The questionnaires were given in Norwegian, but the titles and questions have been translated to English to be used in this thesis. The raw data is available in Appendix B - Collected data

4.1 RESULTS FROM THE QUANTITATIVE STUDY

4.1.1 Preliminary survey

The focus of the preliminary survey was to expose relevant biases in the sample, and to establish the test subjects existing relation and attitude to the use of technology and peer assistance. The survey was performed on February 7. 2017, on Campus Grimstad, and was answered by 42 students from the bachelor programs Data and Multimedia at the University of Agder. Figure 7 shows the aggregated results on technology acceptance and Figure 8 their experience with and attitude towards peer assistance

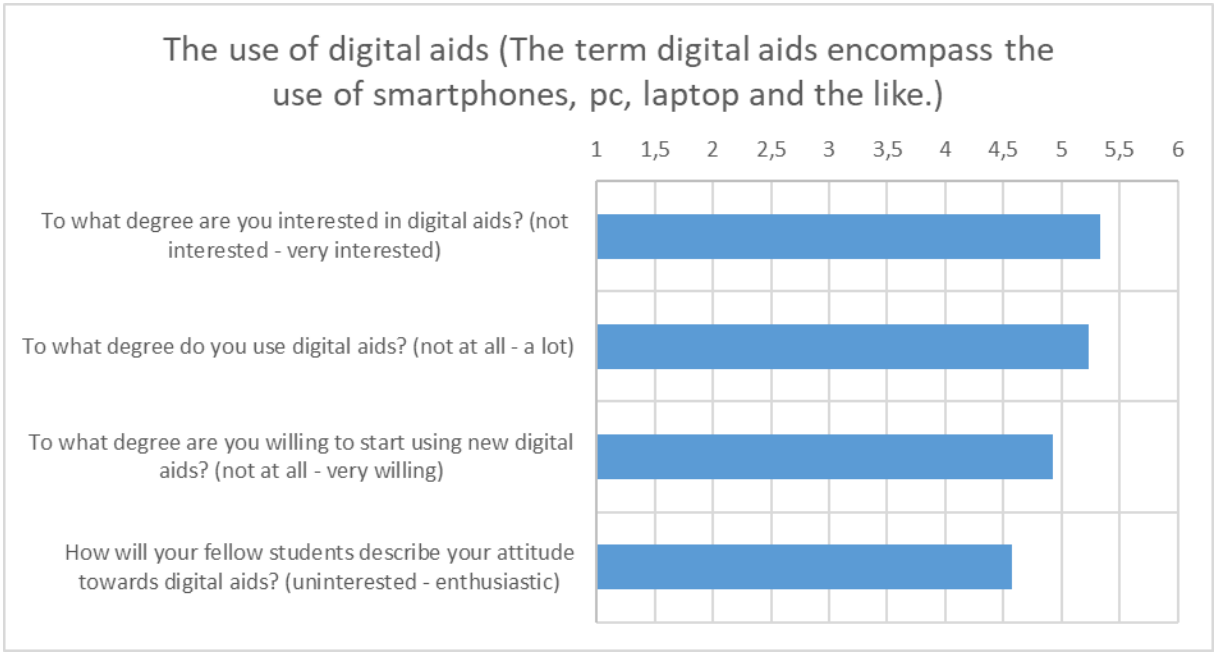

Figure 7 - Bar chart showing the acceptance of digital aids

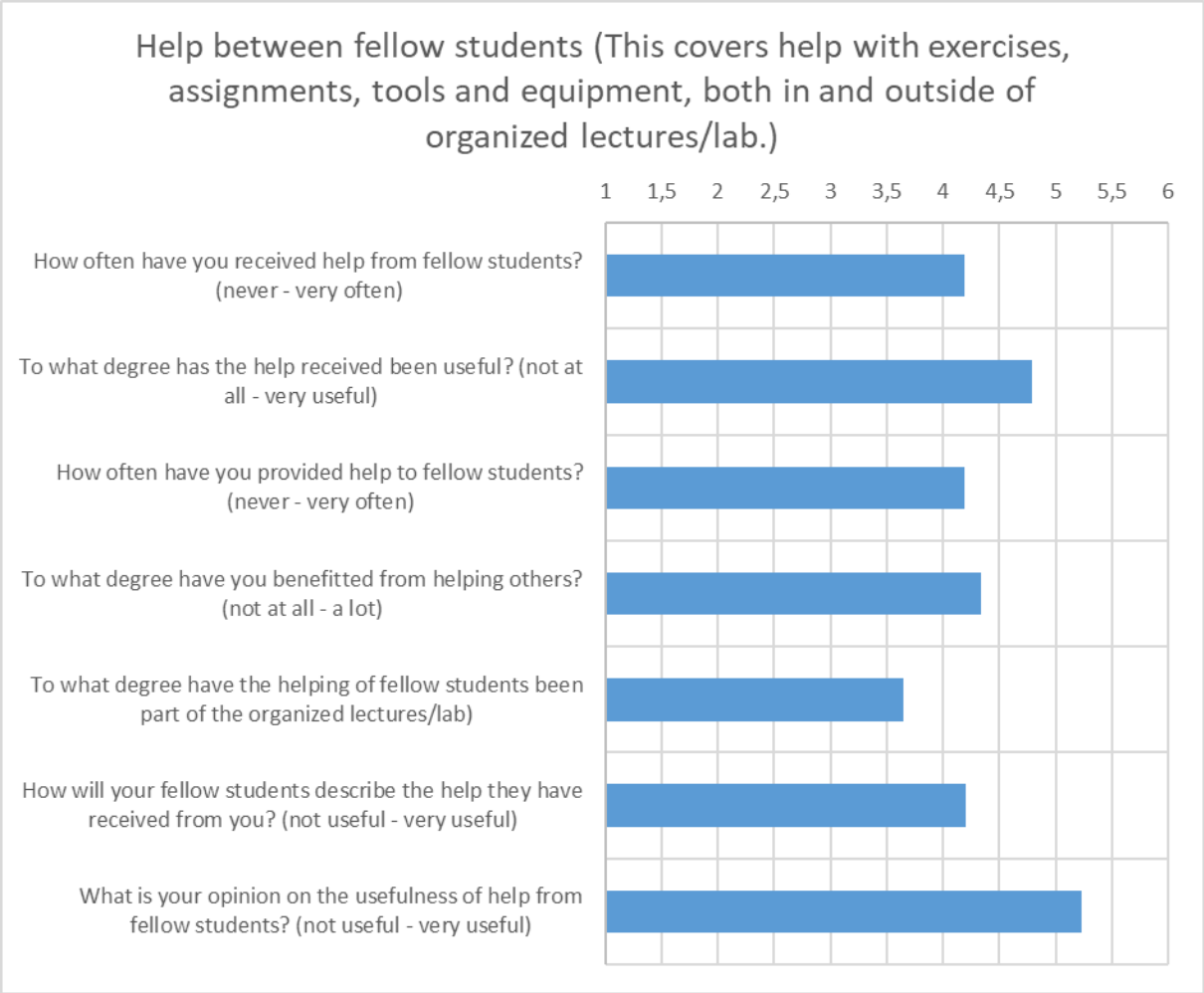

Figure 8 - Bar chart showing the attitude towards peer assistance.

4.1.2 Frequency surveys

