**Master of Information Systems:
Digital Business Systems**

Tired of reminding your coworkers?
An experimental study on the effects of gamification on task performance

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Abstract

Gamification is a rising trend in academia and an exciting concept for practitioners across different industries. There are many promising effects related to gamification, but all are related to increased engagement. One specific domain that is intriguing is in project management, as there are many routines and processes related to projects that might be considered tedious. Regardless, task performance has to be high in order to reach goals on time. This thesis has examined if gamification could boost engagement and subsequently task performance. With the help from a case company in the construction industry, gamification behaviours were explored through a between-group experiment in a natural setting. Intentional data was gathered and analyzed as well, in order to test both the actual and perceived effects of gamification. In parallel, an experiment in a more controlled setting was also conducted in relation to the COVID-19 pandemic, where a group of participants were recruited to do tasks related to official guidelines and advice on hygienic and personal well-being in state of emergency.

This study aims to examine the grand promise of gamification; increased engagement. Being able to examine from two vastly different settings gave unique insight of what engagement can be inflicted by gamification, and how to design good gamified systems. A technical checklist process application was developed with the ability to switch on and off gamification elements to collect data. Despite a small dataset, the findings showed a tendency that there are indeed more engaged users in gamification in contrast to users not not being exposed to gamification. Therefore, applying gamification to combat tedious aspects of work life is proven to be a promising future avenue.

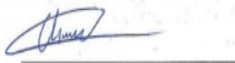Keywords: Gamification, project management, task management, experiment

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We certify that the work presented in the thesis is our own unless referenced

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1. Introduction

1.1. The Problem Domain: Engagement in Work and Tech

For every two employees who report to be engaged at work in the United States (US), there is one that reports to be disengaged. While that might initially seem acceptable, a whopping 50 percent report to be in the blunt category of simply "not engaged" (Gallup, 2019). This can potentially lead to job dissatisfaction, leave of absence (Fisherl, 1993) or intentions to quit (Saks, 2006). On the flipside, high employee engagement is positively associated with organizational commitment and organizational citizenship, as well as customer satisfaction (Harter, Schmidt and Hayes, 2002). Engagement is crucial in project performance as well, as it is shown to have a positive effect in several instances, among those we find task performance; activities that are related to the formal job (Torrente et al., 2012). Failing to deliver projects on time has several implications, especially monetary penalties and loss of credibility. This is a risk projects of larger size tend to have (Tukel and Rom 1998). If engagement is ensured, then productivity can be elevated. As soon as productivity is set in

motion, this allows a redirection of focus towards more profitable efforts (Humlung and Haddara 2019). Based on this, it is important to create technology that serves its function, as well as keeping employees engaged in their job.

Information technology (IT) and information systems (IS) are usually among the main tools for enhancing performance, and we often look towards them in order to find a solution to our problems (e.g. Spiro and Nix, 2009, Keim 2010, Sadik, 2008). Such a problem can for instance be lack of engagement. However, IS systems themselves face the same challenge, users not being engaged in using them (McAfee, 2006). As a result, a massive stream of research in the IS field concerns itself with challenges regarding technology adoption[1]. Nevertheless, companies continue to face the challenge of bridging people and technology in the workplace, 65 percent of executives report tech-related annoyances, over 30 percent of employees claim that workplace tech does not induce progress in their most important work, and only 50 percent of employees agree with their executives that their needs are being paid attention to when introducing new technologies (PwC, 2018). This can translate into typical IT-related challenges such as incorrect usage, poorly developed technology or lack of understanding user needs.

Another part of the reason users are not engaged can be linked to the argument that when something is streamlined and optimized, it could easily be considered unengaging (Hosseini and Haddara, 2019). While technology has made many tasks and actions easier, we are still required to interact with the technology at some point in order for it to do what we need. Calculators need us to punch in the numbers, e-mails need to be written, sensors must be worn and data needs to be analyzed. Streamlined interaction is becoming a routine, work becomes repetitive, unrewarding, and feels unimportant, in short, the interaction is perceived as boring.

1.2. The Promise of Gamification on workplace technology engagement

Keeping users engaged is effortlessly being done in one particular industry: games. The gaming industry reached a total revenue of 134.9 billion dollars in 2018, a 10 percent growth compared to the preceding year (GamesIndustry.biz, 2019). 60 percent of Americans report playing daily, and of those, 70 percent are older than 18 years. The player demographic is quite evenly split between the genders (Entertainment Software Association, 2019). Because of its massive traction and the technology becoming cheaper, games have started to receive the attention of many industries such as education, health, banking and construction and academics, with the goal of achieving the same engagement that people have in games into IT systems and workplaces (Hosseini and Haddara, 2019). Games are fundamentally different from the majority of IT systems, as the measurement of worth is not in how well the game can serve a function, but rather if the game is being played or not. More play (use) equals more worth. IT systems generally are viewed as utilitarian, as in serving a pure

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[1] *138.000 results on "technology acceptance" on Google Scholar as of fall 2019.*

practical function. Games are hedonic in nature, which means that their primary purpose is being a pleasant sensation. The two are thus inherently different.

The push is now towards unifying the hedonic and utilitarian qualities into one. At the forefront of this trend, we find gamification. It is applied in non-game settings with the idea that the game elements will elevate the experience of doing a task or process; thinking about something trivial like jogging or cooking as an activity that can have elements of for instance competition, cooperation, exploration or storytelling. As Kapp (2012) puts it, gamification is "*the idea of engagement, story, autonomy and meaning*". Consequently, he states that gamification aims to gain positive outcomes and behavioural changes as a result of the process. Those engaging in gamified systems should *want* to invest their time and energy, not feel obligated to.

Gamification has already been proven to be highly successful at engaging when applied correctly (Burke 2014), and therefore bears much promise for organizations looking to optimise their business. If applied correctly, gamification can create a positive and meaningful experience for employees when interacting with workplace technology, which in turn can mitigate the probability of IT resulting in lack of engagement.

1.3. Challenges in Gamification

The field of gamification bears several challenges as it is relatively new and thus lacks unison on definition and best practices. Furthermore, there is a discussion around which research field it belongs to, and it is often misinterpreted as "exploitationware" (Bogost, 2013) or simplified through the misunderstanding that it is making something "game-like" (Landers, 2018).

This thesis argues that the above mentioned challenges are taking focus away from a greater problem in the field of gamification; there is a lack of cases which has successfully isolated the effect of gamification where engagement has been boosted. While it is hard to isolate any variable in natural circumstances, there is room for improved effort in this area.

1.4. Research Purpose and Objectives

This thesis aims to contribute to the body of gamification literature by adding empirical work explaining and isolating what direct effect gamification and gamification design elements have on engagement while keeping the theoretical foundation of gamification in mind. This will be done by deploying a gamified application amongst workers in a project in the construction industry.

The case company operates as a coordinator of Building Information Modeling (BIM), and is responsible for ensuring the integration of the work of several participants in a project, spanning across many disciplines, in a variety of projects. Following Sommerville, Craig and Hendry (2010), a project manager is generally *taken to be the person accountable for delivering a project safely, on time, within budget and to the desired performance or quality*

standards determined by the client". Anantatmul (2010) points out the management of teams composed of different disciplines as part of the management of a project. As such, the tasks and roles of a BIM coordinator highly resembles that of a project manager.

In order to support the work of the BIM coordinator and keep the project moving forward, workers from all the different disciplines are given reporting tasks in addition to their routine. This can for instance include filling in self reporting checklists about their work that is connected to the BIM model. The BIM coordinators in the case company often face problems related to these reports (late, incomplete or none delivered at all. This in turn compromises the work of the BIM coordinator, who then has to spend time requesting and waiting, going over and checking these reports resulting in time being lost, all contributing to misuse of time and decreased efficiency of the project. The mission in this thesis is to mitigate these issues through applying gamification to the above mentioned process and accompanying technology. The ambition is to engage workers to deliver high quality work on time and thus avoid the BIM coordinator having to spend time and effort reminding them.

The task of making workplace technology more engaging is broad and complex. While the focus of this particular project might seem narrow and highly specific towards a given context, we believe the findings can be useful for several purposes:

- Serve as a vantage point for the exploration of gamification for engaging workers in project management.
- Understand gamification in the context of integrating and aligning different participants in a project. If results are positive, it justifies a deeper exploration of, and investment in, applying gamification to a wider selection of not only the coordination processes in construction, but also in similar contexts where participants are dependent on correct and timely deliveries from each other such as for instance software developing, different types of engineering, or simply; project management in general.
- Due to its name which might indicate "play" or "unseriousness", gamification in itself could easily be discredited by researchers and practitioners. Through this project, we seek to validate gamification as a serious tool for engaging people and elevate their experience of doing a task and in return elevate the results they produce.
- This project tests gamification in an industry which has not yet received much attention from academics and practitioners of gamification. If results are positive, it will showcase that gamification is generative and can be applied in a variety of contexts and fields, illuminating the power it can possess.

The area of interest in this project is not primarily to expose different designs of gamification as the design will vary depending on the context. On the contrary, the purpose is to isolate and understand the effects of gamification design elements as a method or technique to generate engagement.

This all leads up to the following **research question:** *Does gamification have a positive effect in engaging people to do quality work?*

2. Literature Review

2.1. Method

In this literature review, all papers have been identified through the Google Scholar database by researching the combination of the following keywords: "gamification", "gamify", "project management", "task management", "user engagement", "project team", "information systems", "factors", "team" and "people". The search was conducted in October and November of 2019. All papers had to be peer-reviewed to be included in the thesis, and include the most seminal papers in both literature domains (project management and gamification). Below is a quick overview of the review process:

- A search was conducted on gamification literature, specifically on history, definition and in practical use.
- Secondly a similar search was conducted for literature on project management, task management and BIM.
- A number of articles were collected, the abstract and introduction read to check relevance towards the thesis. Those deemed less relevant were abandoned.
- An additional search was done by scanning through the reference list of the collected articles to potentially find any articles which would be relevant for this thesis.

2.2. Project Management

The main goal of this case is to help project managers ensure success in terms of operational views[2]. In our context, that translates into task management, completion and performance. The importance of task management in projects is in many ways given. One of the most salient leadership models, the Situational Leadership Model, emphasizes the importance of task management (Hersey, Blanchard and Johnson 2001). They refer to it as directive behaviors, behaviors that give directions, establish objectives and methods, define roles and introduce how goals are to be achieved (Hersey, Blanchard and Johnson 2001). The orientation towards people is equally important for project success. Task and people must be balanced (e.g. development tasks should be made for developers), as a high level of team and task conflict is found to impair overall satisfaction in a project (Cserháti and Szabó 2014).

In order to understand how gamification can be applied, it is important to create a solid foundation of knowledge tied to the problem domain. In the next chapter, the aim is to establish an understanding of the project and project management literature, and to apply this as a vantage point for diving into a more granular view of the different underarching task management aspects. This will provide a more precise point of departure for the review of

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[2] Reduce the amount of time spent on correcting and/or waiting for reports for the BIM coordinator.

the gamification literature, and in turn a broader understanding of the research question and the project design.

2.2.1. Tasks, People and Project Management

Following Munns and Bjeirmi (1996), there is a need to separate projects from project management (PM). While a project in broad terms is described as a series of resource consuming activities towards a specific objective, PM is the process of controlling the achievement of said objective. This includes *"defining the requirement of work, establishing the extent of work, allocating the resources required, planning the execution of the work, monitoring the progress of the work and adjusting deviations from the plan"* Munns and Bjeirmi (1996). Once the objective(s) is reached, all management activities will cease. As they state, PM is considered a short term undertaking compared to projects which are more long term in their focus and goals.

As presented by Baker, Murphy and Fisher (1988), a project can be assessed as successful despite not fulfilling the operational requirements. To illuminate the importance of this distinction, one can for instance look to the Sydney Opera House, which would be considered a failure according to operational factors as it took more than three times the allocated time and over ten times the proposed budget. Nonetheless, it is now arguably one of the world's most famous buildings and serves as a strong tourist magnet for Sydney. Few people would deem the project a failure according to the perceived end result (Shenhar and Dvir 2007).

Understanding PM and project success is more nuanced. Baker, Murphy and Fisher (1988), in their argument that operational/process factors are not sufficient to assess project success, point out that what matters in assessing project success is *"[...] whether the parties associated with, and affected by, a project are satisfied."*. By "parties", they refer to the customer, the developer, the project team, and the end-user. What is notable about their definition is that it specifically refers to the project members. Shenhar and Dvir (2007) sharpen this focus on team by separating the different views into three: operational/process, strategic/business and team/leadership. Such views are also supported by Belassi and Tukel (1996) and Baccarini (1999), they all bring team related factors into the equation for project success. This all underlines that PM success should be understood by more than operational views, as PM also includes the management of teams (Anantatmula 2010). True to this, the PM area has been taking an interest in what Cserháti and Szabó (2014) refer to as the "*task and people-oriented focus of leadership*", essentially fusing operational-oriented leadership and people-oriented leadership[3] into one way of leading. They conclude that several studies highlight the human factor as a key element of successful project implementation. The importance of the people-view on success is also highlighted by Cooke-Davies (2002) as they conclude that there are human dimensions included in all success factors, rendering the

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[3] Operational-oriented: Give directions, establish objectives and methods, define roles and how to achieve goals.
People-oriented: Provide social and emotional support, share information and request input; based on two-way communication **(Blanchard, 2010)**.

final project outcome completely reliant on the quality of processes performed by people. Focusing on people is generally viewed as a good strategy toward project success.

On that note, Cooke-Davies (2002) brings up the issue that much research regarding project management and people is mostly concerned with what the people are doing, rather than investigating the quality of their interaction with team members, decision-making practices and motivation. This is an important finding, as such interpersonal and behavioural factors are found to have a positive effect on the satisfaction of team participants (Cserháti and Szabó 2014), which in turn can bring the project closer to success.

The literature is still having trouble determining causality between specific variables and project success (Chan and Scott 2004). In essence, due to the complex view(s) on what constitutes project success, it is hard to know what positive reinforcement to make, as projects continue to fail despite the evolution of project success frameworks (Cserháti and Szabó 2014).

It can therefore be interesting to look towards mitigating failure factors. The aim in this case is to mitigate the issue of the case company by engaging employees by the use of gamification. The findings from the literature review encourage a focus on task and team related factors in PM to guide our implementation of gamification. Baker, Murphy & Fisher (1988) list 29 factors which strongly affect perceived project failure (see appendix 1 for an overview of these). Out of those, 12 are relevant for the team related view on project success. Two failure factors in particular are of interest to the task context: Insufficient use of status/progress reports and use of superficial status/progress reports. They also list 23 factors which strongly affect perceived project success of which five are relevant for the team related view on project success. The heavy amount of team related factors on the failure side also highlights the importance of team related factors for mitigating any hindrances of success. Finally, 10 factors are listed which affect the project linearly to both perceived success and failure (the presence of them can lead to more success, while the absence can lead to more failure). Four are found relevant for the team. In conclusion, out of a total of 62 potential affecting factors, 23 (37%) are related to the project team and tasks.

Project Management and Information Technology
Before finishing this section, we need to understand the role of IT in all of this. Implementing IT has been one of the main drivers for optimizing and enhancing products and processes in many fields such as information integration, communication, supply chain and innovation, and PM is not an exception (Anantatmula 2008). Interestingly, while the implementation of IT generally has resulted in positive outcomes (e.g. (Wamba et al. 2017), (Prajogo and Olhager 2012), (Koellinger 2008)), project success has not been found to be particularly affected by the implementation of computer supported PM processes (Dvir, Raz and Shenhar 2003). While those findings date back to 2003, Mir and Pinnington stated in 2014 that despite advancements in PM processes, tools and systems, project success has still not improved by any significance. The 10 year span between the two research articles have granted a lot of time for technology advancements, and one would assume that the problems would be mitigated along with its evolution. Nevertheless, project success has still not been positively

affected by infusing technology in PM. This firstly supports the notion that it is hard to correlate certain factors with project success, and secondly that one cannot distinguish one particular reason for IT not aiding in project success (e.g. poorly implemented technology, wrong use and so on.). However, it can be of interest to apply gamification to the IT-supported processes in PM. If it has a positive effect, this serves as evidence that simply digitizing and optimizing something in a operational/utilitarian manner is not enough to create a positive effect for users, and that the people-oriented aspect is important as well.

2.2.2. Task Management

The question of whether one allocates and prioritizes tasks effectively is a trouble many people will sympathize with (Bellotti and Smith 2000). In Human Computer Interaction (HCI) literature, there has been much research focused towards personal information management (PIM) on the problem of efficient organization of documents. Yet, less attention has been paid to task management. Specifically, tools which can help people assess the current state, extent and priority of a task that needs to be completed (Bellotti et al 2004). Referring back to Baker, Murphy & Fisher's (1988) 29 factors affecting perceived project failure, one can look towards the two task related project success factors of particular interest, insufficient use of status/progress reports and use of superficial status/progress reports. It is interesting to investigate how a task management system can help project managers create, understand and prioritize tasks for their team members.

