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The Impact of Gamification on Motivation to Learn: A study on Using Gamification to Increase Intrinsic Motivation and the Interaction with Personality

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Abstract

Gamification is a concept which can be used to enhance performance and motivation to learn with the help of game design. The present study aims to investigate the effects of gamification on performance, intrinsic motivation, amotivation, as well as exploring the interactions with personality traits. In two separate studies using a randomized experimental design gamification defined by narrative, avatars, challenge, feedback, and rewards was tested. The results show that people in the gamified conditions scored higher in self-reported intrinsic motivation (d =.40, .80). There was also a significant effect on amotivation in study two (d =.48). However, no differences were found on performance in any of the studies. Results also show that personality interacts with gamification in certain circumstances. The importance of context, age, and application of individual game design elements are also discussed.

Keywords: *Gamification, Intrinsic motivation, Amotivation, Narrative, Performance*

Introduction

This paper aims to explore the potential of using gamification to foster motivation to learn and interact with an online learning material. Gamification has been defined as *"the use of game design elements in non-game contexts"* (Deterding et al., 2011, P.9). By using game design elements motivational aspects fostered by the game are channelled towards more mundane tasks to make them seem more fun and engaging to perform (Deterding et al., 2011; Domínguez et al., 2013) Common game design elements used in gamification are: *avatars, ranks, leaderboards, levels, point systems, competition and challenges, narrative, badges, etc.* (Deterding et al., 2011; Landers et al., 2017). This makes for a wide range of application and at the pace of digitalisation this concept has seen rapid expansion in the last two decades (Landers, 2019; Perryer et al., 2016). For example, gamification has been used to increase user engagement in mobile apps (Seiffert-Brockmann et al., 2018), and improve user engagement in an employee selection tool (Georgiou et al., 2019) etc.

Gamified learning is presently one of the largest fields within gamification research (Perryer et al., 2016). A recent meta-analysis conducted by Sailer and Homner (2020) stated that the overall effects of gamification within a learning setting is deemed to be positive. However, the amount of available material for a meta-analysis was considered small with effect sizes in danger of becoming unstable (Sailer & Homner, 2020). A large portion if the research into gamified learning have proven effective in increasing academic performance and motivation to learn (Bouchrika et al., 2019; Jurgelaitis et al., 2018; Tsay et al., 2018). However, evidence for the contrary has also appeared. Hanus and Fox (2015) found that students in a gamified course scored lower than their non-gamified counterpart in their final exams. The participants in this study also reported less intrinsic motivation to learn when compared to a control group (Hanus & Fox, 2015). Several other researchers also report unsuccessful gamification interventions in terms of performance and learning results (e.g., Stansbury & Earnest, 2017; Tan & Hew, 2016).

Unsuccessful gamification of learning and motivation to learn has primarily been blamed on bad execution of the gamification (Loughrey & Broin, 2018; Toda et al., 2018). Even so, the critics of gamification is urging for caution with applying gamification while pointing at the necessity to target innate psychological needs instead of short term gains in performance (Conway, 2014; van Roy & Zaman, 2018). This controverse points at the complexity in understanding gamification. In many ways, gamification have been viewed as a uniform concept which is either successful or not (Aldemir et al., 2018). There is a need to widen the scope to better understand how to utilise the many different elements of game

design as a system concept (Rapp, 2017; Robson et al., 2015; van Roy & Zaman, 2015). A growing group of researchers also points out the necessity of researching the moderating impact of individual differences on gamification (Ghaban & Hendley, 2019; Höllig et al., 2020). Trait competitiveness, trait playfulness and the Big 5 personality dimensions have all been mentioned as having influential effects on gamification regarding both productivity and motivation (Deterding et al., 2011; Höllig et al., 2020; Jia & Voida, 2017; Landers et al., 2019).

This paper aims to use gamification to foster motivation as explained by self-determination theory (SDT). In two separate studies a system of game design elements was applied in two distinct types of contexts. Using a randomized experimental design, both studies were designed to answer the question if gamification can be used to increase performance in a learning task simultaneously as fostering intrinsic motivation and decrease amotivation to learn and interact with the gamified system. Both studies also assess the role of personality in the context of gamification. Before explaining the studies in more detail, the theoretical underpinnings will be discussed.

Theory

Motivation

Self-determination theory (SDT) is a metatheory of motivation highlighting the importance of people evolving inner resources for personality development and behavioural self-regulation (Ryan & Deci, 2000). It takes the focus away from viewing motivation as a singular construct. Instead, it admits that motivation could take many forms and be driven by many factors simultaneously or individually (Deci & Ryan, 2000). To be more precise, a person performing a task could be driven by internalised motives thereby being intrinsically motivated. Also, the same person could be driven by more external motives thereby being extrinsically motivated to perform the task. Extrinsic motivation is also embossed by several layers of internalisation (Ryan & Deci, 2000). At the opposite end of motivation stand the construct of amotivation. Amotivation represent the lack of motivation or feelings of meaningfulness toward the task at hand and has been defined as the state of lacking the intention to act (Ryan & Deci, 2000). Amotivation comes from not valuing an activity or not expecting it to yield a desired outcome (Ryan, 1995; Seligman, 1975).