The key information to be extracted from the frequency surveys was whether or not there was a change in the number of times a student provided and received help from his or her fellow students. As there were a different number of participants in each survey, the frequency measurement had to be averaged out per student to get comparable values. To accomplish this, the frequency ranges were set to their lowest value, then each participants value was added together, and finally the sum was divided by the number of students participating in the survey. Figure 9 shows the number of times help was provided and Figure 10 shows how many times help was received, both on average per student per month. The orange bar represents the “Survey of frequency before using the reQuest app”, the blue the “Survey of frequency after using the reQuest app without gamification” and the grey is the “Survey of frequency after using the reQuest app with gamification”.

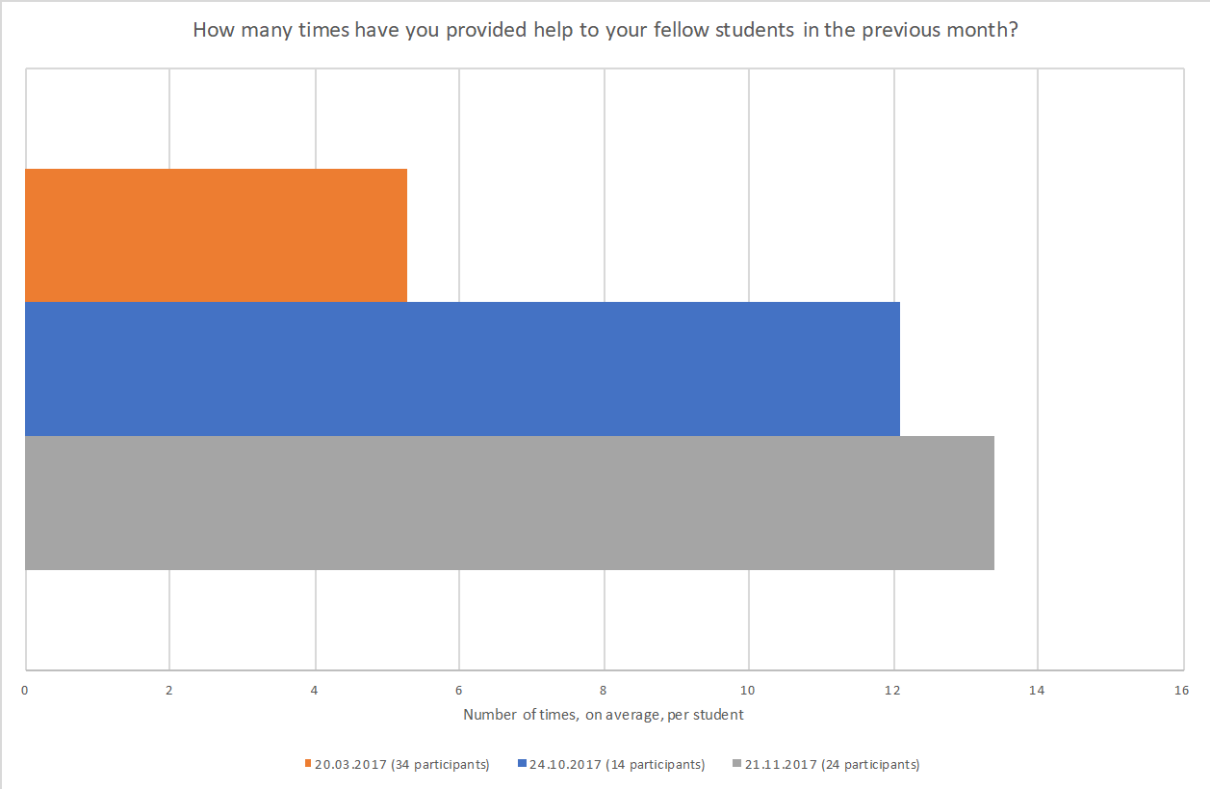

Figure 9 - Bar chart comparing how many times, on average, a student provided help in the previous month.