In task management there is a difficulty level between tasks. Some are complex, others so complex that they are divided into smaller portions (Riss, Maus and van der Aalst 2005) and finally we have routine tasks which revolve around daily/weekly habits (Belotti et al. 2004). All tasks are not equal, as both the task itself and the context in which it must be executed varies in complexity (Riss, Maus and van der Aalst 2005). Separating complex tasks and routine tasks is reasonable. Routine tasks tend to have no need of explicit reminders as they are already part of a person's habits (Bellotti et al. 2004).

However, despite the project manager's wishes, not all desired tasks are habitualized, which in turn leads to the need for reminders. The automation of routine work is found to have a positive impact on project scope management (Javernick Will, La Ratta and Corvello 2017). If a project manager can habituate routine work such as self-reporting checklists for their project team, more of their efforts can be turned towards other aspects of their roles.

Routines as repetition of a behaviour in a consistent context is key to habit formation (Lally et al. 2009). Furthermore, the researchers find that on average, one can expect a time frame of 66 days before a behaviour is automated (thus becoming a habit). However, habit formation is found to happen quicker, down to 18 days at the minimum. A project manager will yearn for a quick establishment of habits in the team. A good opportunity to do so is to create a consistent context for the routine. If that consistent context is engaging as well, one can assume that users keep coming back at their own initiative, potentially resulting in making that routine a habit quicker.

2.2.3 Task Management and Routine

What happens when the consistent context crumbles? Such is the case of the COVID-19 pandemic which washed over the world in 2020, and all public places and events were rapidly shut down, leaving people unable to carry out their daily routines.

The sudden changes in daily routines and habits ensuing the pandemic provided an opportunity to expand the project and include a second context in which gamification of task management could prove beneficial; when personal routine is lost due to a pandemic outbreak. In regards to gamification, an understanding of context is essential in order to create fitting gamified systems. Following is therefore a brief literature review on task management in the context of loss of routine.

2.3. Gamification

In order to properly utilize gamification and design good gamified systems, it is essential to understand the gamification concept as a whole. The concept is relatively new, and while its popularity has risen, there is still lack of an unison understanding of what gamification is. A thorough literature review on the field is therefore provided.

2.3.1. Definition

Gamification has quite a chaotic history which may contribute to its highly contested background. The term was coined in 2002 as far as to the extent of our knowledge (Liu, Santhanam and Webster 2017), but the concept of using game elements in non-gaming context can be argued to have existed since the 1980s. Popular marketing tactics such as loyalty programs with the introduction of loyalty cards, point accumulation and reward tiers are typical examples that have made up the foundation for gamification (Werbach and Hunter 2012). Beyond that, militaries have been using war games for centuries. Many historians believe that the 7th century game Chaturanga may be the first game that used pieces to serve as military figures on a fictional battlefield for war training. In more recent history, teachers, faculty members and cooperative trainers have been using game-like techniques for a long time as well (Kapp 2012). What is new however, is the bringing of all these elements together and understanding them in relation to each other. Gamification as a concept started to get rapid traction as late as 2008 among practitioners, around the same time the term "officially" entered the academic domain (Deterding et al. 2011, Seaborn and Fels 2015).

2.3.2. Separating "game" and "play"

Because of the fragmented background, gamification is often referred to with alternative terms such as "gamified" or "gamify" (Deterding et al. 2011, Seaborn and Fels 2015, Liu, Santhanam and Webster 2017). This results in it being mixed up in concepts which are similar but not the same such as game-based learning or serious games (Deterding et al. 2011, Seaborn and Fels 2015).

With the aim to unearth and organize this mess, Deterding et al. (2011) wrote a seminal paper aspiring to properly conceptualize gamification, as well as pointing out that there is a difference between something having "playful design" in contrast to "gameful design". While playful design is more freeform impreversational behaviour (the "goal" being to play freely) (Deterding et al. 2011), gamification is rooted in gameful design principles, but is structured by rules and goal oriented processes. This is what makes gamification suitable outside a non-game context, as it has an *aim*, usually to encourage behavioural change. During their examination of the history behind gamification, Deterding et al. (2011) came with arguably the most cited definition of gamification to date: "*gamification is the use of game design elements in non-game context[s]*".

2.3.3. But what *is* gamification?

Many of the earlier academic contributions to gamification literature had the main goal of conceptualizing, discussing and analyzing what it entails for something to be defined as gamification. Seaborn and Fels (2015) in their literature survey synthesized a significant portion of the gamification in theory, and concluded that most researchers have a shared agreement that gamification is inspired by games/game theory/game design, and that it is used in non-game context, quite accurate to Deterding et al's (2011) definition. Despite the researchers being somewhat in harmony on this, the field still experiences difficulties when identifying what it actually entails for something to be gamified, as the definition arguably is quite vague. Many of the big questions raised are related to the fact that there is subjectivity in determining when a system is gamified versus it being a game. This is why other researchers such as Houtari and Hamari (2012) aimed to view the definition from a more psychological and social science point of view. Their main argument against the more "technical" definition is that you cannot identify gamification solely on a set of game design mechanics and principles. They point to the example that dashboards, loyalty programs and other marketing tactics would fall under this definition, effectively saying that such elements are not gamification.

This leads to one of the major criticisms against the Deterding et al. (2011) definition, that not every game design element in non-game contexts should be considered gamification. By such a logic, almost everything that includes a progress bar or a leaderboard would be gamification, like for instance a business intelligence dashboard. Werbach and Hunter (2012) back up the view of Houtari and Hamari (2012), arguing and proposing that the definition should pivot into saying that gamification should make processes more "game-like", and take into account the psychological perspectives attached to it.

Zichermann and Linder (2010) also view gamification in a similar manner as Houtari and Hamari (2012), with Zicherman (2011) especially taking it a step further by connecting it to self-determination theory (SDT). SDT is a macro-theory which looks into the motivations of human behaviour, and is being used to understand people's behaviour in sports, health care, religion, work and education. The theory has several sub-theories, and connects to concepts such as feelings of autonomy, competence and relatedness, concepts which are tightly linked

with hedonic experiences in games as they are found to be associated with enjoyment (Kapp, 2012).

2.3.4. Effects of Gamification

Connecting gamification to learning theory highlights the importance of not forgetting the effect gamification aims to have which is to foster human motivation and performance in a given activity (Sailer et al. 2017). This translates to engagement. When motivation is internalized within an individual, it becomes a driver of good quality engagement (Ryan and Deci 2000), and has naturally received much attention amongst gamification researchers (e.g. Alsawaier 2018, Mekler et al. 2017 and Sailer et al. 2017). However, not all motivation is found to be internal. There are two main types: an action is *intrinsically* motivated when it suits an inner desire (the joy, learning or feeling of accomplishment), while on the other hand actions are *extrinsically* motivated when external rewards being offered, or in avoidance of a consequence (Ryan and Deci 2000). This separation of motivations would initially lead gamification designers to focus their efforts towards designing experiences that taps into intrinsic motivations.

However, while extrinsic motivations cannot be transformed into intrinsic motivations, they can become internalized (Deci and Ryan 1985). This makes extrinsic motivations attractive for gamification designers, as it then can lead to greater persistence, positive self perception, and finally, better quality of engagement. Extrinsic motivations have also been found to positively affect performance quality (Mekler et al. 2017). Therefore Zichermann (2011), suggests that gamification implementations must take into consideration both intrinsic and extrinsic motivation to maximize the effects.

As noted by Mekler et al. 2017, lacking the comprehension of intrinsic and extrinsic motivations can lead to the undesired effects. For instance, a case of implementing leaderboards to motivate and reward employees resulted in many feeling they were micromanaged and were under the whim of an "electronic whip" (Liu, Santhanam and Webster 2017). This is arguably a result of not understanding the target group and context in which gamification is applied. Hamari and Tuunanen (2014) bring up the importance of this, comparing it to segmenting customer groups in the marketing industry. This can be illustrated in Kapp's (2012) fourth gamification element, conflict, competition and cooperation (Appendix 2). In the case mentioned above, a better approach might be to implement game elements that promote cooperation instead of competition. As pointed out by Hamari and Tuunanen (2014), it is important to understand the target segment in a nuanced manner, as it quickly can result in simplifications and speculation if not. They bring up the four player types (killers, achievers, socialicers and explorers) introduced by Bartle (1996) as a central contribution to this issue. Bartle (1996) introduces the difference between the player types and how they interact, and provides guidelines as to how game designers can emphasize one type of play over another. For instance, males are found to be more motivated to conquer and outdo other players than females, who are more interested in their own performance (Heeter et al. 2011) and previous research has shown that collective work engagement increases task performance of students working in groups (Salanova et al., 2003). Following Hamari and

Tuunanen (2014), a player type "*essentially refers to an emphasis in the set of motivations or behaviors*". Therefore, having an understanding of player types is helpful in understanding how to apply the correct gamification elements in a given context, depending on the desired effect.

2.3.5. Socio-technical?

While the push towards viewing gamification as more of a social science-grounded concept resulted in important understandings of it, gamification can arguably not be completely viewed to belong in those fields. Looking at Kapp's (2012) overview of the different elements of gamification, it is made up of many hard-to-measure elements such as abstractions, conflict/cooperation, storytelling etc. (see Appendix 2). This demonstrates that gamification is a complex concept, as it is a combination of physical and non-physical elements, adding to the confusion as to which scientific field gamification should fall into. Therefore, while the discussion between social, psychological and technological belonging have resulted in a better understanding about what gamification *is,* it has not led us towards better understanding *how* it is done.

In order to illuminate this, Table 1 summarizes and analyses how the concept is being defined and understood by different researchers:

Table 1: Overview of gamification definitions

	Definition	Authors, Year	Technical	Social	Effect
1	Gamification is the use of game design elements in non-game contexts	Deterding et al., 2011	X		
2	Gamification is the incorporation of game design elements into a target system while retaining the target system's instrumental functions	Liu et al., 2017	X		x
3	Gamification as adding game elements to an application to motivate use and enhance the user experience	Fitz-Walter et al., 2011	X	X	X
4	Gamification as a process of enhancing a service with affordance for gameful experience in order to support user's overall value creation	Houtari and Hamari, 2012		X	X
5	Gamification is a tool for supplementing branding initiatives through the application of game elements and mechanics	Zichermann and Linder, 2010	X	X	
6	Gamification is the use of game thinking and game mechanics to engage users and solve problems	Cunningham and Zichermann, 2011	X	X	X
7	Gamification is the use of game-based mechanics, aesthetics, and game thinking to engage people, motivate action, promote learning, and solve problems	Kapp, 2012	X	X	X

2.3.6. Gamification from the Technological Perspective

The common theme among the researchers examining and conceptualizing gamification is that gamification must have strong and specific user engagement with instrumental goals,

achieved by using game design elements (Seaborn and Fels 2015, Liu, Santhanam and Webster 2017). This serves to position gamification in the IS field. However, there is no explanation, framework or description on how these game design elements should be chosen to achieve specific tasks and to create a desired user engagement and interaction (Liu, Santhanam and Webster 2017). This refers back to one of the major criticisms gamification has received, where they take issue with the most "standard" approach of just implementing points, badges and leaderboards to any task and call it a day (Kapp 2012, Bogost 2013), completely disregarding the contributions from the social science researchers of motivation, social and psychological factors and context (Landers 2018, Landers et al. 2018). This highly technical approach of implementing gamification is criticized both by game designers and researchers, as they argue that you take the "least" essential parts of game design and implement it as the core pillar and experience for users in gamification (Kapp 2012, Seaborn and Fels 2015, Landers 2018). In response to this, Liu, Sanathanam and Webster (2017) have proposed a framework to help guide researchers to properly evaluate, examine and incorporate proper theory when designing gamified systems.

Another point of contention is that disregarding the social-psychological context in such design choices is that risk of backfiring on users. It can result in a disregard and/or lack of understanding intrinsic and extrinsic motivations in the given context. This adds to the argument that the design part of the gamification definition should not be viewed as "simply" a technical implementation. It should also imply an understanding of the social/psychological theoretical foundations of gamification in the social context.

2.3.7. Gamification in Action

Gamification has been implemented across many different domains. Even though the literature is quite young (considering there is a lot of papers still discussing and conceptualizing it), there still has been empirical work done to explore behavioral effects and experience gamification has on users. According to Seaborn and Fels (2015) who did a systematic survey of gamification in action, explains that the majority of the studies lacked proper reference to the theory or mention or address the theoretical foundations (Seaborn and Fels 2015, Hamari, Koivisto and Sarsa 2014). This can be alarming as it limits the growth of the field both in terms of its practicality, but also in theory. Another point of contention is that there is a lack of comparative and longitudinal cases, which could isolate and provide evidence for the effect gamification specifically has had.

In the majority of the cases, gamification was applied to increase user motivation, engagement and lastly to change behaviour (Seaborn and Fels 2015 ,Hamari, Koivisto and Sarsa 2014), What was interesting is that a very small minority actually used gamification to increase measured the enjoyment of the systems use (Seaborn and Fels 2015, Alsawaier 2018).

Many studies do not take into consideration Bartle's (1996) player types when designing their gamification implementation. Seaborn and Fels (2015) supports this, arguing that such missing considerations result in failed implementations of gamification. Bringing more

importance to understanding users and context can possibly help bridge the gap between theory and action. This can also lay the foundation for understanding why certain game design elements do or do not work in particular domains and contexts.

The most widely used game design elements are points, badges and leaderboards, which can explain why the industry is still scratching the surface of what gamification can achieve. As we know from Kapp's 12 game design elements (2012) (Appendix 1), there is a wide variety of combinations and elements that can be adopted to achieve the desired effect. This showcases that mostly, practitioners are very modest in applying and experimenting with different game design elements in gamification.

A majority of studies in the educational domain have largely found gamification as a positive appliance and successful in terms of increasing motivation and engagement within their users (Hamari, Koivisto and Sarsa 2014). It should be noted that these studies also managed to connect the empirical data to a theoretical foundation, specifically Self Determination Theory in all cases (Seaborn and Fels 2015, Koivisto and Hamari 2019). This is also where gamification has been found to have the most proven effect, in engaging people (Seaborn and Fels 2015, Hamari, Koivisto and Sarsa 2014, Kovisto and Hamari 2019).

2.4. Gamification and Project Management

Before drawing conclusions about the effect of gamification in project management, previous research on the topic was reviewed. Most gamification studies have been organized in the education and health domains (see Seaborn and Fels 2015, Hamari, Koivisto and Sarsa 2014, Kovisto and Hamari 2019), yet there are still some studies done in project management. As argued by Sammut, Seychell and Attard (2014) it is one of these areas where the potential benefits for gamification is exponential (Sammut, Seychell and Attard 2014). They developed two prototypes to help with data gathering within a project. One of the prototypes was a basic project management system, while the other prototype was the exact same featuring the gamification elements: experience points, leveling system, visual elements and badges. They aimed to discover whether gamification managed to increase employee motivation and/or if the implementation of these features would complicate the existing workflow. Data were collected by semi-structured interviews with the participants. Their findings showed that all of the participants were generally positive towards the gamified prototype, but not all design elements were equally received as positive. For example project managers were critical towards badges, whereas developers found them very motivating and rewarding (Sammut, Seychell and Attard 2014). They concluded with the prototype being successful, but realized they needed to be more mindful about what elements should be implemented, and maybe not every role in a project team should have the same gamification mechanics (Sammut, Seychell and Attard 2014).

M. Pereira et al. (2017) also aimed to gamify an agile project management process tool called iMobilis, with the hope of increasing the speed and delivery of tasks in each sprint. Their results showed that participants in general found to be more engaged, but more

interestingly they also showed an increase in collaboration amongst the team members, which indirectly resulted in increased productivity (M. Pereira et al. 2017).

2.5. Knowledge gaps

There is a lack of consensus in the definition of gamification and how it is perceived. Adding to that is that there is not much provided description, explanation or framework for implementing gamification. These issues can relate to that gamification still is a young academic domain, so little empirical work exists. More specifically, few empirical studies have been initiated to prove and isolate the effect of gamification with proper reference to theoretical foundations. There are also few qualitative, longitudinal and comparative studies on the field.

In conclusion, gamification seems to be useful for project management. In addition, the following insights are important for this research project:

- As it is hard to determine causality between specific variables and project success, we find it more fruitful to mitigate any barriers that might hinder success in project management.
- Little research is conducted on the quality of people's interaction with team members, decision-making practices and motivation in project management. This leads to the question about how the team related factors in project management affect the choice of game design elements in gamification.
- While the discussion between social-psychological and technological belonging has resulted in a better understanding of what gamification *is,* it has not led toward a better understanding of *how* it should be done.
- When choosing the *technical game design elements*, one needs to take the *social and psychological factors of the particular context* into consideration. This is the biggest contribution for non-technological researchers in gamification.

2.6. Research Framework

With the literature review and research question in mind, the research model for this thesis is presented. The table below showcases the suggested relationship between the independent variable (gamification) and dependent variable (task performance). Below we list the influencing factors on the two, as well as potential moderating variables in the middle column. The following sections elaborate on all three variables.

Table 2: Research framework

Independent Variables	Moderating Variables	Dependent Variables
Gamification - Rules - Competition - Time - Reward structures - Feedback - Aesthetics	- Gender - Game literacy	Task performance - Quality - Timing

2.6.1. Dependent Variables

This project seeks to make a habit for users to deliver on time and of highest quality as quickly and effectively as possible. As brought forward in the literature review, habits are closely linked to routine (Lally et al., 2009). In the introduction the idea that routine can result in work becoming boring is presented. The probability of establishing habits quickly out of tedious routines is arguably slim - at least slimmer than it needs to be.