The foundation of self-determination rests on the pillars of three basic human needs. The need of *competence*, *autonomy*, and *relatedness*. Fulfilment of these needs are deemed crucial for fulfilling motivation to perform in various tasks. The level of which each of the

needs are fulfilled also determines the level of intrinsic or internalised motivation someone has towards completing a task at hand (Deci & Ryan, 2000; Ryan & Deci, 2000).

Gamification

Gamification is about repurposing something that is originally used for hedonic purposes into a utilitarian setting (Van der Heijden, 2004). The theoretical underpinnings of how gamification works rests of three pillars. *A gameful system* is a system which serves as a thought through structure of how the game design elements are used together. It is not enough to randomly put game design element together to foster engagement and motivation (Landers, 2019; Landers et al., 2019c). For gamification to be successful, there needs to be a thought through system that accounts to how the different components will work together and form a unity that fits the purpose (Landers, 2019). *A gameful design,* entails the design process that leads to a gameful system. *A gameful experience,* entails the physical and mental experience the user gets when interacting with the gamified system (Landers et al., 2019c). The exact definition of what constitutes a gameful experience is an ongoing debate. For example, one common misconception is to mistake gamefulness for playfulness which are two distinct concepts (Deterding et al., 2011). Motivation is one of the most researched consequences of gameful experience and is often understood within the context of self-determination theory (Zainuddin et al., 2020).

The research into the functionality of different individual game design elements is diverse (Mekler et al., 2017; Zainuddin et al., 2020). Mekler et al. (2017) assessed the individual game design elements of points, levels and leaderboards. All three elements were found to individually increase productivity in an image annotation task. However, they were not effective in improving motivation to continue performing the task when applied as isolated elements (Mekler et al., 2017). A similar result was found by Landers et al. (2019b) when a simple challenge was added to a brainstorming task. Participants that were challenged showed improved output in generated ideas. However, intrinsic motivation to perform was not moderating the increase in productivity as believed (Landers et al., 2019b).

Gamified Motivation to Learn

In a study by Domínguez et al. (2013) the authors concluded that gamification has potential to increase student's motivation when applied to a e-learning tool. A similar result was found by Stansbury and Earnest (2017) which concluded that general motivation to attend a gamified version of a course was greater when compared to a non-gamified variant. The potential of using gamification to increase motivation has led to a practice of designing gameful systems that cater towards wide psychological needs satisfaction (Deterding, 2015).

The idea is that learning and long-term productivity tends to be explained by intrinsic rather than extrinsic motivation and thereby needs to be addressed in terms of satisfying fundamental needs which ultimately foster intrinsic motivation (Nicholson, 2015; Ryan & Deci, 2000).

To develop functional gameful systems which fosters intrinsic motivation to learn one must find a balance that satisfies a wide need satisfaction (Deterding, 2015). The need for *autonomy* is primarily tied to decision freedom (Tondello et al., 2019). This primarily boil down to the different ways a user can choose how and when to use the gamified system. Also, choices within the gamified system counts within this spectrum (Tondello et al., 2019; Nicholson, 2015; Landers et al., 2017). The need for *relatedness*, is often connected to task meaningfulness, and is above all utilised by applying a narrative, or a meaningful storyline to create a meaning for the user to interact with the gamified system (Sailer et al., 2017; Nicholson, 2015). The need for *competence* is tied to challenge and achievement. This implies that users of gamified systems need to be challenged in a way that fits their present level of competence so that they get room to evolve (Tondello et al., 2019). While satisfying the need for competence care must be taken not to step over the line of feeding the user of the gamified system with extrinsic cues. Extrinsic cues are mainly triggered by external rewards (Ryan & Deci, 2000).

A gamified system which caters for competence, relatedness, and autonomy simultaneously becomes stronger in the sense of increasing users' intrinsic motivation to interact with the gamified system (Landers et al., 2019b; Sailer et al., 2017; Tondello et al., 2019). If the user's intrinsic motivation to learn and interact with a learning material increases, so does the chance of learning from it (Ryan & Deci, 2000). It has also been shown that intrinsic motivation to interact with digital tools like learning apps is highly related to user intention to keep using the apps (Mitchell et al., 2020).

At the opposite of side of intrinsic motivation is amotivation, which has been described as a general lack of motivation (Deci & Ryan, 2000). Longitudinal research has shown that amotivation is having a opposite development over time compared with intrinsic motivation (van Roy & Zaman, 2018).

Personality Big 5

Big 5 is one of the most recognised theories on personality today, and it involves five distinct dimensions of personality traits (Kajonius & Mac Giolla, 2017). These traits are represented parallelly in all people and individual specific personality is measurable as being higher or lower than average on each of the traits (Goldberg, 1999). The Big 5 traits of

personality are: *Openness*, is often attributed as being curious, open minded and imaginative. *Conscientiousness* is defined as having high self-control, strong-willed and purposefulness. *Extroversion* is the dimension of sociability and talkativeness. *Agreeableness* are defined as sympathetic to others and an eagerness to help. *Neuroticism* is the tendency to experience negative affect (Johnson, 2014; Rothmann & Coetzer, 2003)

Personality and gamification: Within the field of gamification, the most researched trait among the Big 5 is extroversion. While extroverts tend to have a positive perception towards the use of leaderboards (Jia & Voida, 2017), introverts tend to prefer badges (Codish & Ravid, 2014). Buckley and Doyle, (2017) found that extroverted people tended to like a gamified university course while conscientious individuals were less motivated by gamification. Openness to experience has not been widely used to better understand gamification. However, since highly open people are known to have high imagination and a generally open scene towards novelties (Rothmann & Coetzer, 2003). These factors speak for highly open people open to gamified systems. In all, individual differences seem to have potential of influencing the way gamification is subjectively perceived by the user of the gamified system (Buckley & Doyle, 2017; Ghaban & Hendley, 2019). However, the amount of research into this matter to date is poor which creates a demand for more research in how personality moderate the impact of gamification on for example motivation to learn.