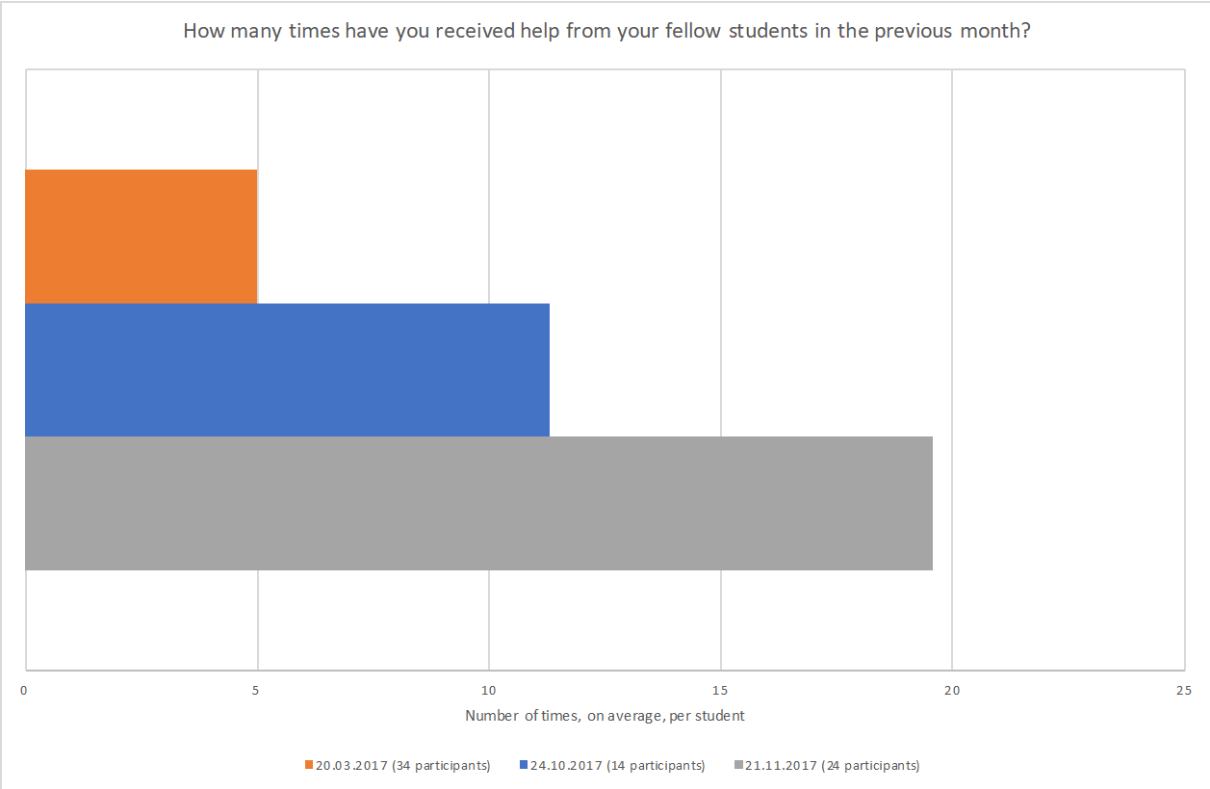

Figure 10 - Bar chart comparing how many times, on average, a student received help in the previous month.

4.1.3 Results from the reQuest mobile application

The data extracted from the use of the reQuest mobile application is shown in Figure 11.