Gamification has been proved to increase engagement with users, especially in contexts related to learning/training which has a set amount of daily routine work. The aim of this thesis is to examine whether gamification can have the same similar effect on task performance in project management, especially if the quality remains or increases during repeated deliveries over a longer stretch of time, creating better and more stable habits for routine work in task performance. Two factors make up task performance in our research model, quality and timing.

Quality (approval rating)
Performance is measured based on quality of work. Following Cooke-Davies (2002) from the literature review, the final project outcome is completely reliant on the quality of processes performed by people. In the context of project management, the objective is to specifically look into task management, completion and performance. More precisely, whether gamification in routine tasks can increase both on-time delivery and quality of work in project management through habitualizing routine work. The quality of work is measured by making use of controllers that will check if the task has been done, and then give a rating of "approved" or "not approved" depending on the result, inspired by two-way authentication. From there a percentage will be calculated and will represent the quality of the delivery (calculated based on amount of approved versus not approved).

Based on this, the first assumption is:
A1a: *Gamification will impact higher quality of work in task performance*
A1b: *Gamification will help with better quality of work in subsequent deliveries over time*

Timing (delivery and deadline)

Another essential aspect of task performance in project management is, as mentioned, delivery and deadline. As brought up in the literature review, many projects usually fail to be delivered on time, especially in the construction sector, which results in large capital expenditures. The project management definition from the literature review notes that it includes "*defining the requirement of work, establishing the extent of work, allocating the resources required, planning the execution of the work, monitoring the progress of the work and adjusting deviations from the plan" (*Munns and Bjeirmi 1996). On many occasions, this relates to being able to deliver in a timely manner in order to move on to the next step and push the project forward. The goal of project management is for the activities to cease as project objectives are reached.

In order to test the effect of gamification on timing, a distinction is made between delivery and deadline. The ambition is to see if there is a connection between routines resulting in habits or not. For example if one deadline is missed (routine is broken), does that affect the amount of deliveries differently with and without gamification? Will gamification motivate users to complete their tasks even though the deadline is missed, and/or will users perform better in regards to the deadline next time?

This leads to the two following assumptions:
A2a: *Gamification will help with more on-time deliveries*
A2b: *If a deadline is missed, gamification will have a positive impact in ensuring that work will be delivered anyways*

2.6.2. Independent Variable - Application as apparatus

Controlling gamification, the independent variable, involves administering when gamification is applied and when it is removed. The decision was made to develop a working application with the possibility of adding and removing gamification elements as required. This application has served both as the independent variable as well as the apparatus.

The application has been created to facilitate the checklist-process. Today, in the BIM case company, this process involves a representative from each discipline filling out a checklist-like document in a text editor, saving and uploading it to a document management system as a PDF. Each point is checked as either done, not done or irrelevant. The challenge in this process is that checklists often are delivered late, incomplete or not delivered at all.

From a practitioner point of view, there is a   potential to streamline the checklist-process digitally, thus removing the need to use text editors and PDF formats. However, as argued, there is a risk of not maximizing the engagement potential by simply digitizing, as IT itself suffers from lack of engagement. As a result, gamification is applied to this process to test whether the users will be more engaged and receive better results for project management.

Figure 1 shows the process as how it functions today. There are two roles during the checklist-process:

1. Admin: responsible for assigning and reviewing each delivery of lists.
2. User: responsible for completing as many tasks as possible, and delivering the list on time.
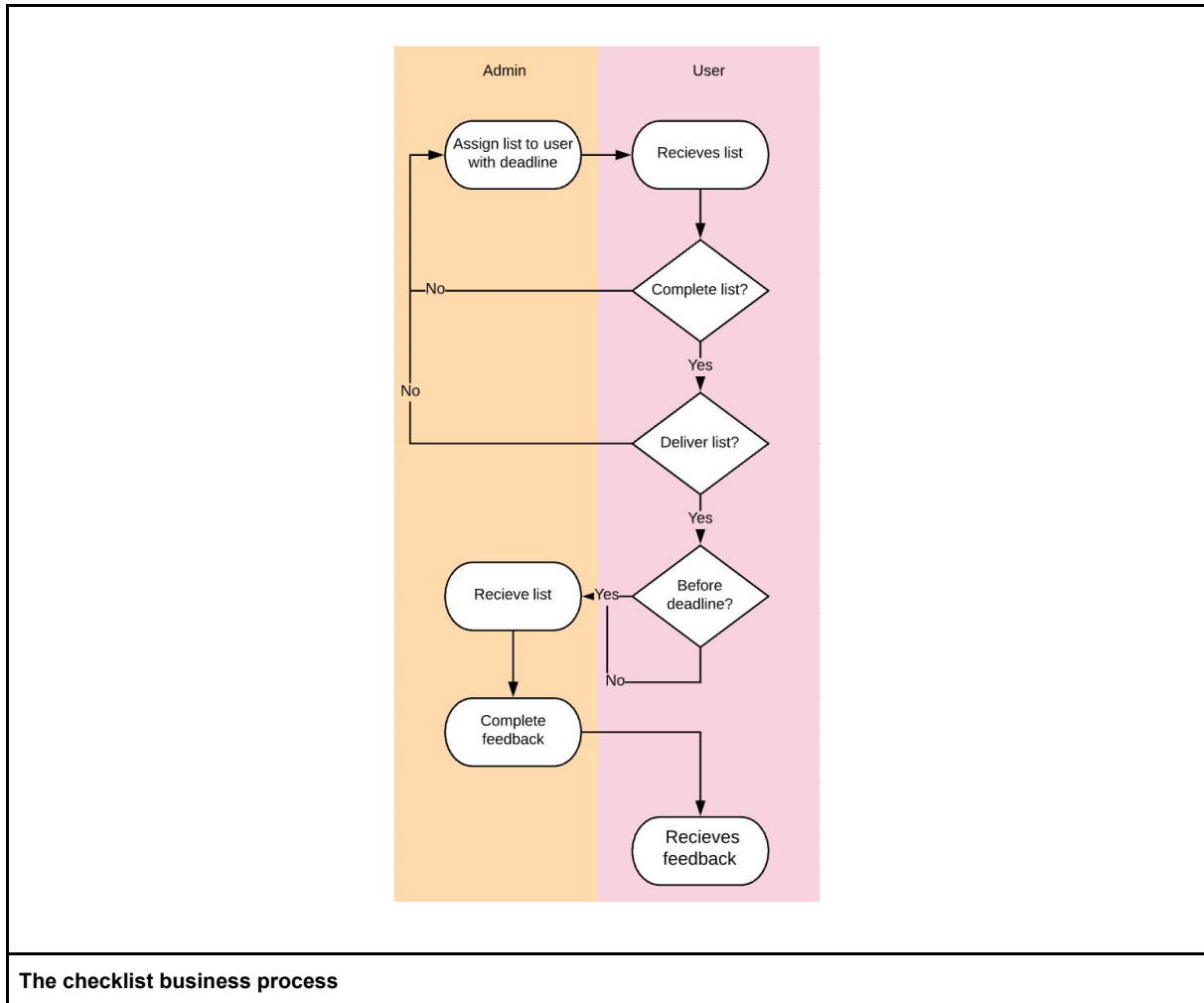
The checklist business process

Figure 1: The checklist process

This goal is firstly to reduce the amount of time spent on correcting or waiting for reports for the BIM coordinator, as well as to increase the quality of the delivered lists, thus effectively enhancing the task performance on checklists in the project. The expected result is an enhanced hedonic experience for users, which creates more engagement and hopefully the creation of habit as a consequence of the repetition of a behaviour in a consistent context.

Secondly , the objective is that for the users to experience less effort in delivering lists as well as elevating their performance in the checklist process. Finally, the aim is for the gamified system to provide project managers and project members with a tool for communication by implementing feedback mechanisms from project managers to members in the gamified system.

Based on the literature review on both gamification and the relevant context, a gamified application has been designed and developed for the checklist routine. Based on Kapp's (2012) gamification elements, the following design elements have been chosen: :

- **Rules:** Game Design Fundamentals define four types of rules - Operational, constitutive/fundamental, implicit or behavioral, and instructional rules. Operational rules are adopted, meaning that the users have to check off all list points in order to deliver a list.
- **Competition:** Users do not impede each other, but focus on optimizing their own performance. Winning is accomplished by being faster, cleverer or more skilled than the opponent. In our case, this relates to the feedback-based **leaderboards**. This also connects to two of Bartle's (1996) four player types, killers and achievers. As mentioned in the literature review, it might be unwise to implement competition-based elements. However, as there is a difference in male and female motivation, competition is implemented in order to identify any potential effects. Competition is also applied in the sense of **self competition**, as users are urged to optimize their own performance against their previous selves by comparing their own feedback percentages.
- **Time:** Time is implemented as a motivating factor for list delivery.
- **Reward structures:** Following Kapp, reward structures are usually the points and badges that are important to show progress and provide instant reward, but also as a social "bragging" incentive. Reward structures have been heavily discussed, and are therefore not implemented. Easy points and badges that are not directly related to the main goal of the application are avoided. A good **feedback** percentage should be a good accomplishment in itself, so the reward lies in receiving good feedback percentages and being able to "brag" on the **leaderboard**.
- **Feedback:** In his book, Kapp refers to Robin Hunicke when speaking about feedback. According to her, it should be "juicy". She refers to it as tactile, inviting, repeatable, coherent, continuous, emergent, balanced and fresh. **Frequent feedback** is applied on lists via admin review. It is used to promote the "correct" behaviour which entails being honest when checking off list elements. This is represented in the **feedback bar and pie charts**. While **progress bars** are not directly referred to as feedback by Kapp, these are implemented as a form of instant, coherent and continuous feedback. As users check off list elements, progression is positive no matter what state they check off list elements in.
- **Aesthetichs:** Aesthetics is adopted for visual pleasure, but also for distinguishing between elements in the application. Especially in the form of differentiating between the state of list elements (done/not done/irrelevant/unchecked) as well as the state of a list segment (complete/not complete).

Figure 2 showcases where in the business process users will be exposed to the different gamification elements:
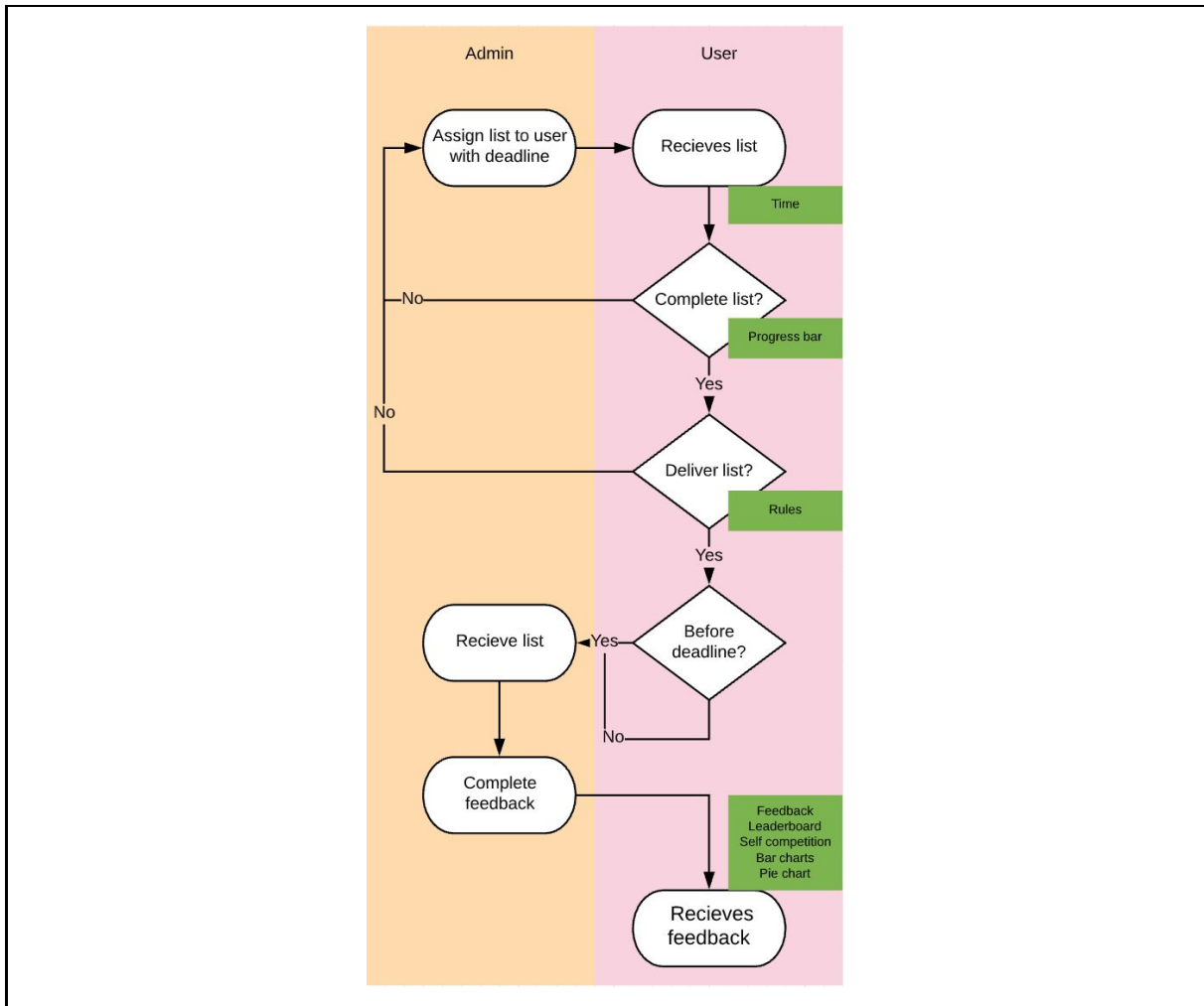
The checklist business process with the added gamification elements. Aesthetics permeate the whole process as the application itself is designed accordingly.

Figure 2: The checklist business process with the added gamification elements

A main finding in the literature review is that when choosing technical game design elements, as the ones employed in this application from Kapp, there is a need to take into consideration the particular context. In order to do so, the framework Liu, Santhanam and Webster (2017) laid forward is employed as a response to critiques towards gamification. Table 3 illustrates how the different gamification elements work together in the framework:

Table 3: Gamification design framework

Gamified Systems	Gamification Objects	- Progress (bar) (1) - Time (2) - Bar charts (3.1) - Pie charts (3.2)
	Gamification Mechanics	- Leaderboard (4) - Self competition (5) - Rules (has to complete list before delivery) (6)
Implemented Gamification Design Principles		- Feedback (7) - Aesthetics (8)

Meaningful Engagement	Desirable Experiential Outcomes	● Improved hedonic experience (engagement) ● Create and reinforce habit for task delivery and performance
	Desirable Instrumental Outcomes	● For companies: Higher quality performance, on time delivery. Less time spent on quality checks and waiting for deliveries. ● For project members: More communication, less effort in delivery lists, higher performance on self-reporting.
Our gamified system following the framework laid forward by Liu, Santhanam and Webster (2017)		

The next few illustrations showcases how the gamified system took its final form:
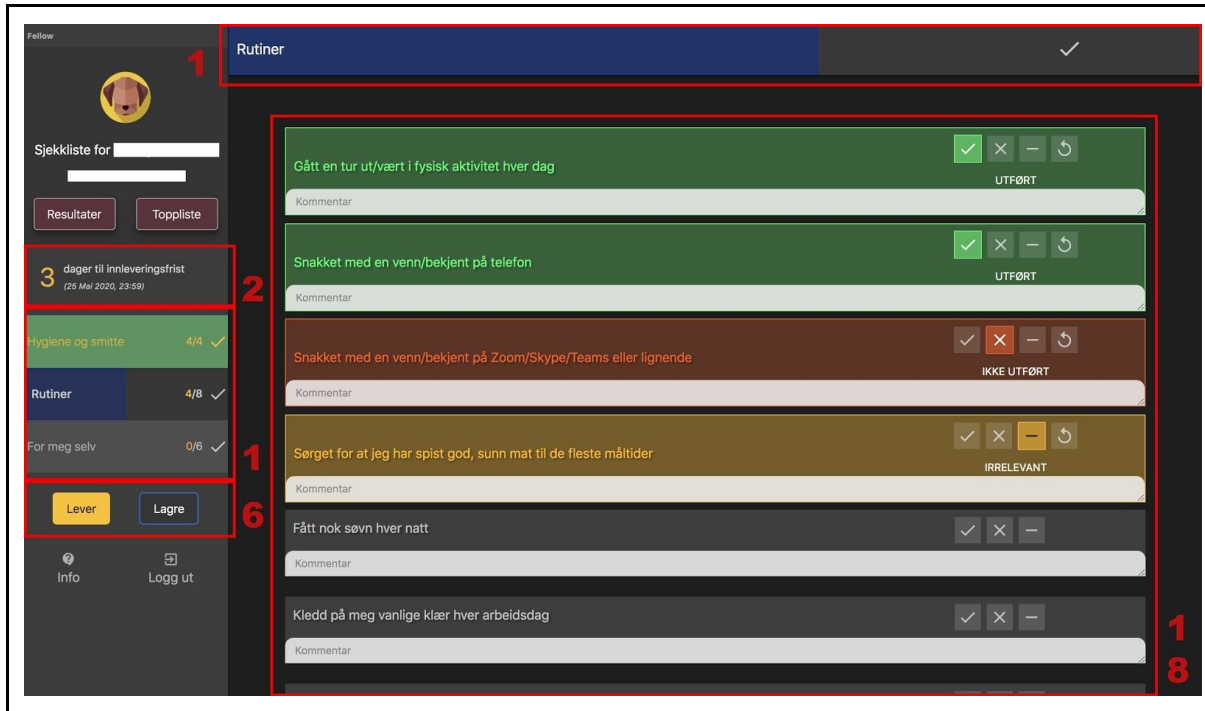
Figure 3: Progress (bars) (1) providing feedback on checking off list elements. Time (2) to motivate for action. Rules (6) to urge users to check off all list elements (not allowed to press "deliver" until all elements are checked). Aesthetics (8) to distinguish between list element state.