The Present Study

The present study had two aims. *First*, to test if gamification could be used to increase performance and foster intrinsic motivation simultaneously as decreasing amotivation to learn when interacting with an online learning task. *Second*, to research if the impact of gamification on intrinsic motivation is interacting with extraversion, conscientiousness, and openness to experience.

The rationale behind the use of gamification in training and learning is to make otherwise mundane informational materials more intriguing and engaging to interact with (Armstrong & Landers, 2018; Landers, 2019). Fostering intrinsic motivation to interact with a material has shown to positively benefit user intention to keep interacting with the material (Mitchell et al., 2020). However, prior research also show that contextual factors come to play in how effective gamification can be (Landers et al., 2019a; van Roy & Zaman, 2015). Therefore, two separate studies were conducted within two distinctly different contexts.

Prior research has shown that gamification have potential of increasing learning output (Tsay et al., 2018). However, as previously discussed prior research results regarding

performance are diverse. Nevertheless, need supporting gamification has previously been used with great effect to increase short term productivity in both brainstorming and image annotation tasks (Landers et al., 2019b; Mekler et al., 2017). Therefore, the following hypothesis was crafted.

H1 *Performance score will be higher in the gamified condition then in the control condition.*

Both studies assumed that gamification could be used to satisfy the needs for autonomy, competence, and relatedness (Deterding, 2015; Nicholson, 2015). This would lead to increased intrinsic motivation to learn, which in turn is established to have a positive impact on actual learning (Ryan & Deci, 2000). This led to the following hypothesis.

H2 *Intrinsic motivation will be higher in the gamified condition then in the control condition.*

Amotivation has been defined as the absence of motivation (Deci & Ryan, 2000), and may in this context be depicted as a person not valuing the informational content presented to them (Ryan, 1995). Previous research within the context of gamification has shown that amotivation normally has a opposite curve compared to intrinsic motivation (van Roy & Zaman, 2018). In this study, it was expected gamification would lead to decreased amotivation due to the increased intrinsic motivation as well as adding value to the informational content presented to the participants.

H3 *Amotivation will be lower in the gamified condition compared to the control condition.*

Individual differences are generally a rather under-researched area in combination with gamification (Höllig et al., 2020). However, personality as defined by the five-factor model may be an important factor to further understand the impact of gamification on both performance and motivation. Highly conscientious people have been found to be neutral towards gamification (Jia et al., 2016). However, they have also shown to prefer game design elements that enforces progress (Ghaban & Hendley, 2019). Using such game design elements with these features should result in highly conscientious people responding positively to the gamification.

H4 *Conscientiousness will interact positively with gamification on intrinsic motivation.*

Openness to experience is a personality trait which has not been widely researched within the context of gamification (Ghaban & Hendley, 2019). However, since highly open people has shown appreciation towards novelties (Rothmann & Coetzer, 2003), it is believed that highly open participants will be more motivated by game design features used in both studies.

H5 *Openness to experience will interact positively with gamification on intrinsic motivation.*

Previous research show that people high in extraversion is engaged by game design elements often used in context of extrinsic rewards (Buckley & Doyle, 2017; Jia & Voida, 2017). However, not much research into how extraversion interact with game design elements designed to foster intrinsic motivation exist to date. To gather more knowledge into how extraversion interact with gamified systems designed towards intrinsic needs satisfaction the following hypothesis was crafted.

H6 *Extroversion will interact positively with gamification on intrinsic motivation.*

Study one

Study one took advantage of the ongoing COVID-19 pandemic in Sweden at the time of data collection. An experiment was set up around a learning task that utilised informational content covering Swedish crisis management. All participants in the study were situated in Sweden. The intent was to create a setting around the informational content which provided a reason for the participants in the experiment to genuinely interact with the information material.

Method

Study one utilised a randomized experimental design consisting of two conditions. The independent variable: *gamification* was defined with five types of game design elements (*narrative storyline, avatar, challenge, feedback, arbitrary rewards).* The dependent variables were *intrinsic motivation* and *amotivation* to learn about Swedish crisis management. Three personality variables were also hypothesised to interact the effect of gamification on motivation, *openness, conscientiousness,* and *extraversion.*

Procedure

The experiment was designed using the online software *Google Forms*. Since the survey was to be distributed in Sweden, Swedish was chosen as a survey language.

The survey was divided into three segments. *First*, a demography section together with pre-measure of big-5 and motivation. *Second*, the experiment featuring three short learning tasks about Swedish crisis management. This part was the only one that differed between the experimental conditions as will be thoroughly explained later *Third,* after-measure of motivation, as well as additional data collection.

Before commencing data collection, the survey was tested on three participants. Their feedback led to some restructuring of the content in the gamified condition to make it clearer and more stringent.

Two separate examples of the survey were set up, one for the control condition and one for the gamified condition. The participants were recruited online by e-mail and social media platforms like LinkedIn. All invitations to the survey were accompanied with a prompt to redistribute the link to the survey in their own networks to create a snowball effect.