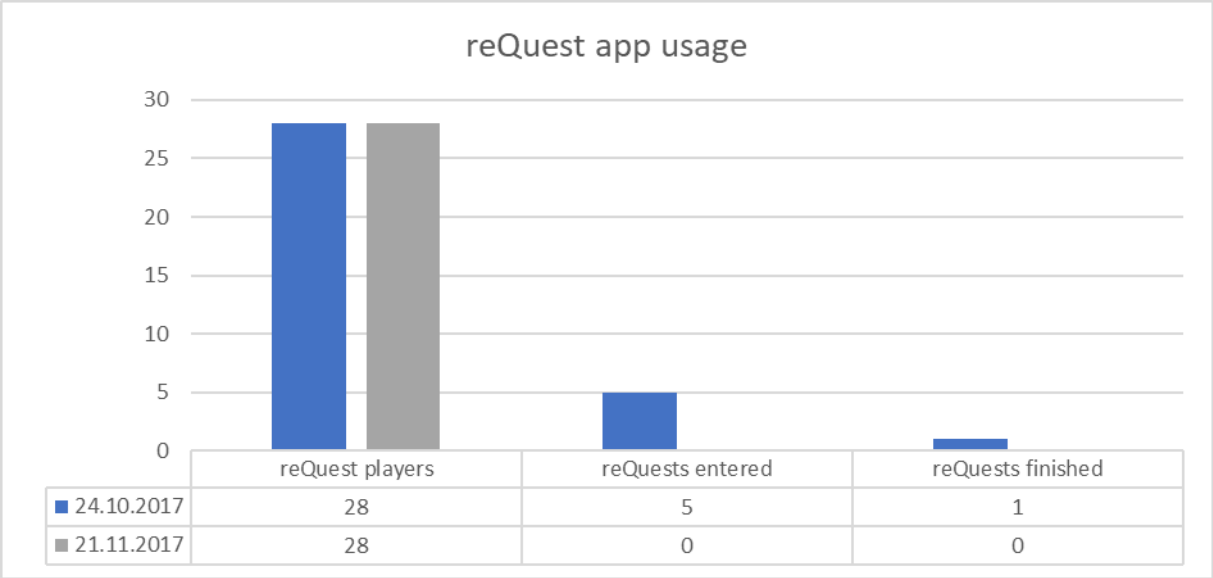

Figure 11 - Bar chart showing the usage statistics of the reQuest mobile application broken down by the dates of the frequency surveys.

4.2 RESULTS FROM THE QUALITATIVE STUDY

The essence of the interviews has been summarized in Table 5. The responses are sorted by the topics from Table 4. The audio recordings from the interviews are available on request, but will be destroyed once the thesis is graded.

HEADING AND KEYWORDS	GROUP 01 SUMMARY	GROUP 02 SUMMARY
GAMIFICATION: POINTS, RATING, PRIZES	The possibility to "buy" powerups A top 10 score board Earn points to buy exemption from exercises. Be included as part of course grade. High participation could give a diploma or recommendation letter. Not every participant approves of scoreboards.	Good rewards would be exemption from exercises or gift cards in the coffee shop
MOTIVATION: VOLUNTARY, OWN LEARNING	It is nice to help others More interesting if it is fun	Getting the possibility to help
INFLUENCE: GIVE BACK, DO SAME, DO AS TOLD, LIMITED RESOURCE		
EMOTIONS: MASTERY, JOY OF HELPING, PRIDE	Feels good to help	Gets happy from helping others
PERVASIVE GAMING: UNNECESSARY OBSTACLES, COMPETITION, SCENARIOS	No extra time	Must not make it more cumbersome
ORGANIZATION: MOBILE APPLICATION **TEAMS, HOW TO CREATE, STARTUP WEEK,**	To convey the need for help is most important. Team "spirit" must be created Startup week sounds like a good idea The mobile application must be easy to use. The app must work properly	Teams must be introduced early on. Startup week could work. Visible team identity, like colored armbands

Table 5 - Authors summary of group interviews

5 DISCUSSION

The thesis tries to answer if focus on peer assistance, or tools and gamification could increase the activity, and motivate students, to participate in peer assistance. The result from the quantitative study shows an apparent increase of the frequency of peer assistance during the survey. Logs of usage and the qualitative survey, implies that the use of the app was low before and after the introduction of gamification. The internal validity of quantitative study was therefore partially compromised. In hindsight, more effort should have been put into promoting the app, but at the time, the inclination was to make the students interact with the app freely and not enforce any use of the app. However, an interesting question is what caused the substantial increase in peer assistance activity during the study? The answer to this can be related to both on how peer assistance was implemented in the class that participated in the study and on any results from peer assistance in itself. In addition, the qualitative study and observations suggest certain design-characteristics of a system where the student uses an app, including game elements, as an aid for peer assistance.

5.1 PEER ASSISTANCE IN PRACTICE

The results from peer assistance must be seen in relation to the strategies that is being used in the environment and by peers.

5.1.1 Peer assistance in the environment

In the two semesters in which the study took place, the students in the sample took two types of courses that were favorable for peer assistance. The first type consisted primarily of project work in groups with regular project meetings with supervisors. The second type consisted of lectures, exercises and project work. This latter type of course was very common at the current department of the learning institution, and the students already had experience with this type of teaching from other courses. In this type of course, all three generations of learning theories are used in parallel on the same group of learners. This is done to better support a group of learners with various levels of knowledge and to adapt to the preferred learning style for individual learners. The lectures and instructions derived from Cognitive-Behavioristic conceptions, exercises and guided work in groups derived from Social Constructivism and independent research, using search engines and databases, derived from Connectivism. Because peer assistance is inherent in Social Constructivism, the most fertile environment was exercises and projects where the students worked in small groups. This was so apparent among the students that it may have resulted in a too low estimate of frequency of peer assistance in the surveys. This was discovered during the final interviews where some of the students said that they limited their estimate of frequency to only group work within a class, and did not consider other types of peer assistance.

The courses that included both lectures, exercises and project work, changed characteristics during the semester by emphasizing project work more in the later part of the course. This could have an influence on the peer assistance activity because the students were encouraged to work more independently with less support from the teacher.

5.1.2 Peer assistance strategies used by peers

The pedagogy practiced by students assisting their peers could also be related to the other two generations of learning theories, but in a subtler way. Observations during classes indicated that by removing any possibility to receive help from the teacher, the groups often had to search for help on websites, forums and databases. The quality of the search, and the search results, varied among the

groups, but some of the groups was able to establish external networks corresponding to connectivism, in addition to the internal network within the group. Observations also indicated that when the students assisted other students, their preferred method was to give instruction, corresponding to Cognitive-Behaviorism.