Figure 4: Pie chart representing a users total checked list elements (3.2)	Figure 5: Feedback based leaderboard (4)

Figure 6: Pie chart (3.2) representing total user feedback (7) and bar chart (3.1) showcasing a users best and most recent feedback percentage, urging self competition (5).

Naturally, the non-gamified version is stripped for all the showcased elements above. The resulting non-gamified application is presented below:
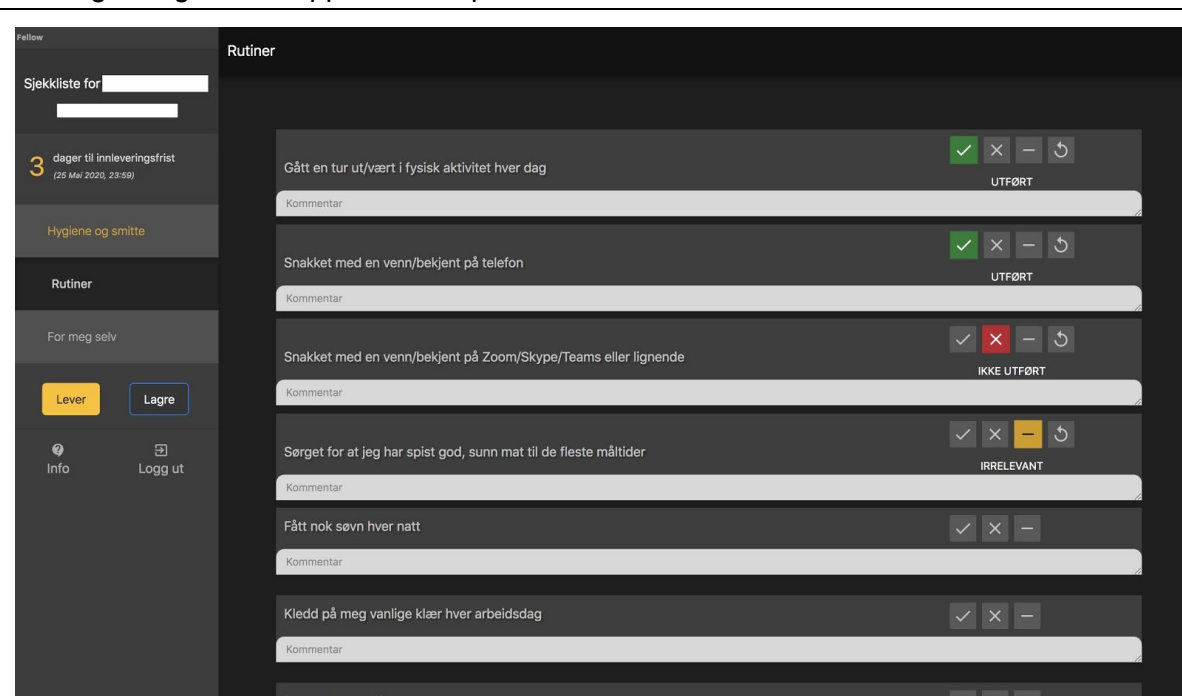
Figure 7: Non-gamified version stripped down to only utilitarian use. Note that menu elements for leaderboard and results are not present.

The gamified application is mindfully designed as it takes inspiration from Kapp's (2012) Game Design Elements while at the same time being adapted to its particular context

according to Liu et al.'s (2017) framework. In addition, all elements are orchestrated to serve the goal of reducing time spent and quality in delivery, in line with how most researchers define gamification, the desire to achieve an effect.

This all translates into a design that is in line with the main reason for implementing gamification: users should want to invest themselves in it, not feel obligated to. Based on this is the following assumption:

B1a: *Users will prefer the gamified application to the non-gamified.*

Software Development
The application has been conceptualized and developed over the course of three months (february to april 2020). While the great majority of software development has been performed by a peer, the application design (on all levels) has been completed by the researchers (the authors of this thesis). The same is true for frontend styling and user interaction as this is essential to control the application of the technical game design elements. Another important reason to retain the responsibility for styling and user interaction was to maintain a coherent system for which visuals and components to show/hide for the gamified and non-gamified versions.

The application was developed over a short period of time and therefore a majority of typically automated tasks such as export, receipts and user management had to be completed manually by the researchers throughout the research period. Receipts and reports were produced regularly in order to mock the flow of the application.

Techstack
-   **Backend:** Java8, Quarkus framework, mongoDB
-   **Frontend:** JavaScript, Vue.js, Nginx, NodeJS
-   **Infrastructure:** AWS, Docker, Firebase
-   **Maintenance:** Postman

2.6.3. Moderating Variables

Technology, wherever it is used, is a multifaceted entity, and it is therefore complex to understand the different factors and variables affecting the use (or lack) of a technological artifact. This has resulted in many researchers trying to understand and uncover said factors and variables. The Unified Theory of acceptance and use of technology (UTAUT) model was formulated with four core determinants of intention and usage: performance expectancy, effort expectancy, social influence and facilitating conditions. Furthermore, it has up to four moderators of key relationships: Age, gender, experience and voluntariness of use (Venkatesh et al. 2003). Employed is the UTAUT model as the foundation for the survey to check for/against all these influencing factors. This is elaborated in chapter 3. In the context of gamification, there are two potential variables believed to have an effect, gender and game literacy.

Gender

Different game elements are likely to be more or less attractive to different genders as what kind of gameplay motivates the different genders is found to differ. Males are found to be more motivated to conquer and outdo other players than females, which are more interested in their own performance **(**Heeter et al. 2011). This arguably relates to the findings in the literature review on Bartle's (1996) player types, and is therefore interesting to examine if different types of player motivation has different effects on the genders. Leaderboards, as implemented here, are leaning towards the killer/achiever player type, and would therefore be more likely a positive motivation for males. Feedback and progression, as implemented here, lean more towards the achiever player types. Finally time acts more of a supporting gamification element to ensure progression, but time restrictions can also be motivation-reducing for socializers and explorers. In conclusion, the chosen gamification design elements are more suited for killer/achiever player types. Based on the knowledge related to player types and gender, the following assumptions are made:

C1a: *Killer/achiever gamification design elements will positively affect the relationship between gamification and task performance for males.*
C1b: *Killer/achiever gamification design elements will negatively affect the relationship between gamification and task performance for females.*

Game Literacy

According to the literature review, game literacy is not brought up in academia however, the concept has gained attention in social media. It can be understood to be similar to media literacy - the act of accessing, evaluating, creating and/or manipulating media (Potter 2010). These are processes that can be taught (such as poem analysis, evaluation of movies and so on .), but they can also be experienced and institutionalized. Game literacy can roughly be translated into knowledge and experience with games. We refer to it as the understanding of possibilities and limitations with games - ability to understand game mechanics. This lays the foundation for accessing, evaluating, creating and, most importantly, manipulating games. At this point it becomes increasingly important to understand who gamification is designed for. Gamification finds its origins in an effort to try and create the same type of engagement games provide to other contexts - regardless of the receiver's interest in games. Games on the other hand, are specifically created for people who seek a hedonic experience.

One can easily imagine that game literacy relates to gender and/or age, yet, the playing demographic says otherwise however. A great deal of game players are not part of the typical young, male demographic one would imagine ("Who Plays Video Games? Younger Men, But Many Others Too" 2020). As the player demographic is broad and varied, there is no reason to believe that age and gender in the context of game literacy will affect the relationship between gamification and task performance.

Regardless of gender, gaming frequency has been found to significantly relate to gaming achievement goals (Heeter et al. 2011). This is important to understand in the context of gamification, as it is heavily based on game design. Games and gamification are different concepts, especially if researchers and practitioners are to move forward with a common

understanding. As game literacy has not been brought up in academia, the ambition in this paper is to gain a better understanding of its effect (or lack thereof). Examining this can help understand if gamification is successful in engaging people regardless of their gaming experience, as it is inherently not directed towards people that have that experience.

This leads to the following and final assumption:
C2a: *Game literacy will not affect the relationship between gamification and task performance*

2.7. Research Framework with Assumptions

Table 4: Research framework with assumptions

Independent Variables	Moderating Variables	Dependent Variables
Gamification - Rules - Competition - Time - Reward structures - Feedback - Aesthetics	- Gender - Game literacy	Task performance - Quality - Timing
B1a: *Users will prefer the gamified application to the non-gamified.*	**C1a**: *Killer/achiever gamification design elements will positively affect the relationship between gamification and task performance for males.* **C1b**: *Killer/achiever gamification design elements will negatively affect the relationship between gamification and task performance for females.* **C2a**: *Game literacy will not affect the relationship between gamification and task performance.*	**A1a:** *Gamification will increase quality of work in task performance.* **A1b:** *Gamification will increase quality of work in subsequent deliveries over time.* **A2a:** *Gamification will positively affect on-time deliveries.* **A2b:** *If a deadline is missed, gamification will motivate users to deliver anyways.*

3. Method

Experiments as main method

As mentioned in the literature review, gamification is complex. According to Myers (1997), the potential knowledge gained from the point of view of the participants and the particular social and institutional context of gamification will to a large degree be lost if textual data are quantified. This makes a case for selecting a mainly qualitative strategy in this research project. However, the assumptions in this paper call for observing and analysing with and without gamification elements. It is therefore crucial to be able to distinguish the behaviour and experiences of the participants as something driven by merely completing the task at hand (utilitarian motivation) versus something driven by gamification elements (an extrinsic or intrinsic motivation inflicted). This makes the quantitative strategy of experiments suitable for the project, as it is a strategy which seeks to (dis)prove cause and effect (Oates 2006).

Natural and controlled setting

The application is created and employed in a case company, and the setting of the experiment is thus a natural one. Experiments in a natural setting are desirable especially considering the particular interest in the social context in which the gamification is applied. The challenge of experiments in a natural setting is that there is little opportunity to isolate cause and effect with great confidence. Laboratory experiments are usually the go-to solution for such cases, but then the challenge is that they are inherently less true to real world circumstances (Oates 2006). This project is therefore conducted as an experiment in a more controlled setting rather than a pure laboratory experiment. The outbreak of COVID-19 presented a unique opportunity to run experiments in a more controlled setting than otherwise possible, as many people remained in their homes for a long stretch of time, effectively reducing the influencing variables.

Behavior and intention

A weakness of experiments is that they showcase behavior, but intention can be harder to understand. This is especially relevant considering the aim in this project to distinguish between utilitarian and hedonic motivation. Utilitarian behavior is arguably easier to find in usage data, but hedonic motivation is largely found internally with the users. The UTAUT model is therefore employed in the form of a survey, which tests for intention, attitude, social influence and so on. In addition, the UTAUT model will help discover if users experience other challenges related to usage, such as not understanding the interface, accessibility and other related issues to technology. Such influencing variables are important to identify and rule out as experiments in natural settings have many influencing factors. With this approach, one can to a better extent isolate and analyze the effect of gamification.

In addition to questions related to the UTAUT model, users will be asked to rate their own experience with technology and games in order to better understand their technology and game literacy.

Three stages of the Research Method

This research method is divided into three different stages. The first stage consists of setting up for collecting behavioral data - controlled and natural experiments. The second stage is gathering intention data, which takes the form of a survey after the experiment. Finally the behavioral and intentional data from the two settings will be analysed. Below is a brief overview over the main differences between the natural and controlled settings for our experiments. Details will be given in the upcoming sections.

Table 5: Differences between natural and controlled setting

	Natural Setting	**Controlled Setting**
Tasks:	BIM self reporting in construction projects	Sanitary, mental and physical health guidelines for routine in state of emergency
Admin:	BIM Coordinators (project managers)	Researchers
User:	Discipline leaders (project members)	Volunteers recruited through social media and friends
Deliveries:	Every week and every 2 weeks	Every 3 days
Time frame:	Less than three weeks	Less than four weeks

3.1. Experiment in a natural setting

Building Information Modeling (BIM) has become a prominent and central part of all construction processes (Yalcinkaya and Singh 2015). Statsbygg, the government owned building master of Norway now requires BIM to be the main point of reference in all projects they order ("Digitale Kontraktskrav - Statsbygg.No" 2020). BIM replaces the traditional plan drawings with 3D models of a construction, incorporating all disciplines from the architecture itself to electricity, piping, landscape architecture and so on in one single model. The disciplines can be separated into isolated models for simplicity, and then combined into the same model again in order to identify conflicts in the model before the actual construction (Howard and Björk 2008). A discipline group is composed of several people, ranging from two (in special cases) to twelve people.

The objective is to observe the effect on creation of behaviour itself in measuring if response time (delivery of the checklists) is being shortened, and if task performance is being enhanced. This is done by measuring if participants deliver lists before or after their deadline, and if the BIM coordinators spend less time going over and correcting the delivered checklists.

These three measurements are used to to dis(prove)/test the assumptions:

- **Approval rating:** When BIM coordinators go through each delivery of a checklist and measure if the work has been done or not. Each list item will have state approved or not approved.
- **Deadline:** If the checklist has been delivered before or on deadline.
- **Delivery:** If the checklist was even delivered or not.

In addition, results from the UTAUT survey will provide additional insight (performance expectancy, effort expectancy, attitude, self-efficiency and intention to use).

3.1.1. Participants and Setting

This thesis is conducted in cooperation with a BIM coordinator company which handles the related work in different construction projects. The experiment is conducted in two of their construction projects which both have four participating discipline groups. For each discipline, there is one person responsible for communicating with the BIM coordinator, and these people are the participants in our experiment, a total of eight people.

Table 6: Participants in a natural setting experiment.

	Age 26 - 39	Age above 40	Total
Males	5	2	7
Females	0	1	1

3.1.2. Apparatus

The application described in section 2.6.2 was the apparatus. It was accessible through the users preferred browser, so no additional apparatus was necessary. The application was not optimized for mobile, so participants were urged to access it from desktop. The lists and their content were already pre-made from the case company, and were related to the work users were doing in their respective positions.

3.1.3. Design

A between-group design was employed as it allows to test for effects of gamification and no gamification simultaneously while the participants went on with their regular work. The experiment consists of one test group (A) and one control group (B), where group A will be using the application with incorporated gamification elements, and group B will be using the application stripped of gamification elements. This design has the potential to identify the cause and effect of gamification. Another reason to utilize the between-group design is that it allowed users to continue to use the same application over time, an important aspect to keep in mind as time itself is a central part of gamification (Kapp, 2012).

At the end of the experiment timeframe, all participants were asked to complete an online survey consisting of 14 questions relating to their experience using the application, technology experience and game literacy.

3.1.4. Procedure

The participants were informed that they were part of a research experiment (and asked for consent), and that this would mean that they abandon the current way of performing the checklist-process in favour of the application. Each participant was given a unique username and password for logging into the application via their internet browser. One half received access to the gamified version, and the other half received access to the non-gamified version. They were not informed that they would be exposed to different applications.

The BIM-coordinator responsible for each construction project took on the role as administrator and was thus responsible for giving feedback to all lists as well as setting a deadline for list delivery.

All participants were to complete a checklist at the end of each delivery cycle. As long as they completed and delivered the list, it had no effect if they delivered long before (or after) the deadline on their part. The length of a delivery cycle varied depending on which construction project the participants worked on, but either one or two weeks. This resulted in two deliveries from one construction project, and four from the other.

3.1.5. Analysis

These three behavioural measurements are used to dis(prove)/test the assumptions:
- **Approval rating:** When admins go through each delivery of a checklist and measure if the work has been done or not. The percentage of approved versus not approved checkpoints results in the approval rating for each list.
- **Deadline:** If the checklist has been delivered before or on deadline.
- **Delivery:** If the checklist was even delivered or not.

Analysing the behavioural data will be done through manually extracting all lists and their reviews per delivery.

In addition, results from the survey will provide additional insight to understand the behavioural data. For testing the assumptions, the UTAUT variables relating to performance expectancy, effort expectancy, attitude, self-efficiency and intention to use are of interest. Social influence, facilitating conditions and anxiety are included to ensure that users do not experience outlying issues in using the application. A likert scale from 1 (strongly agree) to 7 (strongly disagree) will be employed for users to rate to which degree they relate to each claim or not, meaning that lower scores equals more positive perception. A statistical analysis on highest and lowest ratings, mean value, standard deviation and variance on the gamification versus non-gamified users will lay the foundation for understanding their perception compared to each other.