Randomization was ensured by linking the surveys to a randomization tool, which randomly directed the participants towards either the gamified condition or the control condition. Care was taken not to mention anything about games, fun or engagement in the information text about the experiment. Instead, all participants were told that the study was about performing an information processing task.

In the gamified condition the participants got introduced to the narrative storyline by getting to meet Kim at an early stage right after the pre-measure of motivation. In total, the study was aimed to take about 20 minutes for the gamified condition and about 15 minutes for the control condition to finish. No direct compensation was given to the participants in the survey. However, all participants got the possibility of being provided with the results of the study.

Ethical: guidelines were followed. No participants below the age of 18 was allowed. All participation in the survey was completely voluntary, anonymity was guaranteed and no risks either physically or psychologically were expectable from participation. Furthermore, it was possible for participants to exit the survey at any time. Also, none of the scales measuring psychological variables was set as mandatory in the survey, thus giving the participant the chance of not answering individual items. The only exception of this was the informed consent in the beginning of the survey as well as checkboxes in the gamification manipulation which was mandatory due to their ability to send the participants in different directions in the survey depending on which alternative they answered. No physical harm was believed to come from participating in the online survey. No risk of psychological harm was deemed as a hinderance of proceeding with the experiment.

Participants

Data collection commenced on the 24/2-2021 and closed at the 17/3-2021. The restriction of participation was set at a minimum of 18 years of age, and since the study was conducted in Swedish language, the ability to read and understand written Swedish was demanded from the participants. Also, as the SIMS scale for measuring motivation was validated in English, and therefore used in its original language, skills in English language was also demanded. The total amount of respondent in the survey was 110 participants. Out of these, six participants were eliminated. Four of these were eliminated due to reported

insufficient English skills. Another two participant was eliminated due to obvious inconsistencies in answering behaviour. The final sample (*N* = 104) consisted of two subgroups. The gamified condition (*n* = 61), and the control condition (*n* = 43). Swedish, was the reported native language (*n* =95, 91%), followed by other (n=9, 9%). In terms of age, the sample varied over all the pre-set age groups from 18-29 till over 60 years old. The highest share with (36%) among the age group between 30-39 years old, followed by (24%) for participants between 50-59 years of age. Regarding gender distribution of the sample, (45%) of the participants identified with female and (55%) with male gender. Furthermore, most of the sample (79%) was employed, followed by (9,5%) self-employed entrepreneurs, and (5,7%) students. The remaining participants indicated either unemployed (3,8%), or retired (1,9%).

Materials & Study Design

The control condition: Was the basis of the experiment. After designing the control condition, the gamified condition was designed to wrap around it. The participants job was to first read the information material as can be seen in figure 1.

Figure 1
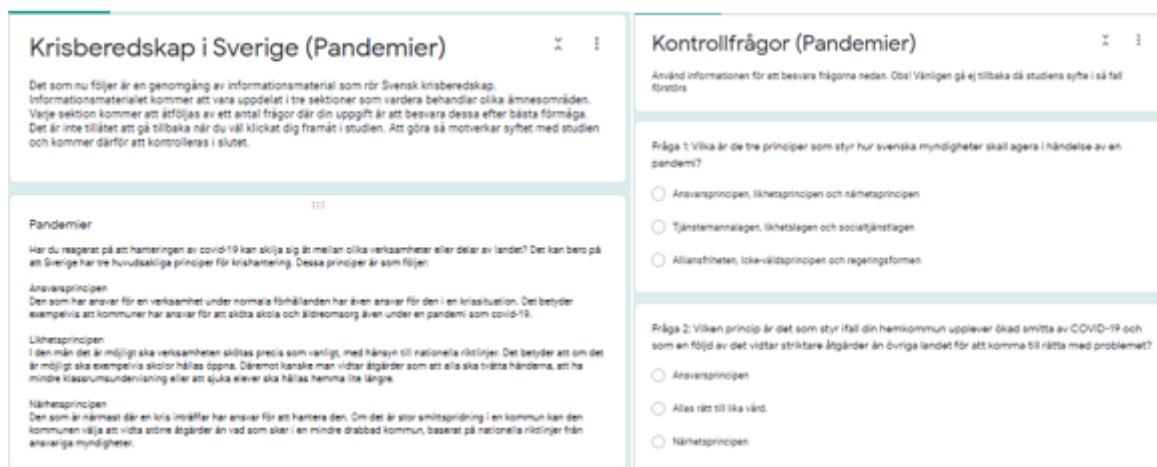
To the left: An information text about pandemic-response.

To the right: Multiple-choice control questions connected to the previous text material.

After having read the information, they clicked forward. This took them to the next frame containing a follow-up quiz (figure 1) with three multiple choice questions. Each question had three to four choices. All correct answers to the questions were to be found in the informational text in the previous frame. The participants were informed that they were not allowed to backtrack to look at the information again.

All texts were formal information taken straight out of official sources. The texts were divided into three short segments which constituted the learning task. They were labelled *"pandemic guidelines", "general crisis management", and "warning signals"*. The text about pandemic guidelines was taken directly from the Swedish government web portal (krisinformation.se). The remaining texts were taken from the pamphlet (Om krisen eller kriget kommer, 2008), which is the official information pamphlet from MSB (Myndigheten för samhällsskydd och beredskap). None of the texts was altered in any way to distort its meaning. However, some of the texts was shortened to limit the time needed for the participant to finish the experiment.