5.2 RESULTS FROM PEER ASSISTANCE

To be able to explain the results from our study, we must explore some of the possible fallouts from peer assistance in itself. For example, any positive results could increase the peer assistance activity, corresponding to a process of maturation (Ringdal, 2001, p. 130)

5.2.1 Positive results

Several studies emphasize the positive results of both learning by teaching and of having peers as teachers. A review of peer teaching in higher education, (Goldschmid, 1976) point out several factors and results that contribute to the popularity of peer assistance (labeled *peer teaching* in the review). One of the most essential results is that peer assistance can help students to be less isolated. At large universities and colleges, the relation to faculty staff can feel distant. Students will often find it easier to approach fellow students when they have questions about courses and career choices. In addition, peer assistance creates social relationships. *"… peer teaching – quite apart from the cognitive gains it may achieve – can, through its emphasis on close personal contact, contribute significantly to satisfying the students' socio-psychological needs."* (Goldschmid, 1976, p. 12).

Peer assistance also leads to more active learners. In a traditional classroom, the participation of the average student is usually very low. By letting fellow students teach and interact with each other, the level of participation becomes much higher. *"… peer teaching situations require total involvement of 'tutee' and 'tutor' alike"* (Goldschmid, 1976, p. 12). This type of interaction and teamwork also emphasizes group achievements in favor of individual achievements, which again leads to less competitive behavior. A group is also more likely to solve more difficult problems than the individual learner. This results in increased motivation, creativity, confidence and self-esteem. In addition, working in groups promote student retention. This is especially important for the first-year students where the number of drop-outs is more pronounced. In his research, Vincent Tinto points out the importance of cross-subject learning communities and collaborative learning to increase retention. *"Active involvement seems to be the key. Students who are actively involved in learning activities and spend more time on task, especially with others, are more likely to learn and, in turn, more likely to stay."* (Tinto, 1999, p. 6).

Positive results can also emerge from having the role as a teacher. *"Students who tutor other students profit not only on a cognitive level (i.e., become more expert in the subject they are teaching), but also on an interpersonal, affective one: their self-esteem increases and their attitude towards the course and the school or teaching and learning in general becomes more positive"* (Goldschmid, 1976, p. 26). It is worth noting that a common outfall of teaching fellow peers is to become more reflective and open for diversity. For example, in as study about student nurses participating in a peer teaching program, the students found that the peer-teachers had to change their style of teaching for different students. *"In their reflection, the students identified the need to consider different teaching styles and to consider explaining information using a variety of techniques as they recognized that people approach their learning in unique ways"* (Priharjo, 2010, p. 42). The result was the same in another study, where business managers became involved in teaching their peers and colleagues: *"The great learning potential inherent in teaching would appear to be generated as the result of a particular aspect of the teaching process itself: the encounter with diversity, which on the one hand tends to increase reflexivity while on the other hand tends to break*

down resistance to change" (Cortese, 2005, p. 87). As a result, the learning from teaching is not inert, but becomes an active quest for new knowledge. *"The teacher learns as, being aware of his ignorance, he or she wills him or herself to learn and initiates an active knowledge search"* (Cortese, 2005, p. 106). Students having the role as a teacher will also often feel that they are more autonomous with greater control and responsibility of their own learning (Goldschmid, 1976, p. 26). In addition, they also feel a responsibility for other learners, resulting in a reduction of competitive behavior (Goldschmid, 1976, p. 24). This means that the increase in frequency that was found in our study could, at least in partial, could be explained by these positive effects. This also corresponds with the possible sources of error when measuring performance. Both the ability to teach and ask for help may increase because of closer relations between the students (Touré-Tillery & Fishbach, 2014, pp. 336-337). One can argue that the time-lapse of our study, especially between the second and third survey of frequency, was too short for any such maturing to occur, but an individual learner can experience positive results almost instantaneously. For example, a single pleasant episode acting as a peer teacher can very quickly inspire the student to teach more.

5.2.2 Problems related to peer assistance

Several factors can cause problems and issues, making it far from trivial to successfully implement a system for peer assistance. On the most basic level, the relation between the peer-teacher and the peer-student can be flawed, resulting in limited learning or no learning at all. One reason for this is the peer teacher's inadequate skills. *"Too often students have been trained to become passive recipients of information. They may therefore lack important skills in peer teaching, such as finding good sources of information, asking appropriate questions, giving pertinent feedback, making contact, establishing a relationship which is conducive to learning, etc."* (Goldschmid, 1976, p. 25). Even more severe is peer assistance leading to negative learning. This is arguably more common in situations where peer assistance is used in therapy and interventions, where deviant behavior is transferred from the peer-teacher to the peer-student. *"This negative peer influence is often described as an 'iatrogenic effect', referring to the idea that a treatment intended to provide a benefit – e.g. promoting health and discouraging drug use – might unintentionally facilitate the behavior it was intended to prevent"* (Karakos, 2014, p. 2).

To avoid inherent problems in the peer to peer relation, it is important to facilitate guidance for the peer-teachers in using appropriate pedagogy and ways of communication. (Goldschmid, 1976, pp. 25-26). In situations where a deliberate selection of peer-teachers is possible, several attributes should be considered, not only academic achievements. Relations to peers and enthusiasm assisting others, are also important. In addition, too many students participating in each session can cause some students to be inactive. A good choice is therefore to organize the peer assistance into smaller groups, preferable dyads. (Goldschmid, 1976, p. 23).