Finally, users will be asked for their game and technology experience. Asking participants to specify how often they play games on computers, consoles and/or mobile. This to be able to draw any conclusions on game literacy.

3.2. Controlled experiment

3.2.1. Participants and setting

Participants were gathered by social media posts. Friends and relatives were denied participation in order to ensure as little bias as possible on the participants.

The participants in the controlled experiment were people that had to carry on with their everyday life from home instead of their usual workplace. Beyond that, there were no restrictions as to who were seen as desirable participants (apart from them being older than 18 years). Nine people volunteered to participate in the study which occurred over a course of three weeks.

Table 7: Participants in a controlled experiment.

	Age below 25	Age 26 - 39	Total
Males	1	0	1
Female	3	5	8

3.2.2. Apparatus

The participants used the same application as in the natural setting experiment. However, the content of checklists had to differ. The list contents were the result of a search through the Norwegian Institute of Public Health's recommendations for different routines, advice and cautionary measures to take in a state of disease related emergency. In addition, a search for different recommendations in regards to one's own mental health in state of emergency from the Norwegian state-owned news broadcasting company NRK was made. The results of the search (see appendix 3) made up the final checklist with tasks for participants to do.

3.2.3. Design

The design of the controlled setting was the same as in the natural setting.
See chapter 3.1.3.

3.2.4. Procedure

The procedure in the controlled setting was similar to the natural setting. The difference was that participants were free to choose if they wanted to access the application and deliver lists. If no list was delivered, the new list would take its place. Delivery cycle length was three days.

The researchers had the role of administrators, and thus responsible for reviewing lists. A list element would be reviewed as accepted if it was checked "done", or "irrelevant" with a

commentary. Lack of commentary on "irrelevant" checkpoints resulted in not accepted review.

3.2.5. Analysis

Analysis will happen the same way as in the natural setting.
See chapter 3.1.5.

4. Findings

4.1. Experiment in a natural setting

Figure 8 showcases that participants had overall no noteworthy game literacy.

Game Literacy
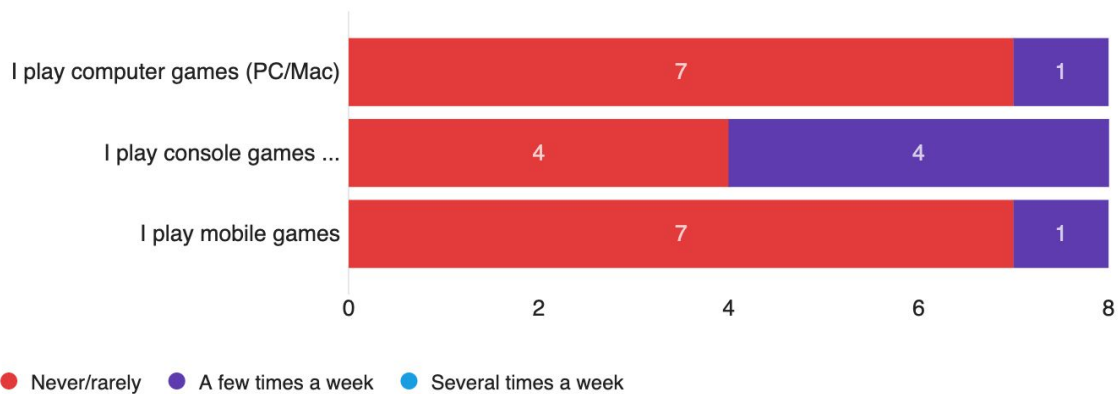
Figure 8: Game literacy in participants in natural setting

4.1.1. Behavior data

Quality in list deliveries
Table 8 displays all of the deliveries done by the gamified group and what the quality rating was on each of their deliveries. It also shows their quality rating averaged for each user, a total average for each user, average for each delivery and finally average for every user's list quality.

Table 8: List quality for gamified users in natural setting

Natural	Delivery 1 Quality	Delivery 2 Quality	Delivery 3 Quality	Avg List Quality
Gamified User 1	100%	100%	0%	67%
Gamified User 2	0%	100%	90%	63%
Gamified User 3	100%	n/a	n/a	100%
Gamified User 4	90%	n/a	n/a	90%

Total Average	73%	100%	45%	80%

Table 9 is structured the same as Table 9, but instead shows how each of the delivery quality ratings was for the non-gamified group.

Table 9: List quality for non-gamified users in natural setting

Controlled	Delivery 1 Quality	Delivery 2 Quality	Delivery 3 Quality	Avg List Quality
Non-Gamified User 1	100%	95%	95%	97%
Non-Gamified User 2	100%	100%	100%	100%
Non-Gamified User 3	90%	*n/a*	*n/a*	90%
Non-Gamified User 4	95%	*n/a*	*n/a*	95%
Total Average	96%	98%	98%	95%

Deadlines in each list

Table 10 displays how many times each gamified user managed to deliver their lists within the deadline attributed. Average was calculated for each user, and for each delivery. Finally a total average for every user.

Table 10: Time of list deliveries for gamified users in natural setting

Natural	Delivery 1 Deadline	Delivery 2 Deadline	Delivery 3 Deadline	Avg Before Deadline
Gamified User 1	On-time	On-time	Missed	67%
Gamified User 2	Missed	On-time	On-time	67%
Gamified User 3	On-time	*n/a*	*n/a*	100%
Gamified User 4	On-time	*n/a*	*n/a*	100%
Total Average	75%	100%	50%	84%

Table 11 is structured the same as Table 10, but instead shows the data for the non-gamified users.

Table 11: Time of list deliveries for non-gamified users in natural setting

Natural	Delivery 1 Deadline	Delivery 2 Deadline	Delivery 3 Deadline	Avg Before Deadline
Non-Gamified User 1	On-time	Missed	On-time	67%
Non-Gamified User 2	On-time	Missed	On-time	67%

Non-Gamified User 3	On-time	*n/a*	*n/a*	100%
Non-Gamified User 4	On-time	*n/a*	*n/a*	100%
Total Average	**100%**	**0%**	**100%**	**84%**

How many deliveries was done

Table 13 shows how many times each user delivered, with the average for each user. It also displays the average for each delivery. For example delivery 1 for all of the gamified users, show that 3 out of 4 delivered, so the average is 75%. Total average for all users is also displayed.

Table 12: List deliveries for gamified users in natural setting

Natural	Delivery 1	Delivery 2	Delivery 3	Avg Delivery
Gamified User 1	Delivered	Delivered	Not Delivered	67%
Gamified User 2	Not Delivered	Delivered	Delivered	67%
Gamified User 3	Delivered	*n/a*	*n/a*	100%
Gamified User 4	Delivered	*n/a*	*n/a*	100%
Total Average	**75%**	**100%**	**50%**	**84%**

Table 13 is structured the same as Table 12, but with the non-gamified users.

Table 13: List deliveries for non-gamified users in natural setting

Natural	Delivery 1	Delivery 2	Delivery 3	Avg Delivery
Non-Gamified User 1	Delivered	Delivered	Delivered	100%
Non-Gamified User 2	Delivered	Delivered	Delivered	100%
Non-Gamified User 3	Delivered	*n/a*	*n/a*	100%
Non-Gamified User 4	Delivered	*n/a*	*n/a*	100%
Total Average	**100%**	**100%**	**100%**	**100%**

Summary

Table 14 shows a comparison table between gamified group (G) and non-gamified group (NG), for each of the measurements that was collected from the experiment. The gamified group performs on average poorer than the non-gamified group.

Table 14: Summary of avg between gamified (G) and non-gamified (NG) group in natural setting

Natural	G	NG
Total Avg Quality	80%	95%
Total Avg Deadline	84%	84%
Total Avg Delivery	84%	100%
Total Avg	**82%**	**93%**

4.1.2. Intention data

Performance Expectancy

The table below illustrates that overall, the non-gamified users perceived the application to be more helpful in their performance than the gamified users. As all results lie around the 3,5 mark, most perceptions are neutral. Opinions are also in general coherent.

Table 15: Performance expectancy for gamified (G) and non-gamified (NG) groups in natural setting

		Min	Max	Mean	Std Dev.	Variance
X is useful in my work	G	2,00	3,00	2,25	0,43	0,19
	NG	2,00	3,00	2,25	0,43	0,19
Using X allows me to perform my tasks faster.	G	2,00	4,00	3,00	0,71	0,50
	NG	2,00	4,00	2,75	0,83	0,69
Using X increases my productivity.	G	4,00	4,00	4,00	0,00	0,00
	NG	2,00	4,00	3,00	0,71	0,50
Using X increases the likelihood of my work being rated as good.	G	2,00	3,00	2,50	0,50	0,25
	NG	1,00	2,00	1,75	0,43	0,19
AVG	**G**	2,50	3,50	2,94	**0,41**	**0,24**
AVG	**NG**	**1,75**	**3,25**	**2,44**	0,60	0,39

Effort Expectancy

According to the findings, effort expectancy is perceived to be equal between the gamified and non-gamified users.

Table 16: Effort expectancy in gamified (G) and non-gamified (NG) groups in natural setting

		Min	Max	Mean	Std Dev.	Variance
Using X is clear and easy to understand for me.	G	1,00	2,00	1,50	0,50	0,25
	NG	1,00	2,00	1,25	0,43	0,19
It was easy for me to become good at using X.	G	1,00	2,00	1,75	0,43	0,19
	NG	1,00	2,00	1,75	0,43	0,19
I think X is easy to use.	G	1,00	2,00	1,75	0,43	0,19
	NG	1,00	2,00	1,25	0,43	0,19
It was easy to learn using X for me.	G	1,00	2,00	1,75	0,43	0,19
	NG	1,00	2,00	1,25	0,43	0,19
AVG	**G**	**1,00**	**2,00**	**1,69**	**0,45**	**0,21**
AVG	**NG**	**1,00**	**2,00**	**1,38**	**0,43**	**0,19**

Attitude

Overall, gamified users had a more positive attitude towards the application. Note that in the additional row asking if use of the application is a bad idea, a negative response is desirable. Here, results are in favour of the gamified application.

Table 17: Attitude towards use in gamified (G) and non-gamified (NG) groups in natural setting

		Min	Max	Mean	Std Dev.	Variance
Using X is a good idea	G	1.00	2.00	1.75	0.43	0.19
	NG	1.00	3.00	2.00	0.71	0.50
X makes my work more interesting	G	3.00	4.00	3.75	0.43	0.19
	NG	3.00	4.00	3.75	0.43	0.19
Using X is fun	G	2.00	4.00	3.00	0.71	0.50
	NG	3.00	4.00	3.75	0.43	0.19
I enjoy working with X	G	2.00	3.00	2.75	0.43	0.19
	NG	2.00	3.00	2.50	0.50	0.25
AVG	**G**	**2,00**	**3,25**	**2,81**	**0,50**	**0,27**

		2,25	3,50	3,00	0,52	0,28
AVG	**NG**	2,25	3,50	3,00	0,52	0,28
Using X is a bad idea	**G**	**6.00**	6.00	**6.00**	**0.00**	**0.00**
	NG	4.00	6.00	5.50	0.87	0.75

Self-Efficiency

The gamified application was overall perceived to be slightly more desirable in terms of self-efficiency.

Table 18: Self-Efficiency in gamified (G) and non-gamified (NG) groups in a natural setting

		Min	Max	Mean	Std Dev.	Variance
I can do what I need to in X without anyone having to be there and help me.	**G**	1.00	2.00	1.75	0.43	0.19
	NG	1.00	3.00	2.00	0.71	0.50
I can do most tasks in X if I can call someone when / if I am stuck.	**G**	1.00	4.00	2.25	1.09	1.19
	NG	4.00	5.00	4.25	0.43	0.19
I can do most of the work at X using the built-in help features.	**G**	2.00	4.00	3.50	0.87	0.75
	NG	2.00	4.00	3.50	0.87	0.75
I can do most of the work at X if I get enough time dedicated to it.	**G**	2.00	4.00	2.75	0.83	0.69
	NG	1.00	4.00	3.25	1.30	1.69
AVG	**G**	**1,50**	**3,50**	**2,56**	**0,81**	**0,71**
AVG	**NG**	2,00	4,00	3,25	0,83	0,78

Intention to use

The gamified application was perceived as more desirable to continue use than the non-gamified. Gamified users were also in much more agreement in their intentions compared to the non-gamified.

Table 19: Intention to use in gamified (G) and non-gamified (NG) groups

		Min	Max	Mean	Std Dev.	Variance
I´m going to use X in the next 4 weeks ahead.	**G**	2.00	4.00	3.00	1.00	1.00

	NG	3.00	7.00	4.25	1.64	2.69
I guess I'll be using X over the next 4 weeks.	G	2.00	4.00	2.50	0.87	0.75
	NG	3.00	7.00	4.50	1.50	2.25
I plan to use X over the next 4 weeks.	G	2.00	3.00	2.25	0.43	0.19
	NG	1.00	7.00	3.75	2.17	4.69
AVG	G	**2,00**	**3,67**	**2,58**	**0,77**	**0,65**
AVG	NG	2,33	7,00	3,49	1,77	3,21

4.2. Controlled experiment

Figure 9 illustrates that participants had low levels of game literacy. One participant reported to frequently play mobile games, but no similar frequency was found in console or computer games.

Game Literacy
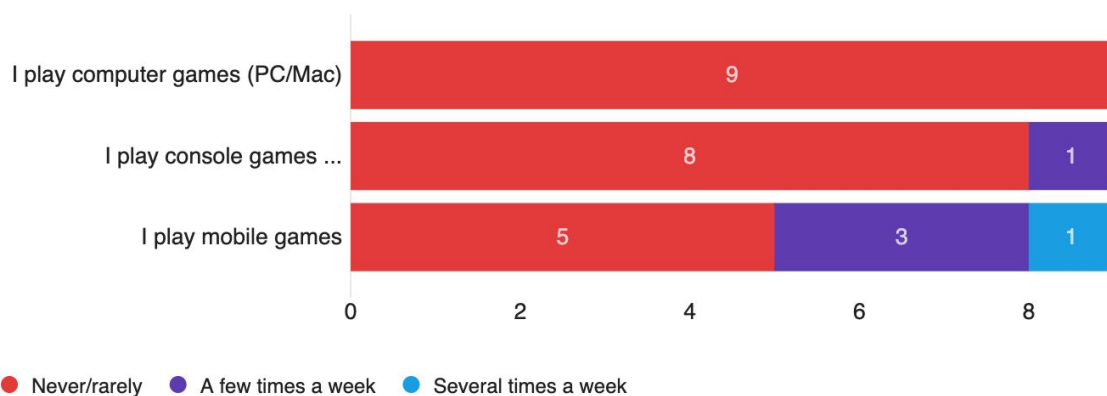
Figure 9: Game literacy in participants in controlled setting

4.2.1. Behaviour data

Quality in lists deliveries
Table 20 and 21 showcase that gamified users on average delivered twice the quality compared to non-gamified users. Furthermore, gamified users start off in high quality, then drop down before picking up the level of quality. Non-gamified users showcase a downward trend for the whole time frame.

Table 20: List quality for gamified users in controlled setting

Controlled	Delivery 1 Quality	Delivery 2 Quality	Delivery 3 Quality	Delivery 4 Quality	Avg List Quality
Gamified User 1	61%	67%	78%	0%	52%
Gamified User 2	83%	83%	0%	72%	60%
Gamified User 3	67%	0%	0%	72%	35%
Gamified User 4	44%	0%	0%	55%	25%
Total Average	**64%**	**38%**	**20%**	**50%**	**43%**

Table 21: List quality for non-gamified users in controlled setting

Controlled	Delivery 1 Quality	Delivery 2 Quality	Delivery 3 Quality	Delivery 4 Quality	Avg List Quality
Non-Gamified User 1	0%	0%	0%	0%	0%
Non-Gamified User 2	0%	72%	0%	0%	18%
Non-Gamified User 3	83%	72%	61%	55%	68%
Non-Gamified User 4	67%	0%	0%	0%	17%
Total Average	**38%**	**36%**	**15%**	**14%**	**26%**

List deliveries

As with list quality, gamified users score twice as good compared to non-gamified users in terms of list deliveries. Likewise, gamification users tend to deliver their lists after failing to do so for some time, while that is not the case in non-gamified users.

Table 22: List of deliveries done for gamified users in controlled setting

Controlled	Delivery 1	Delivery 2	Delivery 3	Delivery 4	Avg Delivery
Gamified User 1	Delivered	Delivered	Delivered	Not Delivered	75%
Gamified User 2	Delivered	Delivered	Not Delivered	Delivered	75%
Gamified User 3	Delivered	Not Delivered	Not Delivered	Delivered	50%
Gamified User 4	Delivered	Not Delivered	Not Delivered	Delivered	50%
Total Average	**100%**	**50%**	**25%**	**75%**	**63%**

Table 23: List of deliveries done for non-gamified users in controlled setting

Controlled	Delivery 1	Delivery 2	Delivery 3	Delivery 4	Avg Delivery
Non-Gamified User 1	Not Delivered	Not Delivered	Not Delivered	Not Delivered	0%
Non-Gamified User 2	Not Delivered	Delivered	Not Delivered	Not Delivered	25%
Non-Gamified User 3	Delivered	Delivered	Delivered	Delivered	100%
Non-Gamified User 4	Delivered	Not Delivered	Not Delivered	Not Delivered	25%
Total Average	**50%**	**50%**	**25%**	**25%**	**38%**

Time of list deliveries

In reaching the deadline, gamified users perform better than non-gamified users. The same inverted bell curve trend as with list quality and delivery is also spotted here.