The independent variable (Gamification): The gamified condition in this experiment was designed as a system combining four types of game design elements.

Narrative storyline & avatar are game design elements with potential to create a context which connects the learning material with the participants, and makes it become more accessible to understand. The narrative can also be used to clarify goals, rules, and results in a useful way so that the participants can experience progress (Nicholson, 2015). A well-designed narrative storyline has the potential to foster user's intrinsic motivation to interact with the system (Nicholson, 2015; Tondello et al., 2019). In study one, the narrative storyline was created to feature a fictive character, Kim. Kim was also portrayed as an avatar in the story to give the story more life and relevance in the form of a face. Kim was first described as a person to create a level of attachment towards the character.

> *Hi, my name is Kim!*
>
> *Kim is 32 years old and live a relaxed and cosy life in a typical Swedish small-town. Kim is good at cooking and spends the spare time with friends and going on long walks in the woods. As a person, Kim is described as sociably nice to spend time with but also a bit indecisive. This indecisiveness is best shown in situations where Kim is put under pressure and fast decisions needs to be made. Later in this survey, you will help Kim to find information and act in such pressed situations.*

When the experiment started, Kim was written into each of the three short stories that accompanied the informational content in the gamified condition (figure 2):

> *At Kim's place, its cold and dark. You wake up suddenly and can almost feel the eerie silence. A quick look at the watch shows the time to be at midnight. There is a certain depth to the darkness and the only light in the apartment is the dim moonlight seeping in through the window. As you look out the window you are met by compact darkness, and you realise that the entire town must be veiled in darkness due to a power failure.*

You fumble after the light switch, but the only thing you hear is "Klick" and nothing happens. As it dawns on you that it must be a great power failure. As the heat slowly dissipate from the apartment, a feeling of loneliness and panic slowly starts spreading through your body.

The narrative was designed as a frame from which the participant would use the information to help Kim handle the situation described in the narrative. Therefore, the narrative was placed on top of each segment of information material (Figure 2). The quiz that followed was identical in both conditions apart from that the gamified condition had the following text added:

"Help Kim to deal with the situation by correctly answering the questions below."

This text was meant to connect the participants answers in the quiz to helping Kim handle the situation described in the narrative. This way the quiz became integrated in the narrative.

Figure 2
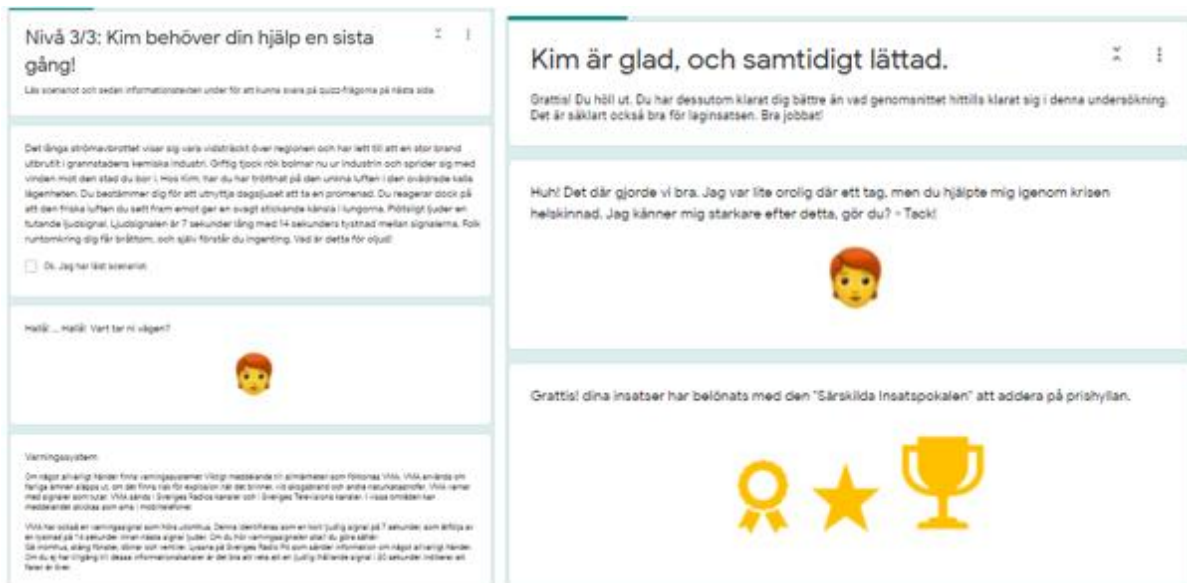
To the left: The narrative story is in the top segment, and the information text is in the bottom. To the right: The follow up feedback screen after each quiz. Competition feedback in the top, and rewards in the bottom.

Challenge is a key feature in gamification. Previous research has shown that competition can have both positive and negative impact on the outcome of intrinsic motivation depending on how its designed (Höllig et al., 2020). While short-term productivity

and competition tend to be results of increased extrinsic cues, learning tends to be better fostered by intrinsic cues (Ryan & Deci, 2000). Therefore, the competition needed to be driven by the need for competence rather than being confrontative towards other participants (Tondello et al., 2019). Also, previous research has suggested that working together leads to higher engagement (Höllig et al., 2020). Therefore, the competition segment was designed in two separate levels. *First*, the participant was engaged on a collective level by tying their personal effort to a larger context. The participant was told:

"If the combined effort of all participants together scores above 80% correct in the quiz. Then Kim will treat all the participants to a gift that benefit all participants together."