A favorable selection of peer-teachers may be problematic in a system, like the reQuest app, where there is no deliberate selection of peer teachers and which includes features similar to a social network. This may lead to that only the most extroverted, social or confident students participate as peer-teachers. Even if this is a potential problem, a study about using a social network for online collaborative learning showed that most students benefitted from using the system (Li, Dong, Untch, Chasteen, & Reale, 2011, p. 411). The result from the interviews in our study also indicated that most students was eager to help other students, as long as they had the required knowledge of the subject matter. The problem of peer-teacher selection may be reinforced by introducing game elements. Without these elements most student-teachers are motivated by the positive feeling of helping others, but when these elements are included some students may be motivated by the game alone. This can lead to students that are good at playing the game, but are not competent to perform their task as teachers. A process of maturation may limit this problem. Either the students are quitting

their role as teachers, based on bad feedback, or they become better teachers with more practice. *"Past experiences have demonstrated that these attitudinal and behavioral changes toward respect for colleagues and cooperative learning can be achieved when the students begin to realize the positive results of peer teaching"* (Goldschmid, 1976, p. 25).

5.3 ORGANIZING PEER ASSISTANCE

There are many ways to organize peer assistance in higher education, but some accepted methods have evolved. For example, it is common to use more experienced students to lead seminars or lab-work related to the lectures in a course. The assumption is that it is easier to relate to a fellow student than the teacher, and thereby make it less difficult to participate in discussions and ask questions. However, the success of this method depends on the student-teacher's level of education/experience. If for example a graduate student is guiding undergraduates, the graduate student is perceived much in the same way as an ordinary teacher. It seems that the positive effect of peer assistance benefits from having student teachers more or less on the same level as the students, for example undergraduates teaching undergraduates (Goldschmid, 1976, p. 16).
Peer assistance don't have to be organized with a specific guide or student-teacher. Self-directed study groups are common at most colleges and universities, and is an inexpensive way to implement peer assistance. In addition to increasing the ability to retrieve information beyond the course, this method also avoids any authority issues emerging from having a peer-teacher. On the downside, the learning is dependent on each student's social skills and the ability to be open for other student's knowledge and meanings (Goldschmid, 1976, p. 18). By having only two students in each group (a dyad), these problems are reduced, especially if the participant's social skills are at the same level (Goldschmid, 1976, p. 21).
Another type of peer assistance is to make students become advisors for other, individual, students in a course. This type of peer assistance can also be useful for the academic staff to retrieve relevant feedback about the course, for example progress, quality of the course material etc. (Goldschmid, 1976, p. 18). At best, the relationship evolves into a friendship where the student-teacher feels personal responsible for the achievements of the guided student not only in a single course, but in a wider context, both in academic and social matters (Goldschmid, 1976, pp. 21-22).
Letting students evaluate and give feedback on others work in a peer review is also an important aspect of peer assistance. *"… giving feedback forces the students to gain insight in what is of high quality and what has improvement potential. This might again lead to more motivated students backed by feedback from their peers as well as their tutors"* (David F. Conway, 2015, p. 103).
In a study about student persistence, one of the findings was that early participation is a key factor for increased retention and preventing drop-outs. *"… students who are not involved early in the fall semester tend to stay uninvolved throughout the year. Moreover, they are less likely to perceive the institution or their peers as supportive, less likely to become integrated, and as a result, less likely to persist"* (Berger, 1999, p. 658).
A system for peer support can also fail on the institutional level if it is not fully supported. *"Experience has shown that peer-teaching situations which are initiated - either by faculty or students - with little organization and structure are not likely to survive, nor do they generally offer all the benefits they potentially entail"* (Goldschmid, 1976, p. 25). Even if the framework and organization is in place, social factors can give raise to faults. For example, students that are not concurrent with prevalent norms and values are less persistent and more likely to drop out. The campus environment should therefore encompass the norms and values of all the students, not only a selected few (Berger, 1999, p. 662).
One of the findings in our study, was that the peer assistance activity increased substantially after

the first survey of frequency. This could be explained by maturation effects and a considerable drop-out between the first and second survey that may give biased results, but observations indicated that the increase happened shortly after the distribution of the first survey of frequency. The reason for this could be that the students experienced focus on peer assistance by receiving information about the study. Before the first survey of frequency, the students had participated in a preliminary survey. One should therefore expect that the students already had experienced this focus and that the level of activity should be high in the first survey of frequency. This indicates that only repetitive information about peer assistance gives positive results and that it takes some time to be significant. If the observations are correct, it seems that simply focus on, and information about, peer assistance is an effective method to increase the activity and, assuming that the positive result is persistent, the need for a rigorous organization may be excessive. It is also worth mentioning that the information about peer assistance given to the students was only information about the study itself in addition to the questionnaires. It is possible that a more deliberate design of the information could further increase the activity.