Table 24: List of deadlines for gamified users in controlled setting

Controlled	Delivery 1 Deadline	Delivery 2 Deadline	Delivery 3 Deadline	Delivery 4 Deadline	Avg Before Deadline
Gamified User 1	On-time	On-time	On-time	Missed	75%
Gamified User 2	On-time	On-time	Missed	On-time	75%
Gamified User 3	On-time	Missed	Missed	On-time	50%
Gamified User 4	On-time	Missed	Missed	Missed	25%
Total Average	**100%**	**50%**	**25%**	**50%**	**56%**

Table 25: List of deadlines for non-gamified users in controlled setting

Controlled	Delivery 1 Deadline	Delivery 2 Deadline	Delivery 3 Deadline	Delivery 4 Deadline	Avg Before Deadline
Non-Gamified User 1	Missed	Missed	Missed	Missed	0%
Non-Gamified User 2	Missed	On-time	Missed	Missed	25%
Non-Gamified User 3	On-time	On-time	On-time	Missed	75%
Non-Gamified User 4	On-time	Missed	Missed	Missed	25%
Total Average	**50%**	**50%**	**25%**	**0%**	**31%**

Summary

Overall, gamified users have a higher task performance than non-gamified users. While the elevated effects are generally equally larger, the greatest effect seems to be in reaching deadlines.

Table 26: Summary of average between gamified (G) and non-gamified (NG) group in controlled setting

Controlled	G	NG
Total Avg Quality	43%	26%
Total Avg Deadline	56%	31%
Total Avg Delivery	63%	38%
Total Avg	**54%**	**31%**

4.2.2. Intention data

Performance Expectancy

Gamified users perceived the application to be more useful for them performance-wise compared to non-gamified. However, gamification users were less in unison than non-gamification users.

Table 27: Performance expectancy for gamified (G) and non-gamified (NG) groups in controlled setting

		Min	Max	Mean	Std Dev.	Variance
X is useful for routines	G	2.00	6.00	3.40	1.50	2.24
	NG	2.00	5.00	3.25	1.09	1.19
Using X makes me complete routines faster	G	1.00	6.00	3.40	1.62	2.64
	NG	4.00	5.00	4.75	0.43	0.19
Using X makes me complete more routines	G	2.00	6.00	3.80	1.47	2.16
	NG	2.00	6.00	4.00	1.58	2.50
Using X elevates the probability for me to complete routines	G	2.00	6.00	3.60	1.62	2.64
	NG	3.00	5.00	4.25	0.83	0.69
AVG	**G**	**1.75**	6.00	**3.55**	1.55	2,42
AVG	**NG**	2.75	**5.25**	4,06	**0.98**	**1,14**

Effort Expectancy

Gamified users found the application to demand less effort from them than the non-gamified.

Table 28: Effort expectancy in gamified (G) and non-gamified (NG) groups in controlled setting

		Min	Max	Mean	Std Dev.	Variance
Using X is easy for me	G	1.00	2.00	1.60	0.49	0.24
	NG	1.00	2.00	1.75	0.43	0.19
It is easy for me to get good at using X	G	1.00	5.00	2.80	1.33	1.76
	NG	2.00	7.00	3.75	2.05	4.19
I think X is easy to use	G	1.00	3.00	1.80	0.75	0.56
	NG	1.00	2.00	1.50	0.50	0.25
Learning to use X was easy for me	G	1.00	3.00	1.80	0.75	0.56
	NG	1.00	2.00	1.25	0.43	0.19
AVG	**G**	**1.00**	3.32	**2,00**	**0.83**	**0,78**
AVG	**NG**	1.25	**3.25**	2.06	0.85	1,21

Attitude

Gamification users had a more positive attitude towards the application. Note that in the row below surveying if the use of the application is perceived as a bad idea, negative responses are desirable. Here, the gamified application scores significantly higher than the non-gamified compared to the differences in other variables in the survey.

Table 29: Attitude towards use in gamified (G) and non-gamified (NG) groups in controlled setting

		Min	Max	Mean	Std Dev.	Variance
Using X is a good idea	G	1.00	4.00	2.40	1.02	1.04
	NG	1.00	5.00	3.25	1.79	3.19
X makes routines more interesting	G	2.00	4.00	3.00	0.89	0.80
	NG	1.00	5.00	3.25	1.79	3.19

		Min	Max	Mean	Std Dev.	Variance
Using X is fun	G	2.00	6.00	3.40	1.50	2.24
	NG	2.00	6.00	4.00	1.41	2.00
I enjoy using X	G	2.00	6.00	3.80	1.33	1.76
	NG	2.00	5.00	3.50	1.12	1.25
AVG	**G**	1,75	**5,00**	3,15	1,19	1,46
AVG	**NG**	**1,50**	5,50	3,50	1,53	2,41
Using X is a bad idea	G	**4.00**	7.00	**5.20**	1.17	1.36
	NG	2.00	7.00	4.75	**1.92**	**3.69**

Self-Efficiency

Differences in perceived self-efficiency were marginal. In general, all users had positive experiences in regards to self-efficiency.

Table 30: Self-Efficiency in gamified (G) and non-gamified (NG) groups in controlled setting

		Min	Max	Mean	Std Dev.	Variance
I can do what I need to in X without anyone having to be there and help me.	G	1.00	2.00	1.40	0.49	0.24
	NG	1.00	2.00	1.75	0.43	0.19
I can do most tasks in X if I can call someone when / if I am stuck.	G	1.00	4.00	3.00	1.26	1.60
	NG	1.00	4.00	2.75	1.30	1.69
AVG	**G**	1,00	3,00	**2,20**	0,88	**0,92**
AVG	**NG**	1,00	3,00	2,25	**0,87**	0,94

Intention to use

Overall, the users were slightly negative towards continued use of the application. In the controlled setting survey, this question was formulated having users imagine that continued use of the application would be possible beyond the experiment. Therefore, results from this variable are likely to have less reliability compared to other variables which are based on experiences that have already happened.

Table 31: Intention to use in gamified (G) and non-gamified (NG) groups in controlled setting

		Min	Max	Mean	Std Dev.	Variance
I'm going to use X for the next 4 weeks ahead.	G	3.00	6.00	4.20	1.17	1.36
	NG	1.00	7.00	4.00	2.55	6.50
I guess I'll be using X over the next 4 weeks.	G	3.00	7.00	4.40	1.50	2.24
	NG	1.00	7.00	4.00	2.55	6.50
I plan to use X over the next 4 weeks.	G	3.00	7.00	4.60	1.36	1.84
	NG	1.00	7.00	4.00	2.55	6.50
AVG	**G**	3,00	**6,67**	4,40	**1,34**	**1,81**
AVG	**NG**	**1,00**	7,00	**4,00**	2,55	6,50

5. Discussion

The approach to answer the research question was conducting two between-group experiments designed to collect behavioural data in addition to intentional data using the Unified Theory of acceptance and use of technology model developed by Venkatesh et al. (2003). The project collected data from both a natural setting, project managers coordinating project members, as well as a controlled setting, people trying to follow official guidelines in state of emergency. Engagement in this project was measured in the context of task management in both settings. To measure this, collected measurements were quality rating, delivery and deadline on checklists in the application. A gamified and non-gamified application was developed and employed as the independent variable.

5.1. Natural Setting

5.1.1. Task Performance: Quality and time

Assumptions related to quality:
A1a: *Gamification will increase quality of work in task performance.*
A1b: *Gamification will increase quality of work in subsequent deliveries over time.*

Analyzing the behavioural data, the gamification users delivered lower quality lists than the non-gamification users. This was probably a result of two of users in the gamification group missing one delivery each. This can be the reason why the data is skewed towards a negative trend compared to the non-gamfied users, as failing to deliver results in zero positive feedback. It should be noted that the data sample in the natural setting in general is

low, so one slight anomaly can drastically affect the data one way or another. Furthermore, intentional data showcased that gamified users did on average perceive the application less useful for boosting their performance than the non-gamified users. As a result, we conclude that assumption **A1a** is not supported in the natural setting.

The participants have almost no variation in their quality of work, and feedback level showcases generally high quality. What does pull their average down is if they fail to deliver a list. However, for each delivered list the quality has not been lower than 90 percent. We conclude that on average, the quality of work from both the gamified and non-gamified groups is high. It is not possible to draw conclusions with the small dataset, and no trends can be spotted. Assumption **A1b** is inconclusive.

This conclusion generally sits in contrast to the existing literature on gamification. Extrinsic motivations have been found to positively affect performance quality (Mekler et al. 2017). Sat up against our findings, this can showcase that extrinsic motivation in itself is not enough to drive quality engagement, as the literature finds it necessary to achieve a balance between intrinsic and extrinsic motivations. The content of the lists in themselves is related to the work of the participants, not the gamified system they are using. Extrinsic motivation is therefore already in place due to work related demands. Hence, additional extrinsic motivations from a gamified system seems ineffective. On the other hand, it is possible that the issue lies in not having implemented enough extrinsic motivations in the gamified application (e.g. scores, badges or something similar to that extent). However, successful gamified systems need to balance between motivations in order to be effective, and in the case of this experiment, intrinsic motivations seem lower than extrinsic.

Assumptions related to time:
A2a: *Gamification will positively affect on-time deliveries.*
A2b: *If a deadline is missed, gamification will motivate users to deliver anyways.*

Based on initial dialogue with the case company, project managers were on average satisfied with the quality of deliveries. Their more pressing issue was on-time delivery. The behavioral data show that during the first batch of deliveries, all participants in the natural setting experiment delivered on-time. However, there is a noticeable drop already on second delivery. This can be related to participants being more aware they are being observed, as well as the checklist process being fresh in mind during the first delivery. This is reflected both with the gamified users and the non-gamified users equally.

The results are unsurprising taking into consideration that habit formation requires 18 days at minimum (Lally et al. 2009). Furthermore, the checklist process is of relatively low complexity both in the tasks per se and the usage of the application to conduct them. As Belotti et al. (2004) stated, routine tasks tend to have no need of explicit reminders as they are already part of a person's habits. All users failed to meet deadlines on occasions, which can mean that they did not have any strong routine in place. If that is the case, this supports the argument that lack of habit formation is due to short time. If however, they already had a routine in place, the time argument is not valid. We can then see towards the importance of

consistent context in habit formation. Participants were introduced to a new context as they moved from manual PDF documents to an online application. The switching of context can be a reason why we did not see any positive effect on deliveries over time, simply because the new context disrupted their routine.

Due to the time and context-related issues regarding habit formation, the conclusion cannot be drawn that gamification did *not* have a positive effect on our time-related assumptions. Nonetheless, the conclusion that it *did* have an effect cannot be drawn either, which results in assumption **A2a** and **A2b** both being inconclusive.

5.1.2. Gamification

Assumption related to gamification:
B1a: *Users will prefer the gamified application to the non-gamified.*

Intention data from the survey regarding self-efficiency, attitude and intention to use shows that there is a tendency for users to find the gamified application preferable. Only in expectancy of effort, differences were marginally in favour for the non-gamified user interface. Gamification users have a slightly more positive attitude towards the application. While the dataset is not large enough to statistically support any conclusion, the findings suggest support towards this tendency. As the assumption relates to how users perceive the application, there is no behavioural data to attach. Assumption **B1a** is therefore supported.

This can be linked to users finding the gamified user interface and user experience more pleasant. While it is interesting to discuss which gamification element had the most impact, it cannot be tied to any particular game design element. While it is hard to explicitly conclude, the importance of gamification design elements being presented together can be a major reason for this, and this is also in line with the literature review. A progress bar, aesthetics or feedback as standalone elements in a user interface cannot be defined as gamification according to the critics of Deterding et al. (2011), claiming that game elements in non-game contexts are not automatically gamification. Users enjoying gamification of a checklist-process also reflect the views of Werbach and Hunter (2012) and Houtari and Hamari (2012), stating the definition of gamification should pivot into a focus on making processes more "game-like" in order to ensure complete design of gamification. This is supported by Kapp (2012) who highlights the importance of gamification elements being presented in unison.

5.1.3. Gender and Game Literacy

Assumptions related to gender:
C1a: *Killer/achiever gamification design elements will positively affect the relationship between gamification and task performance for males.*
C1b: *Killer/achiever gamification design elements will negatively affect the relationship between gamification and task performance for females.*

The sample size between the genders was more or less non-existent in the natural setting as there was one female compared to seven males. No significant conclusion related to gender can be drawn. Furthermore, all participants in the natural setting, regardless of gamification and gender, had high quality ratings on their list deliveries. Assumptions **C1a** and **C1b** are inconclusive.

Literature has debated the effect of killer/achiever design elements (Liu, Santhanam and Webster 2017). The implemented gamification design in this project was to a large extent successful in terms of how users felt towards it, so killer/achiever elements seemed to not have any negative effects for males. It illustrates that the point laid forward by **Hamari and Tuunanen (2014),** an understanding of the player types in order to keep an *"emphasis in the set of motivations or behaviors"* is valid. Well-orchestrated gamification elements in the terms of balancing motivations ensures that gamification is designed towards achieving the desired effect.

Assumption related to game literacy:
C2a: *Game literacy will not affect the relationship between gamification and task performance.*

Every single participant reports little to no game literacy. As found in assumption **B1a**, users do prefer the gamified version. The lack of game literacy but enjoyment of a gamified application supports that gamification can indeed be designed as it was intended, inflicting the same type of engagement found in playing games to other different contexts, regardless of the person's experience with games. Assumption **C2a** is supported.

5.2. Controlled Setting

5.2.1. Task Performance: Quality and time

Assumptions related to quality:
A1a: *Gamification will increase quality of work in task performance.*
A1b: *Gamification will increase quality of work in subsequent deliveries over time.*

Gamified users delivered lists with about twice the quality compared to non-gamified users on average. The intentional data regarding performance expectancy also displays that users perceived the gamified application to be slightly better for their performance than the non-gamified. Therefore, assumption **A1a** is supported.

Variances in list qualities between the gamified and non-gamified group did show a trend with the gamified users delivering good quality initially, then dropping before raising quality towards the end. Non-gamified users however continued to drop in quality in deliverance for the remainder of the experiment. Assumption **A1b** is supported.

Participants in the controlled setting did not possess any extrinsic motivations to use the application, as they were not offered any form of reward for their participation and there was

no obligation from the researchers. The high quality in lists can be a result of high intrinsic motivations to complete the task as these were related to good hygiene, routines and personal well-being in a state of emergency. The tasks were the same for all participants, and as the gamified users delivered better quality, there is a tendency towards gamification having a positive reinforcing effect on the intrinsic motivations. This coincides well with the promise of gamification that it increases engagement, as it is meant to foster human motivation and performance in a given activity (Sailer et al. 2017). With intrinsic motivations already in place, gamification helps elevate engagement. As noted in the literature review, gamification designers should be inclined to focus their efforts towards designing experiences that taps into intrinsic motivations.

Assumptions related to time:
A2a: *Gamification will positively affect on-time deliveries.*
A2b: *If a deadline is missed, gamification will motivate users to deliver anyways.*

There was no obligation for participants to deliver lists at all in the controlled setting experiment. Between the gamfied and non-gamified groups, there is indeed a variance when it comes to delivery, and if it was done before the deadline. Gamified users did on average deliver more and had a higher on-time percentage than non-gamified users. Assumption **A2a** is supported.

The controlled experiment ran for more than 18 days, meaning that the timeframe to establish a routine was present according to literature (Lally et al. 2009). Participants in the controlled setting experiment did not have any pre-established routines regarding checklist completion on advice on routine in state of emergency, as the COVID-19 situation was unique. Therefore, gamification users showcasing more deliveries and hitting deadlines more regularly can be attached to gamification successfully establishing new routines in a consistent context effectively.

When non-gamified users missed a deadline, they never submitted the list at all. With the gamified users however, there were a few instances where users did deliver their lists even if they had missed the deadline. There are not enough data points to draw any meaningful conclusions on this point, but seen together with gamification literature stating that it is successfully helping to establish routine, the tendency leans towards gamification having a positive effect on delivery despite missing deadline. Assumption **A2b** is supported.

5.2.2. Gamification

Assumption relating to gamification:
B1a: *Users will prefer the gamified application to the non-gamified.*

Intentional data shows marginal support that users perceive the gamified application more positive for self-efficiency. In regards to ease of use and attitude, the gamified application scores generally higher than the non-gamified. On intention to use however, the gamified application is slightly surpassed by the non-gamified. When speaking about preference,

intention to use is naturally a variable that is of high importance. However, in the survey, users were asked to *imagine* that they had the opportunity to continue to use the application. Since continued use was not an option for them, the results from intention to use are not reliable. Yet, attitude towards use and ease of use are more reliable as these variables base themselves on what has already happened. The fact that the dataset is too small of course remains, so drawing any statistically significant conclusions is not possible. The tendency towards users preferring the gamified application above the non-gamified is present. In conclusion, assumption **B1a** is supported.