Second, an individual level of competition was added by simply updating the participant on their individual accomplishment compared with the mean of all the other participants. This was then used as a feedback cue to increase participants engagement:

"Good job! Right now, you are scoring somewhat above average among all participants so far. Keep it up, and do not forget that team performance also counts."

Rewards & Feedback: Useful feedback was given to participants in the gamified condition only. This was communicated through the debriefing screen that appeared between each of the short learning tasks. At the top, the participant get feedback on their performance in the individual competition. In the bottom they also collect arbitrary rewards for each of the three completed learning tasks.

Measures

Personality: To measure personality the IPIP-NEO-30 scale was used. It was originally translated to Swedish by Bäckström, M. (2010), and measures the personality dimensions of openness (α=.71), conscientiousness (α=.81), extraversion (α=.79), agreeableness (α=.63), and neuroticism (α=.89), often referred to as the Big 5. The scale consists of a 30 item self-report questionnaire. Openness to experience is measured by 6 items with 3 items reverse coded. The items are rated on a 5-point liekert scale between 1 (*not at all / seldom*) to 5 (*definitely / almost always*). Example item: "Ser skönhet i sådant andra inte märker". Conscientiousness is measured by 6 items, with 2 items reverse coded. The items are rated on a 5-point liekert scale between 1 (*not at all / seldom*) to 5 (*definitely / almost always*). Example item "Fullföljer alltid mina uppgifter". Extraversion are measured by 6 items, with 2 items reverse coded. The items are rated on a 5-point liekert scale between 1 (*not at all / seldom*) to 5 (*definitely / almost always*). Example item: "Har lätt för att få vänner". Agreeableness are measured by 6 items, with 4 items reverse coded. The items are rated on a 5-point liekert scale between 1 (*not at all / seldom*) to 5 (*definitely / almost always*). Exempel

item: "Känner sympati med de som har det sämre än jag själv". Neuroticism are measured by 6 items, none reverse coded. The items are rated on a 5-point liekert scale between 1 (*not at all / seldom*) to 5 (*definitely / almost always*). Example item: "Känner ofta oro". All items were originally validated by Johnson (2014).

Motivation: The situational motivation scale (SIMS) was originally constructed by Guay, Vallerand, and Blanchard (2000), and measures four levels of situational motivation stipulated from self-determination theory: Intrinsic motivation (α=.69), Identified regulation (α=.80), external regulation (α=.80), and amotivation (α=.85). The scale consists of a 16 item self-report questionnaire. Each dimension is measured by 4 items, and none of them are reverse coded. The items are rated on a 7-point likert scale between 1 (*corresponds not at all*) to 7 (*corresponds exactly*). The factor structure of the scale has been revalidated at least twice since its introduction (Lonsdale et al., 2011; Österlie et al., 2019), This scale was chosen due to its properties to capture motivation to perform in a present activity. The participants were asked to rate their reason to participate in a learning task about Swedish crisis management. An example-item could look like, *"There may be a good reason for doing this activity, but personally I don't see any.",* representing an item for amotivation. "*Because I think that this activity is interesting",* represent an example-item of intrinsic motivation.

Data Analysis

All statistical analyses were conducted with JAMOVI version 1.6.23 The Jamovi project (2021), retrieved from (https://www.jamovi.org). For all statistical tests, an alpha level of .05 was used. Table 3 gives an overview of the hypothesises, and whether they are confirmed or not. Before further analysis, testing for gender effects was done with no significant effects on *intrinsic motivation, amotivation, and performance score* found.

Independent sample t-tests were used to test effects of gamification on participant results, intrinsic motivation and amotivation. Levene's test for homogeneity of variance was used, *Intrinsic motivation* ($F(1, 102) = .64, p = .426$), *amotivation* ($F(1, 102) = .16, p = .695$), and *performance points* ($F(1, 102) = 3.46, p = .066$) which was considered ok. Shapiro-Wilk test was used to assess assumptions of normality, *intrinsic motivation* ($W = .99, p = .306$), *amotivation* ($W = .90, p < .001$), and *performance points* ($W = .93, p < .001$). To control for the unfulfilled assumption of normality in the amotivation and performance score variables all testing was conducted parallelly as both independent sample t-tests and non-parametric Mann-Whitney U tests. Since no notable differences appeared between the parametric and non-parametric versions of tests the decision was made to stick with the parametric tests for reasons of continuity with study one.

A Correlations table are found in table 4. The personality hypothesises was investigated by dividing the personality dimensions of *openness, conscientiousness*, and *extraversion* by the median. This created a factor variable in two levels (*high & low*) of each personality dimension. For each personality trait, a 2x2 factorial ANOVA was conducted revealing effects of *personality * gamification* on *intrinsic motivation*. The reason for this was to investigate interaction effects between high/low levels of personality traits interacting with the effectiveness of gamification on intrinsic motivation.

Results

Manipulations Check & Performance Score.

First, a manipulation check was conducted to assess if participants in the gamified condition ($M = 2.9$, $SD = .98$) had higher awareness of participating in a game-like environment compared to the control condition ($M = 2.1$, $SD = .91$) ($t (102) = 4.13$, $p < .001$, $d = .83$). The result indicates a successful gamification manipulation. No significant difference was found between the conditions when checking for differences in performance score between the conditions ($t (102) = -1.78$, $p = .079$, $d = -.35$). Therefore, **H1,** could not be confirmed.