5.3.1 Adapting to 21st century skills

21st century skills are a set of skills that relates to a rapid changing world, modern technology and digital societies and networks. They include information literacy, collaboration, communication, creativity and innovation, problem solving and responsible citizenship. Several countries implement a subset of these skills into their national curriculum for compulsory education, even though few explicitly use the term "21st century skills" in their documentation (Katerina Ananiadou, 2009, p. 4). Important dimensions in a framework for 21st century skills include *information* and *communication* (Katerina Ananiadou, 2009, pp. 9-10). Implementing an ICT based system for peer assistance, including functionality to establishing social networks where the participation can be reinforced by game elements, will directly help adapting to the 21st century skills. *"… ICT applications strengthen and increase the possibilities of communication and reinforce the development of skills of coordination and collaboration between peers. For example, it has been observed that videogames encourage young people to interact strongly with their peers…"* (Katerina Ananiadou, 2009, p. 10) and *"ICT supplies tools to support collaborative work among peers inside and outside school - for example providing constructive feedback through critical reflection on others work or through the creation of spontaneous learning communities where some take the role of students and others of teachers."* (Katerina Ananiadou, 2009, p. 10)

5.3.2 Implementation

It is important to recognize that a comprehensive implementation of peer assistance don't reduce the need for a teacher or faculty support. On the contrary, this external support is essential for a successful implementation, but shifted and aimed towards sustaining the peer support system. The teacher must expect to take a new role as a participant in a cooperative venture, facilitating peer assistance at several levels. He or she should adapt the curriculum and course material to promote peer assistance. In addition, the teacher must be prepared to solve both academic and personal problems that emerge from the interaction between peers (Goldschmid, 1976, p. 27).
The faculty is responsible for the environment where peer assistance takes place by providing proper rooms and aids for collaborative work. This may involve implementing systems for computer supported collaborative learning, usually by utilizing functionality that is already included in the faculty's learning management system. Some faculties would opt for developing their own systems. For example, at Middle Tennessee State University they use a "tailor made" online application for peer assistance in computer science classes. In a study about this implementation, the preliminary result was that the students that used the application had a much closer relationship, and was more

willing to help fellow students, than the students in the control group (Li et al., 2011, p. 411). An application supporting peer assistance could also include functionality for peer review and immediate feedback. Immediate feedback plays an important role in motivating students and work for better results (David F. Conway, 2015, p. 102). The results from the interview and observations in our study showed that the students appreciated an ICT application to support a system for peer assistance, but they also mentioned that the app should be simple to use, and that the most important functionality was to establish contact between users.

5.4 GAMIFYING PEER ASSISTANCE

The use of gamification in education is not in any way new. Most modern LMSs provide the basic building blocks for this out of the box. Gamifying peer assistance, on the other hand, is a lot less common. Even if the qualitative study shows that, for some students, helping others is intrinsically motivating, this is not true for everyone. The use of gamification makes it possible to motivate students to invest time and effort in a system for peer assistance. The qualitative study also supports this and show that there is an interest in earning rewards in exchange for performing peer assistance. The rationale is that by spending time providing peer assistance will allow those originally extrinsically motivated by rewards to internalize the values and attitudes associated with peer assistance and move towards more autonomous motivation. One more reason for expending the effort of creating a gamified system for peer assistance is that it will provide the scaffolding needed for the students to get the advantage of ZPD.

5.4.1 The reQuest mobile application

As the results show, this project was unable to gather enough momentum to get properly started. There are probably many reasons for this. The gamification mechanisms implemented in the app only make use of the development and accomplishment drive with points and a leaderboard. While this is the most common mechanisms used in gamification (Whitton, 2014), it is also one of the most misused (Deterding et al., 2011, p. 9). For long term engagement, (Chou, 2015, pp. 29-31) recommends focusing on the drives most closely related to intrinsic motivation such as epic meaning and Calling, Empowerment of creativity and feedback, and Social influence and relatedness. This would have required a lot more time designing and developing the app. In addition to reasons related to the design and development of the app, there are several other measures that would have helped. Most notably is the limited resources put into establishing the teams used in the application. As suggested by (Cialdini & Garde, 1987, pp. 167-207) working together towards a common goal will generate a feeling of community and once you have established a community, the probability of continued play increase (Montola et al., 2009, pp. 183-184). This is also reflected in the results of the qualitative study, where both groups were very positive to establishing teams at an early stage and one of the groups wanting to be able to show off their team allegiance through colored armbands. However, the limited sample in this study was probably not big enough to establish and maintain such a community. Over time, once the app is in general use, new students will probably start using the app simply because everyone else is using it (Chou, 2015, pp. 197-230; Cialdini & Garde, 1987, pp. 114-166). Another measure that could have had an impact would have been to require the use of the app as the main means of getting assistance. By using the authority as course instructors to require the use of the app, it is likely that it would have been used more (Cialdini & Garde, 1987, pp. 208-236).

5.5 GOING BEYOND GAMIFICATION

It is also possible to go beyond gamification and into the world of games. (Nordengen & Brinch, 2016) suggests the use of pervasive games to open for a wider range of emotional engagement in the game elements of the app. By extending the peer assistance tasks with an extra dimension of pervasive gameplay it might be possible to trigger emotions ranging from frustration to fiero or from amusement to wonder. While this was somewhat discouraged in the qualitative study, this ambiguity might be caused by the lack of experience with this form of gaming. The version of the app used in this project did not support this kind of extension. To accomplish this further development is needed.

6 CONCLUSION AND FUTURE WORK

This chapter summarize to what degree the research questions have been answered, concludes whether or not the hypothesis has been strengthened, and suggests possible future avenues for increasing peer assistance among university students.