This assumption being supported coincides with the difference in task performance on the non-gamified compared to the gamified users. This is similarly related to the findings in assumption A1a and A1b, where extrinsic motivation from gamification boosted intrinsic motivation which already were in place. If intrinsic motivation is in place, there is an argument towards extrinsic motivational factors successfully tapping into the psychological perspectives and elevating the "game-like" effect, as noted by Houtari and Hamari (2012).

5.2.3. Gender and Game Literacy

Assumptions relating to gender:
C1a: *Killer/achiever gamification design elements will positively affect the relationship between gamification and task performance for males.*
C1b: *Killer/achiever gamification design elements will negatively affect the relationship between gamification and task performance for females.*

In the controlled setting, there was a heavy subset of females compared to males. For this reason, it is difficult to differentiate if the killer/achiever design affected one gender more positively or negatively. In general, task performance is neither exceptionally great nor particularly poor in gamified users. As a result, there is no possibility to isolate competitive gamification design as disheartening or not*.* However, for the non-gamified users, task performance is in general half the quality. Therefore it can be concluded that the competitive gamification design was not corrupting the desired effect of gamification. However, there is no way of knowing if other designs leaning towards for instance more cooperative elements would have provided even better results on the gamidfied users. Therefore, assumption **C1a** and **C1b** is inconclusive.

Assumption related to game literacy:
C2a: *Game literacy will not affect the relationship between gamification and task performance.*

All users reported low game literacy, but the gamified version performed better than the non-gamified. This supports that gamification is not only for people that have experience with games, but for everyone. Yet, there is no way of knowing if gamification would have been more effective if users possessed higher game literacy. Nevertheless, literature backs the conclusion that gamification is effective regardless of users' game experience. Assumption **C2a** is supported.

5.3. General discussion

The goal of this thesis was to answer the following research question: *Does gamification have a positive effect in engaging people to do quality work?*

Concerning quality of work delivered in the natural setting, there was no data to help answer the research question. It is hard to draw any definite conclusions, as the application possibly did not have enough extrinsic gamification elements to impose any significant effect. In this setting, the participants had a much higher moral and economic obligation to deliver their work in high quality as they were delivering work for their employer. Gamification elements which had the aim of enhancing higher quality of work either were not strong enough or irrelevant. In the controlled setting, findings lean towards supporting that gamification does have a major impact on quality of work however.

The difference in findings in the two settings is most likely due to the participants being employees, and thus have a higher obligation in doing their assigned work properly. As such, the participants in the natural setting were arguably more motivated by extrinsic motivations. Private users in the controlled setting were free to decide if they wish to follow the presented guidelines/advice from public institutions, so the need to deliver quality work was not equally pressing. However, if these users did deliver high quality work, their motivations were arguably intrinsic, and as such stronger. This showcases that when intrinsic motivation is in place, carefully designed gamification is not as important. The gamification in this project was specifically designed for the context of the checklist deliveries in the case company, and not for the routine creation in state of emergency. However, participants in the controlled setting did experience an effect by using gamification that was not specifically designed for them. Presence of extrinsic motivational factors showed to have a high impact when intrinsic motivations were in place, and the need for them to be carefully designed was not as pressing.

Since quality of work in the natural setting group is of high standard regardless of gamification, the project managers in the case company had no issues related to quality of delivered work. Rather, a main hurdle was lists not being delivered frequently on time. As on-time delivery is of essence for a project manager, an aim for this thesis was to test if gamification could be effective in habitualized a routine to encourage more rapid and on-time delivery. Due to being compromised by the COVID-19 pandemic, the timeframe for experimenting was drastically shortened. The behavioural data therefore showed that unfortunately there was no time to manifest any significant habit of routine delivery. In the controlled setting, the timeframe was longer, and quite clearly gamification had a positive effect on creating more routine and habits compared to no gamification. If granted enough time, this tendency could likely be replicated in the natural setting.

This thesis has brought up game literacy as a concept, and made tests to see if experience with games had any effect regarding gamification. As assumed, no effect was to be found

since the basis of gamification is introducing game elements and its engaging principles for everyone.

Having two settings showed to be a strength as it was much easier to interpret and understand the data from the controlled setting due to more data points and longer time frame. While it has been noted in the discussion that separating game design elements is hard, the separation of contexts did showcase the effect of one particular gamification element. In the controlled setting, the administrators were the researchers, while in the natural setting, administrators were the project managers from the case company. As pointed out by Kapp and Robin Hunicke, feedback needs to be regular. Examples are found in for instance fitness watches and apps like Polar, MyFitnessPal and Yoga meditation apps, which heavily use gamification elements to motivate users to keep doing rapid "deliveries". On rapidity, feedback was also more quick and timely in the controlled setting experiment. Admins on the natural setting experiment had a tendency to let a couple of days pass before reviewing lists, which can explain why the differences in gamified and non-gamified users was more prominent in the controlled setting. This illustrates the importance of gamified elements being presented in unison, as Kapp (2012) highlights. Irregular feedback stands the risk of breaking the unison of gamification elements.

Table 32: Overview of assumptions, results and assessments

Variables	Assumptions	Results				Assessment	
		Natural Setting		Controlled Setting		Natural	Controlled
		Between Group Experiment (Behaviour)	UTAUT Survey (Intention)	Between Group Experiment (Behaviour)	UTAUT Survey (Intention)		
Quality	**A1a:** *Gamification will increase quality of work in task performance.*	Does not support	Does not support	Support	Support	Rejected	Accepted
	A1b: *Gamification will increase quality of work in subsequent deliveries over time.*	Can not say	Can not say	Support	Support	Inconclusive	Accepted
Timing	**A2a:** *Gamification will positively affect on-time deliveries.*	Can not say	Can not say	Support	Can not say	Inconclusive	Accepted
	A2b: *If a deadline is missed, gamification will motivate users to deliver anyways.*	Can not say	Can not say	Support	Can not say	Inconclusive	Inconclusive
Preference	**B1a**: *Users will prefer the gamified application to the non-gamified.*	Can not say	Support	Support	Support	Accepted	Accepted
Gender	**C1a**: *Killer/achiever gamification design elements will positively affect the relationship between gamification and task performance for males.*	Can not say	Can not say	Can not say	Can not say	Inconclusive	Inconclusive

	C1b: *Killer/achiever gamification design elements will negatively affect the relationship between gamification and task performance for females.*	Can not say	Can not say	Can not say	Can not say	Inconclusive	Inconclusive
Literacy	**C2a:**: *Game literacy will not affect the relationship between gamification and task performance.*	Can not say	Support	Can not say	Support	Accepted	Accepted

5.4. Weaknesses and strengths

5.4.1 Weakness related to research method

Online survey

An online survey can be useful for understanding how gamification affects the enjoyableness of experience, as little previous research has tested this specific part of gamification isolated (Seaborn and Fels 2015). Such self-reporting surveys can be challenging as they rely on the subject actually being aware of their experience and other biases (Donaldson and Grant-Vallone 2002). In our case to mitigate the unsureness of these responses, implementing semi-structured interviews with some of the respondents as a follow-up of the survey results would be useful. This would in addition provide qualitative insight, which is desirable following Myer's (1997) arguments.

Experiments

To make any strong statistical analysis, a greater number of participants in the pool is required. Unfortunately this was not the case for the thesis. A group size of between 15 and 20 would be ideal (Oates 2006). This is because the data was also collected from surveys, in which a sample size of at least 30 is viewed as satisfactory for small-scale first-time research projects (Oates 2006). Still it is not a fault of the research method, but more in the ability to find more participants as well as greater variance in both age and gender.

This challenge surfaced as there was an incident where one participant failed to deliver because of problems they had with their on-premise IT infrastructure, which prohibited them from delivering any list at all. Which shows the disadvantage of having such a small sample size in the experiment combined with a short time frame.

Experiments also require quite a large amount of control and focus on both internal and external validity to produce satisfying results. Especially the "reactivity and experimenter effects" stated by Oates (2006) where participants might behave differently since they are aware of being tested which might affect the data being produced (Oates 2006). That effect is among the biggest threats to validity since the purpose of the thesis is to distinguish when a user is doing a task out of utilitarian sake (i.e doing task because the user has to) versus the user doing a task because of the influence of gamification elements baked into the process of doing said task.

5.4.2 Strength related to research method

Online survey

The UTAUT model proved to be useful in understanding how users experienced the application. This evaluation form has the potential to produce results that can explain the cause and effect of gamification. It might not necessarily be effective in determining which gamification element is most motivating, but (dis)prove whether gamification as a whole is motivating or not. Following Kapp (2012), gamification should be presented in unison as this would in turn result in a more cohesive research on gamification. Therefore it is not a loss that we are unable to distinguish them.

Experiments

This project sought to explore whether gamification could inflict a desirable behaviour and emotional response. That denotes a search for patterns and regularities, which is in line with the positivist research paradigm. Experiments are also one of the most used strategies in positivist research, as they take on the assumption that we can explore and investigate the world objectively (Oates, 2006). As gamification is complex, it arguably makes it hard to design research based on the reductionist method of positivism. Gamification is a combination of many elements working together (Kapp, 2012), and should therefore be researched as a whole. Research on the subject should therefore be designed in a repeatable or refutable manner. Arguably, this project is designed appropriately as it incorporates measurement and observation which allows for quantitative analysis, is not dependent on the researcher(s) being a specific individual (objective), is based on assumptions that can be proved or disproved, and looks for generalizations, all characteristics of positivism (Oates, 2006).

5.4.3 Application development

A working application is preferable for the research as it ensures that the gamified elements are presented in unison (visuals in themselves are important elements in gamification (Kapp 2012). This would in turn arguably result in a more cohesive research on gamification. The scope of a master thesis is not large, and it would generally be unrealistic to be able to develop such a working application both in the sense of time and cost. The decision to do so was bold, and did push the limits of what was feasible to do in the given time frame. An underestimation of the degree of security issues that needed to be resolved in order for the case company to utilize the application resulted in development needing drastically more time than anticipated.

Information systems are inherently complex to develop, and this project aimed to incorporate an already complex theory (gamification) on top of it. Information systems research in general is expected to contribute to both the theoretical body of work, but also aid in solving an issue in the industry (Sein et al. 2011). This is difficult to pull off, as IS researchers have pointed out that there are many cases of disconnect between theory and practice (Sein et al. 2011), something gamification itself is also guilty of. However, both application development and gamification design proved to be successful and is in the end a great strength for this

project as it has laid the foundation for being able to clearly separate gamified and non-gamified elements. Furthermore it has required a mindful design process of a gamified system which resulted in a better understanding of said process.

5.4.4. COVID-19 related issues

The COVID-19 pandemic slowed down both the development of application and limited the data collection in the natural setting in particular. The main issue was related to data collection being drastically shortened as the initial plan to collect data for two months was reduced to under one month. The pandemic did however present a unique opportunity to examine gamification in a controlled setting, which in the end proved to be a great strength since the results from both settings could be discussed against each other.

5.4.5. Future studies

Overall, the short time frame and resulting small dataset makes it impossible to state any actual findings from this thesis. Therefore, repeating the project over a longer time frame would allow for more data collection, and possibly ability to make proper, statistically significant conclusions.

The natural setting data concluded generally in favour for the non-gamified application. As discussed, this could be due to lack of intrinsic motivations amongst workers. Therefore, an investigation into how to design a gamified system that taps into more intrinsic motivations would be an interesting future study.

Finally, other projects and contexts developing and applying gamification designs based on Kapp's 12 Game Design Elements (2012) placed in Liu et al. 's framework (2017) would be interesting to see to test the combination of these two contributions to the gamification literature.

6. Implications

One of the main contributions in this thesis is the support of the assumption that users will prefer gamification above non-gamification. This verifies that the manner in which the gamified system is designed is successful in giving users a positive experience. Both Kapp's 12 Game Design Elements and Lui et al. 's (2017) framework was put into use. As argued in the section about the design of the gamified application (section 2.6.2), the selected elements from Kapp (2012) are technical. The Lui et al. (2017) framework positions the technical elements in the particular context. It urges designers to take into consideration the social and psychological factors in their given application context. This supports one of the main findings in the literature review that successful gamification design takes social and psychological factors into consideration when choosing technical game elements. As such, the discussion in the literature about whether gamification belongs in social, psychological or technological fields have not only resulted in a better understanding about what gamification *is,* it can now also lead us towards a better understanding of how it is done.

Another contribution for practitioners is that the current trend of incorporating gamification concepts to excite and persuade users to find more "tedious" processes such as routine task performance or similar objectives in project management seems to be working, which is supported by the literature claiming that gamification should be used to make employees more engaged in their work (Liu, Santhanam and Webster 2017, Koivisto and Hamari 2019). Therefore, practitioners can be more safe to invest resources in designing and implementing gamification in their systems.

As literature states, researchers have had issues with understanding the perceived effect of gamification. The usage of the UTAUT model as a means to measure the said effect has proved helpful in this thesis, and could therefore be a useful tool for other similar projects.

7. Conclusion

This thesis had the main goal of answering the research question: *Does gamification have a positive effect in engaging people to do quality work?* Through the constructed research framework, it was discovered that gamification does have a slight impact on engaging employees in their task performance in a project management context, but more so on personal task management in a private context. Findings also further showcased tendencies that designing gamification involves a presentation of gamification elements in harmony while taking into consideration technical game design elements and social-psychological contexts. This is especially true when intrinsic motivations are lacking, as gamification can provide more extrinsic motivations. When intrinsic motivations are in place however, the need for gamification to be specifically designed seems to be of less importance.

One of the major reasons for why gamification is being used in many different contexts and as a problem solver, is due to its aim to make "boring" tasks and processes more enjoyable (Liu, Santhanam and Webster 2017, Koivisto and Hamari 2019). If successful, the quality of simple routines and tasks can be elevated as gamification is the idea of engagement, story, autonomy and meaning Kapp (2012). The findings in this thesis supports that possibility.

The context in which gamification has been tested here is a rather small, isolated checklist process. It was found to have positive effects, but we believe gamification can have the biggest impact on information systems where users are constantly engaging on a daily basis, be at an ERP system, e-learning platform or a calorie tracker app on their phone (Seaborn and Fels 2015, Hamari, Koivisto and Sarsa 2014). It is here people can be reached, where engagement can be created and quality work can be done.

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Appendix A (ethical approval)

Kristiania
University
College

25th of May 2020

STATEMENT OF ETHICS APPROVAL

Proposer: Oda Flo Humlung and Chængiz Seydul Hosseini

The school´s research ethics committee has considered your submitted proposal. Acting under delegated authority, the committee is satisfied that there is no objection on ethical grounds to the proposed study.

Approval is given on the understanding that you will adhere to the terms agreed with participants and to inform the committee of any change of plans in relation to the information provided in the application form.

Yours sincerely,

Asle Fagerstrøm
Professor

Appendix B (consent form)

1. Consent form natural setting

Formål
Dette er et forskningsprosjekt som tester bruk av digitale hjelpemidler for egenkontroll. Resultatene brukes for å vurdere hvorvidt et digitalt hjelpemiddel er effektivt for å gjennomføre denne type rutineoppgaver, og hvordan det evt. kan gjøres bedre.

Deltakelse skjer gjennom å bruke et nettsted med egne sjekkliste(r) tilknyttet egenkontroll i prosjektet.

Hvem er ansvarlig for prosjektet?
Ansvarlige er studenter ved Høyskolen Kristiania Oda Humlung og Changiz Hosseini. Prosjektet er del av en masteroppgave som gjennomføres høyskolens institutt for teknologi under veiledning av professor Asle Fagerstrøm.

Selv om dette prosjektet per nå er tilknyttet forskning og utdanning har vi som ambisjon å se på muligheten for å videreutvikle applikasjonen for å gjøre egenkontroll enkelt og effektivt. Resultatene fra masteroppgaven vil legge et grunnlag for det.

Din deltakelse
Vi ønsker din deltakelse ettersom du pleier (eller skal begynne med) å bruke sjekklister for egenkontroll i arbeidet ditt.

Dersom du velger å delta, innebærer å logge inn på et nettsted med din e-post og passord du får tildelt (kommer senere). Nettstedet inneholder en liste med sjekkpunkter fra C3BIM. Her skal du sjekke av for hvert element på listen om du har gjort det eller ikke, og legge til eventuelle kommentarer du måtte ha. Listen gjennomføres i henhold til frister satt fra C3BIM (fristene står på nettstedet). Totalt går dette prosjektet over 4 uker. Bruksdata fra nettstedet samles inn.

Etter at siste liste er levert inn får alle deltakere en digital spørreundersøkelse tilsendt med spørsmål om deres oppfatning av å bruke det digitale hjelpemidlet. Her får du også mulighet for å svare ja/nei på om du vil la deg kontakte for et intervju som går litt mer i dybden på din opplevelse (innsikt vi gjerne vil ha til videre utvikling av nettstedet).