Table 1
Descriptive statistics for all experimental outcomes.

Condition	N	Performance score		Intrinsic motivation		Amotivation	
		Mean	SD	Mean	SD	Mean	SD
Gamification	61	7.77	1.59	4.08	1.17	2.20	1.00
Control	43	8.37	1.85	3.63	1.06	2.05	1.16

Motivation

When testing **H2**, the difference between the gamified condition and control condition regarding self-reported intrinsic motivation was significant ($t (102) = 2.00$, $p = .048$, $d = .40$). **H2,** was confirmed.

When testing **H3**, the differences between the gamified condition and the control condition regarding amotivation showed no significant difference between the conditions ($t (102) = .71$, $p = .478$, $d = .14$). **H3***,* was not confirmed.

Personality

The data output from the 2x2 factorial ANOVAs is shown in table 4. Against expectations, no interaction effect of gamification * conscientiousness, intrinsic motivation was significant. **H4** was not confirmed. Neither was there a significant interaction effect

between gamification * openness, intrinsic motivation. **H5** was not confirmed. The interaction effect of gamification * extraversion, intrinsic motivation was not significant either. **H6** was not confirmed.

Table 2

*Data output from 2x2 factorial ANOVAs with Gamification * Personality*

Factor	Intrinsic motivation		
	F	p	$\eta^2 p$
Gamification	3.86	.052	.04
Openness	.00	.989	.00
Gamification*Openness	.04	.846	.00
Gamification	3.66	.059	.04
Conscientiousness	1.19	.279	.01
Gamification*Conscientiousness	.50	.480	.01
Gamification	**3.95**	**.050**	**.04**
Extraversion	2.65	.107	.03
Gamification*Extraversion	.20	.658	.00

Table 3

Overview of hypothesises and if they were confirmed or not.

Hypothesis	Confirmed?
H1; *Participants in the gamified condition will have higher performance points then participants in the control condition.*	No
H2; *Intrinsic motivation will be higher in the gamified condition then in the control condition.*	Yes
H3; *Amotivation will be lower in the gamified condition compared to the control condition*	No
H4; *Conscientiousness will interact positively with gamification on intrinsic motivation.*	No
H5; *Openness to experience will interact positively with gamification on intrinsic motivation.*	No
H6; *Extroversion will interact positively with gamification on intrinsic motivation.*	No

Table 4

Correlation Matrix

	1	2	3	4	5	6	7	8	9
1-Gamification	—								
2-Age	-.02	—							
3-Gender	-.02	-.01	—						
4-Performance score	-.17	.02	.01	—					
5-Intrinsic motivation	.20 *	-.01	-.15	-.27 **	—				
6-Amotivation	.07	.08	.04	-.06	-.08	—			
7-Openness	-.04	-.09	-.04	.10	.02	-.08	—		
8-Conscientiousness	.07	.05	-.14	.00	.14	-.26 **	-.05	—	
9-Extraversion	.05	.15	-.06	-.16	.04	-.07	-.11	.44 ***	—

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

Discussion study 1

Study one hypothesised that gamification would increase performance score and intrinsic motivation simultaneously as decrease amotivation to learn in an online learning task. It was also hypothesised that the effect of gamification on intrinsic motivation would be moderated by personality.

The lack of effect on performance score was partly in line with previous research (Tan & Hew, 2016; Stansbury & Earnest, 2017). Given the short time span of which the learning task was conducted this is not surprising. Learning does not always come fast, but intrinsic motivation to learn is strongly related to higher learning achievement in the long run (Ryan & Deci, 2000).

Even if the effect of gamification on intrinsic motivation was weak the results show that gamification can be used to foster intrinsic motivation to learn. The weakness of the effect may be explained by several factors. One such factor is that the gamified system used in study one was too weak in its composition to offer any compelling evidence of its ability to foster intrinsic motivation.

The lack of effect between conditions regarding amotivation could be interpreted as the lack of effect of gamification on amotivation. However, another possible explanation for the lack of difference in amotivation is the setting in which the experiment took place. Due to the severity in the ongoing COVID-19 pandemic at the time of data collection, the topic of Swedish crisis management might have contributed to a general drop in amotivation. If the topic were to be more trivial, this might have come out differently. The generally low level of amotivation in both conditions also points out a scale attenuation effect as a possible explanation to the lack of difference between the conditions.

None of the predicted interactions between personality and gamification on intrinsic motivation occurred. This was not surprising given the weak effect of gamification on intrinsic motivation. Also, personality did not correlate significantly with either gamification or intrinsic motivation further indicating that these factors were not guided by personality to any significant extent.

Study two

The results from study one was too weak to draw any conclusions regarding the effectiveness of the gamification manipulation of the experimental condition. To gain more knowledge a new study was set up to cover the possible deficiencies discussed above. Building on study one, the aim of study two was unchanged. *First*, use gamification to increase performance and foster intrinsic motivation as well as decrease amotivation to learn

when interacting with an online learning task. *Second*, to research if the impact of gamification on intrinsic motivation is influenced by extraversion, conscientiousness, and openness to experience.