6.1 SUMMARY OF FINDINGS

The thesis focuses on how the frequency of peer assistance can be increased by implementing systems with various levels of complexity. The lowest level implies a system where only information about peer assistance is given to the students. The next level requires an app that the students can use to contact other students regarding peer assistance. At the highest level, the app also includes game elements to further promote peer assistance activity. During the study, there was an increase in the frequency of peer assistance after implementing each system. Because the use of the app was low, this increase could only be explained by the focus and information the students received about peer assistance, or effects from maturation or events during the study. Even if the quantitative survey gives little information about any effects from using an app or introducing game elements, the qualitative survey and theory give indications on some characteristics and effects.

6.1.1 Will increased focus on peer assistance increase the frequency of peer assistance?

The pedagogic environment where the study was conducted was favorable for peer assistance. All three generations of learning theories were practiced within the scope of our study, but observations confirmed that the highest level of peer assistance activity was in an environment using Social Constructivism. The students helped each other both within, and across, groups during exercises and project work, and several students most likely experienced positive effects from acting as teachers or guides. The increase in frequency found in our study could, at least partially, be explained by these positive effects. Observations also indicated that a few groups experienced an evolution where the first stage was to cooperate and help each other, corresponding to Social Constructivism. They then used more and more external sources and networks to solve problems, corresponding to Connectivism. In this latter stage, the peer assistance activity could actually decrease because the students worked more independently. Some events during each semester could also influence the change in peer assistance activity, but the distinct increase between the first and second survey of frequency indicates that focus and information about peer assistance plays a significant role. This implies that implementing a working system for peer assistance, at least as a first step, can be as simple as to give the students information about peer assistance and that it is expected that the student should participate. Giving information and maintaining the focus on peer assistance will involve the teacher, but the extra workload would most likely be minimal. This was experienced by the author who was acting as a teacher for the class that took part in the study.

6.1.2 Will the introduction of a mobile application for organizing peer assistance increase the frequency of peer assistance?

Previous studies and theory show that an ICT application or system that is supporting peer assistance is favorable. The learning theories and environment that are used in modern education focus more and more on elements that corresponds to the 21st century skills, and an app for peer assistance, including game elements, contribute to the learner's ability to adapt to these skills. The qualitative study and observations gives some indications on how the app should be designed. The most obvious requirements were that the app should be stable and easy to use. In addition, several students suggested that the most important functionality was the ability to facilitate contact between the

students that needed help for a specific problem, and the students that could provide help for that problem. Any system that don't have a deliberate selection of peer teachers may be weakened by inferior quality of the assistance that is given. However, the study showed that most students were willing to act as peer teachers and the positive effects from experience the teacher role may balance any negative effects from some occurrences of poor teaching.

6.1.3 Will the introduction of game elements to this mobile application increase the frequency of peer assistance?

Unfortunately, the field study was unable to show any correlation between the introduction of game elements and the students motivation for providing peer assistance. Motivational theory suggests that it should give a positive effect, and as show in the discussion, the "just press play" project did show just that. By investing more resources into the introduction and support of the app and its game elements, the reward will probably be more use and engagement from the students.

6.2 CONCLUSION

As this thesis was unable to give a conclusive answer to all three research questions, the hypothesis that using game elements will increase a student's motivation for providing peer assistance is neither strengthened nor weakened. However, it has shown that focus on peer assistance will increase the participation and activity, given an environment that is favorable for peer assistance. Also, the qualitative survey suggests that an ICT application would be effective if the application made it easy to establish contact between peers and distribute information about the problems students want help to solve. In addition to this, theory suggests that to motivate the students requiring external incentives long enough for them to internalize the value of peer assistance, a voluntary set of game elements should be included in the application.

6.3 FUTURE WORK

There are many improvements and additions that can be made to increase the benefits a solution such as this facilitates. More effort is needed to introduce students to the application and the benefits of peer assistance. As Adrienne Decker and Elizabeth Lane Lawley has shown with their project "Just Press Play", including social achievements could have a positive impact by increasing the number of participants and overall activity. One concrete example would be to integrate it into the activities happening during the introduction week at the university. The new students can be assigned to their teams as a part of the initiation, and receive achievements for social arrangements such as concerts, parties and competitions. Closely related to organized social activities, team activities placed within the magic circle of a game, can be used to improve the experience. Going beyond the traditional gamification techniques such as points, badges and leaderboards should appeal to the current generation of students whom have grown up with this kind of entertainment. Going even further, blending game scenarios with reality is another genre with its own merits. By employing pervasive game techniques, activities can be woven into a storyline where they are given a higher purpose in this alternate reality than they have in the "ordinary" world. And finally, as revealed in the qualitative study, not everyone is interested in games and competitions. To some the knowledge of the need for and the ability to give aid is sufficient. The level of involvement should therefore be the choice of the user rather than being compulsory. By allowing for a more varied experience, it should be possible to engage a larger audience.

7 APPENDICES

APPENDIX A - SOURCE CODE

SOURCE CODE	FILENAME
MOBILE APPLICATION	reQuest.zip
BACKEND SERVICE	reQuestWeb.zip reQuestUpdateService.zip

APPENDIX B - COLLECTED DATA

COLLECTED DATA	FILENAME
PRELIMINARY SURVEY	ResultsPreSurvey.xlsx
FREQUENCY SURVEY	ResultsFreqSurvey.xlsx
REQUEST APP USAGE DATA	reQuestAppUsage.xlsx

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