Deltakelse er frivillig
Det er frivillig å delta i prosjektet, og du kan når som helst trekke tilbake ditt samtykke om du skulle ombestemme deg underveis. Du behøver ikke å oppgi noen grunn til det. Alle dine

personopplysninger vil da bli slettet. Det vil ikke ha noen negative konsekvenser for deg om du på noe tidspunkt skulle velge å trekke deg.

Personvern - hvordan lagrer og bruker vi dine data?
Data som blir samlet inn vil kun bli brukt til formålene beskrevet her. Alle data vil bli behandlet konfidensielt og i samsvar med personvernregelverket. Alle data vil bli behandlet uten direkte gjenkjennende opplysninger. Denne vil kun være tilgjengelig for Oda Humlung og Changiz Hosseini. I eventuelle publikasjoner vil det ikke være mulig å gjenkjenne data.

Dine rettigheter
I følge personvernlov fra EU/EØS 2018 (General Data Protection Regulation) har du, så lenge du kan identifiseres i dataen, rett til å:
- Få innsyn i hvilke personopplysninger som er registrert om deg, og å få utlevert en kopi av opplysningene
- Få rettet personopplysninger om deg
- Få slettet personopplysninger om deg
- Be om at dine personopplysninger ikke benyttes til noe
- Reservere deg mot at automatiserte dataprogrammer tar valg for deg (dette prosjektet bruker ikke det)
- Få dataen din fra tilsendt fra oss
- Få forståelig informasjon om hva vi skal bruke informasjonen fra deg til
- Protestere eller sende klage til Datatilsynet om behandlingen av dine personopplysninger

Hva gir oss rett til å behandle dine data?
Vi behandler din data basert på ditt samtykke. Dersom du har spørsmål eller ønsker å vite mer, kontakt Oda Humlung (humoda15@student.kristiania.no) eller Changiz Hosseini (seycha15@student.kristiania.no).

Samtykke
Jeg har mottatt og forstått informasjon om dette prosjektet, samt mulighetene til å stille spørsmål, og bekrefter med dette at jeg samtykker til å delta.

2. Consent form controlled setting

Formål
Dette er et forskningsprosjekt som tester bruk av digitale hjelpemidler for å strukturere egen hverdag i unntakstilstand. Resultatene brukes for å vurdere hvorvidt et digitalt hjelpemiddel er effektivt for å gjennomføre denne type rutineoppgaver, og hvordan det evt. kan gjøres bedre.

Deltakelse skjer gjennom å bruke et nettsted med liste over aktiviteter og råd som anbefales å følge når hverdagen plutselig endrer seg.

Hvem er ansvarlig for prosjektet?
Ansvarlige er studenter ved Høyskolen Kristiania Oda Humlung og Changiz Hosseini. Prosjektet er del av en masteroppgave som gjennomføres høyskolens institutt for teknologi under veiledning av professor i markedsføring Asle Fagerstrøm.

Din deltakelse
Du er aktuell for å delta ettersom din hverdagen har endret seg en god del som følge av COVID-19, og du er over 18 år.

Dersom du velger å delta, innebærer å logge inn på et nettsted med et eget brukernavn og passord du får tildelt. Nettstedet som inneholder en liste med aktiviteter og råd som anbefales å følge når hverdagen plutselig endrer seg. Her skal du sjekke av for hvert element på listen om du har gjort det eller ikke, og legge til eventuelle kommentarer du måtte ha. Listen skal gjennomføres på slutten av hver uke (i løpet av helgen). Totalt skal du gjennom 3 uker. Din bruksdata fra nettstedet samles inn.

Etter at siste liste er levert inn får alle deltakere en digital spørreundersøkelse tilsendt med spørsmål om deres oppfatning av det digitale hjelpemidlet. Her får du også mulighet for å svare ja/nei på om du vil la deg kontakte for et intervju som går litt mer i dybden på din opplevelse.

Deltakelse er frivillig
Det er frivillig å delta i prosjektet, og du kan når som helst trekke tilbake ditt samtykke om du skulle ombestemme deg underveis. Du behøver ikke å oppgi noen grunn til det. Alle dine personopplysninger vil da bli slettet. Det vil ikke ha noen negative konsekvenser for deg om du på noe tidspunkt skulle velge å trekke deg.

Personvern - hvordan lagrer og bruker vi dine data?
Data som blir samlet inn vil kun bli brukt til formålene beskrevet her. Alle data vil bli behandlet konfidensielt og i samsvar med personvernregelverket. Alle data vil bli behandlet uten direkte gjenkjennende opplysninger, men i form av en kode som knytter seg til din kontaktinfo i en liste. Denne vil kun være tilgjengelig for Oda Humlung og Changiz Hosseini. I eventuelle publikasjoner vil det ikke være mulig å gjenkjenne data.

Hva skjer med dataen etter avsluttet prosjekt?
Når prosjektet er avsluttet (etter planen 25.05.2020) vil dataen anonymiseres.

Dine rettigheter
I følge personvernlov fra EU/EØS 2018 (General Data Protection Regulation) har du, så lenge du kan identifiseres i dataen, rett til å:

- Få innsyn i hvilke personopplysninger som er registrert om deg, og å få utlevert en kopi av opplysningene
- Få rettet personopplysninger om deg
- Få slettet personopplysninger om deg
- Be om at dine personopplysninger ikke benyttes til noe
- Reservere deg mot at automatiserte dataprogrammer tar valg for deg (dette prosjektet bruker ikke det)
- Få dataen din fra tilsendt fra oss
- Få forståelig informasjon om hva vi skal bruke informasjonen fra deg til
- Protestere eller sende klage til Datatilsynet om behandlingen av dine personopplysninger

Hva gir oss rett til å behandle dine data?
Vi behandler din data basert på ditt samtykke. Dersom du har spørsmål eller ønsker å vite mer, kontakt Oda Humlung (humoda15@student.kristiania.no) eller Changiz Hosseini (seycha15@student.kristiania.no).

Samtykke
Jeg har mottatt og forstått informasjon om dette prosjektet, samt mulighetene til å stille spørsmål, og bekrefter med dette at jeg samtykker til å delta.

Appendix C

1. Team related factors affecting project management failure and success (Baker, Murphy & Fisher, 1988)

Perceived failure	Perceived success	Linear
- Insufficient use of status/progress reports - Use of superficial status/progress reports - Inadequate project manager skills in administration - Inadequate project manager skills in	- Organization structure suited to the project team - Project team participation in determining schedules and budgets - Project manager committed to established schedules	- Goal commitment of project team - Adequate project team capability - Task (vs. social) orientation - On-site project manager

humans (interpersonal) ● Inadequate project manager skills in technology ● Inadequate project manager skills in influence ● Inadequate project manager skills in authority ● Lack of project team participation in decision-making ● Lack of project team participation in major problem solving ● Excessive structuring within the project team ● Job insecurity within the project team ● Lack of team spirit and sense of mission within the project team	● Project manager committed to established budget ● Project manager committed to technical performance goals	

2. Elements in Gamification (Kapp, 2012)

	Game Element(s)	Description
1	Abstractions of Concepts and Reality	Abstracted reality gives inexperienced people to engage with concepts such as business strategy, processes etc.
2	Goals	Adds purpose, focus and measurable outcomes.
3	Rules	Split into 4 types: Operational (How is the game played), Constitutive/Fundamental Rules (Rules only needed to be known by the designer), Implicit/Behavioral Rules (social rules in the game) and Instructional Rules (rules the designer wants the players to know after playing the game)
4	Conflict, Competition, Cooperation	Conflict: Challenge provided by an opponent (real person or from the game) Competition: Compete against each other towards a common goal. Cooperation: Work together towards a common goal
5	Time	Motivating factor for player urgency, such as completing a customer support task. Similar use for consequences, not meeting a deadline etc.
6	Reward Structures	Badges, Points and other similar rewards structures to show progress and provide reward for players.
7	Feedback	Needs to be frequent and instant, and to promote correct behaviour in the game.
8	Levels	Players progress from one level to another, mission oriented structure. Helps make the game not feel "directionless".
9	Storytelling	Give context to the tasks done in the game.
10	The Hero's Journey	Story made up of characters, plot, tension and resolution.
11	Curve of Interest	Flow and sequences of events that keep users engaged.
12	Aesthetics	Visual presentation to provide both feedback and pleasure.
13	Replay or Do Over	Permission to "fail", giving opportunity to explore and experiment in the game.

3. List Elements in Controlled Setting

Hygiene og smitte
- Vært bevisst på å ta meg selv lite i ansiktet
- Vasket hendene hver gang jeg kommer inn et sted
- Unngått håndhilsning, samt kyssing og klemming, med personer som ikke tilhører min egen husstand eller er fast partner
- Holdt god avstand til alle når jeg har beveget meg ute

Rutiner
- Gått en tur ut/vært i fysisk aktivitet hver dag
- Snakket med en venn/bekjent på telefon
- Snakket med en venn/bekjent på Zoom/Skype/Teams eller lignende

- Sørget for at jeg har spist god, sunn mat til de fleste måltider
- Fått nok søvn hver natt
- Kledd på meg vanlige klær hver arbeidsdag
- Pusset tennene hver morgen
- Vasket/ryddet hjemme

For meg selv
- Prøvd å pusse tennene med motsatt hånd en morgen
- Kjent på hvordan været føles mot ansiktet når jeg har vært utendørs
- Gått en tur og latet som om jeg ser mitt eget nabolag for første gang
- Kjent ekstra godt etter hvordan dagens første drikke (vann/kaffe/te) føles i halsen
- Tenkt på å ta opp noe jeg tidligere i livet har hatt lyst til å lære
- Spurt en venn/bekjent hvordan det går med dem

4. Survey Questions Natural Setting

Performance Expectancy

Question	Scale
Jeg syns Fellow er nyttig i mitt arbeid.	1-7
Å bruke Fellow gjør at jeg kan gjennomføre arbeidsoppgavene mine fortere.	
Å bruke Fellow øker produktiviteten min.	
Hvis jeg bruker Fellow, øker det sannsynligheten for at arbeidet mitt blir vurdert som bra.	

Effort Expectancy

Question	Scale
Min bruk av Fellow er klar og lettforståelig.	1-7
Det er lett for meg å bli flink i å bruke Fellow.	
Jeg syns Fellow er enkel å bruke.	
Å lære å bruke Fellow er lett for meg.	

Attitude towards using <name>

Question	Scale
Å bruke Fellow er en god idé.	1-7

Å bruke Fellow er en dårlig idé.	
Fellow gjør arbeidet mitt mer interessant.	
Å bruke Fellow er gøy.	
Jeg liker å jobbe med Fellow.	

Social Influence

Question	Scale
Kolleger som har påvirkning på min hverdag syns jeg burde bruke <navn.	1-7
Mennesker som er viktige for meg syns jeg burde bruke <navn.	
Mine <direkte overordnede> har vært positive og oppmuntrende i bruken av Fellow.	
Generelt sett har min arbeidsplass vært positiv og støttende i bruken av Fellow.	

Facilitating Conditions

Question	Scale
Jeg har det jeg trenger av ressurser for å bruke Fellow.	1-7
Jeg har kunnskapen til å bruke Fellow.	
Fellow er ikke kompatibel med andre programmer jeg bruker på jobb slik som <verktøy, verktøy..>	
En dedikert person eller avdeling er tilgjengelig til å hjelpe dersom jeg skulle ha problemer med Fellow.	

Self-Efficiency

Question	Scale
Jeg kan gjøre det jeg må i Fellow uten at noen trenger å være der og hjelpe meg.	1-7
Jeg kan gjennomføre de fleste arbeidsoppgaver i Fellow dersom jeg kan ringe noen for hjelp om jeg sitter fast.	
Jeg kan gjennomføre de fleste arbeidsoppgaver i Fellow ved å bruke de innebygde hjelpefunksjonene.	
Jeg kan gjennomføre de fleste arbeidsoppgaver i Fellow hvis	

jeg får tilstrekkelig med dedikert tid til det.	

Anxiety

Question	Scale
Jeg føler meg usikker/engstelig på å bruke Fellow.	1-7
Jeg er bekymret over å miste informasjon på grunn av Fellow hvis jeg klikker på noe feil.	
Jeg er bekymret over å bruke Fellow i frykt for at jeg skal gjøre en uopprettelig feil.	
Fellow er litt avskrekkende for meg.	

Intention

Question	Scale
Jeg kommer til å bruke Fellow i de neste 4 ukene framover.	1-7
Jeg antar jeg kommer til å bruke Fellow i løpet av de neste 4 ukene.	
Jeg planlegger å bruke Fellow i løpet av de neste 4 ukene.	

Control (internal validity)

Question	(Scale?)
Jeg har snakket med andre om Fellow i løpet av perioden jeg har brukt den.	1-7
Jeg har snakket med kolleger om Fellow i løpet av perioden jeg har brukt den.	

Demography

Question	Response
Jeg er…	Mann, kvinne, annet, vil ikke oppgi
Min alder er…	Under 25, 26-39, over 40
Hvordan er din bruk av digitale løsninger i jobben?	Ikke noe, Litt (primært for kommunikasjon), Noe (primært for kommunikasjon og

	administrasjon), En del (rundt halvparten av arbeidet foregår i diverse programmer og systemer), Mye (majoriteten av arbeidet foregår i diverse programmer og systemer)
Jeg spiller av og til/ofte spill på datamaskin (PC/Mac)	Aldri/sjeldent, Et par ganger i uka, Flere ganger i uka
Jeg spiller av og til/ofte spill på konsoll (PlayStation, Xbox, PSP ol.)	Aldri/sjeldent, Et par ganger i uka, Flere ganger i uka
Jeg spiller av og til/ofte spill på mobil	Aldri/sjeldent, Et par ganger i uka, Flere ganger i uka
Jeg spiller ikke digitale spill	

5. Survey Questions Controlled Setting

Performance Expectancy

Question	Scale
Jeg syns Fellow er nyttig for rutiner.	1-7
Å bruke Fellow gjør at jeg kan gjennomføre rutiner fortere.	
Å bruke Fellow gjør at jeg gjennomfører flere rutiner.	
Hvis jeg bruker Fellow, øker det sannsynligheten for at mine rutiner gjennomføres.	

Effort Expectancy

Question	Scale
Min bruk av Fellow er klar og lettforståelig.	1-7
Det er lett for meg å bli flink i å bruke Fellow.	
Jeg syns Fellow er enkel å bruke.	

Å lære å bruke Fellow er lett for meg.	

Attitude towards using <name>

Question	Scale
Å bruke Fellow er en god idé.	1-7
Å bruke Fellow er en dårlig idé.	
Fellow gjør rutiner mer interessant.	
Å bruke Fellow er gøy.	
Jeg liker å bruke Fellow.	

Social Influence

Question	Scale
Mennesker som har påvirkning på min hverdag syns jeg burde bruke Fellow.	1-7
Mennesker som er viktige for meg syns jeg burde bruke Fellow.	
De rundt meg har vært positive og oppmuntrende i bruken av Fellow.	
Generelt sett har min husstand vært positiv og støttende i bruken av Fellow.	

Facilitating Conditions

Question	Scale
Jeg har det jeg trenger av ressurser for å bruke Fellow.	1-7
Jeg har kunnskap til å bruke Fellow.	
Fellow er ikke kompatibel med andre programmer/verktøy jeg bruker for rutiner.	
En dedikert person er tilgjengelig til å hjelpe dersom jeg skulle ha problemer med Fellow.	

Self-Efficiency

Question	Scale
Jeg kan gjøre det jeg må i Fellow uten at noen trenger å være der og hjelpe meg.	1-7

Jeg kan gjennomføre de fleste oppgaver i Fellow dersom jeg kan ringe noen for hjelp om jeg sitter fast.	

Anxiety

Question	Scale
Jeg føler meg usikker/engstelig på å bruke Fellow.	1-7
Jeg er bekymret over å miste informasjon på grunn av Fellow hvis jeg klikker på noe feil.	
Jeg er bekymret over å bruke Fellow i frykt for at jeg skal gjøre en uopprettelig feil.	
Fellow er litt avskrekkende for meg.	

Intention

Question	Scale
Jeg kommer til å bruke Fellow i de neste 4 ukene framover.	1-7
Jeg antar jeg kommer til å bruke Fellow i løpet av de neste 4 ukene.	
Jeg planlegger å bruke Fellow i løpet av de neste 4 ukene.	

Control (internal validity)

Question	(Scale?)
Jeg har snakket med andre om Fellow i løpet av perioden jeg har brukt den.	1-7
Jeg har snakket med kolleger om Fellow i løpet av perioden jeg har brukt den.	

Demography

Question	Response
Jeg er…	Mann, kvinne, annet, vil ikke oppgi
Min alder er…	Under 25, 26-39, over 40
Hvordan er din bruk av digitale løsninger i jobben?	Ikke noe, Litt (primært for kommunikasjon), Noe (primært for

	kommunikasjon og administrasjon), En del (rundt halvparten av arbeidet foregår i diverse programmer og systemer), Mye (majoriteten av arbeidet foregår i diverse programmer og systemer)
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Jeg spiller av og til/ofte spill på mobil	Aldri/sjeldent, Et par ganger i uka, Flere ganger i uka
Jeg spiller ikke digitale spill	