Due to the lessons learned from study one, study two was set up with the principle to dial down the situational factor of Swedish crisis management into a more trivial setting. Simultaneously, the gamification factor was tuned up, to increase its potential of fostering intrinsic motivation. The new topic was "*Hummingbirds*" which was deemed to appear neutral for the wider array of participants regarding their prior attitude towards the topic. This would also level the playing field for people who have prior knowledge in the topic.

Method

Study two also utilised a randomized experimental design consisting of two conditions. The independent variable: *gamification* was defined with five types of game design elements (*narrative storyline, avatar, challenge, feedback, arbitrary rewards).* The dependent variables were *intrinsic motivation* and *amotivation* to learn about Swedish crisis management. Three personality variables were also hypothesised to interact the effect of gamification on motivation, *openness, conscientiousness,* and *extraversion.*

Procedure

The survey was in the English language and distributed using the software *Google Forms*. Before commencing data collection, the survey was tested on three participants. The questionnaire consisted of an introduction with some limited background information for the participants together with a mandatory informed consent without which the participant could not proceed with the survey. To be eligible in the survey you needed to be at least 18 years of age, and consent to their data being processed for the purpose of the study. A short demographics section followed, where the participant was asked for information about age, gender, country of residence, native language, occupational status, and educational background. The demographics was followed by a personality inventory of 30 items. Then the experiment commenced as will be described below. The survey was finished with a measure of motivation as well as a debriefing with contact information to the researcher. All participants were given the possibility to share their email address in the end of the survey (optional). In total, the study consisted of 71 items in both conditions, with the difference that the gamified condition had additional checkboxes connected to the narrative storyline. The approximated time needed to perform the survey was 14 minutes for the gamified condition and 9 minutes for the control condition.

Two parallel methods of data collection were used to gather data for study two. *First*, a study link was spread in digital channels, mainly social media, and e-mail, Here, a randomization tool ensured randomization of participants between the conditions. The *second* method was through the online crowdsourcing platform Prolific. Here, participants were recruited by offering a cash payment equivalent to 6 GBP/hour, for participants to perform the experiment online. Views on the use of crowdsourcing for data collection varies. To find the right sample, screening was used to specify certain parameters in the sample. *First*, a filter for using participants with at least 90% approval rate was added to decrease the possibility of bad sampling. *Second*, sine the study was made in English, fluency in English language was set as mandatory. *Third,* since the SIMS scale used to measure motivation factors in this experiment has been shown to differ somewhat between eastern and western cultural contexts (Lonsdale et al., 2011) the decision was made to also apply a geographical filter, focusing on residents within a western cultural setting (UK, Germany, France, Ireland, Scandinavia, Canada, and USA). Data collection commenced on the 11/4-2021 and closed at the 20/4-2021. The minimum required age of participation was set at 18 years of age, but the general data collection on Prolific was filtered so that participants in ages between 25 and 50 years old was eligible for participation. This was done to be able to generalise the results to a larger population. Also, since a lot of earlier research into gamified learning has focussed on younger cohorts in education (Zainuddin et al., 2020) this was a way to widen that view.

Ethical: guidelines were followed. All participation in the survey was completely voluntary, anonymity was guaranteed and no risks either physically or psychologically were expectable from participation. Furthermore, it was possible for participants to exit the survey at any time. Also, none of the scales measuring psychological variables was set as mandatory in the survey, thus giving the participant the chance of not answering individual items. The only exception of this was the informed consent in the beginning of the survey as well as checkboxes in the gamification manipulation which was mandatory due to their ability to send the participants in different directions in the survey depending on which alternative they choose. No physical harm was believed to come from participating in the online survey. No risk of psychological harm was deemed as a hinderance of proceeding with the experiment.
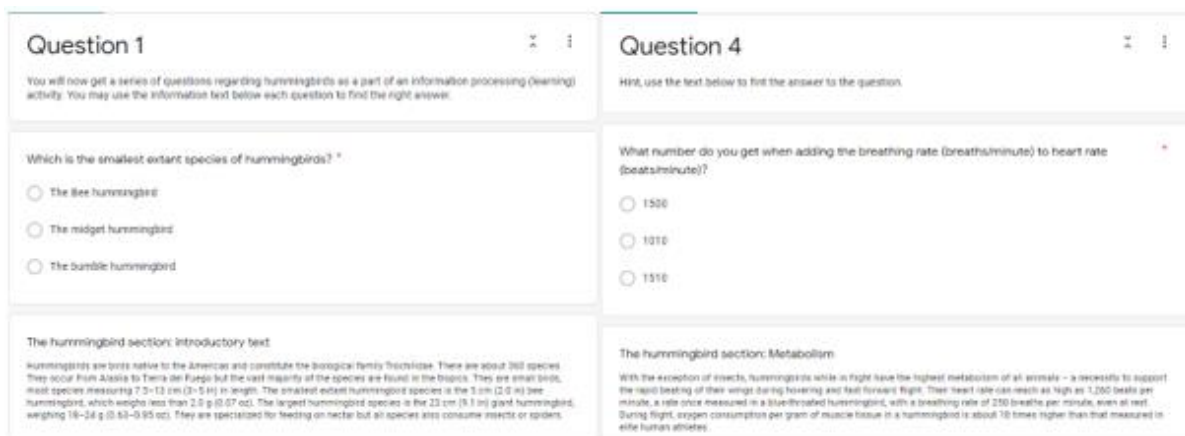
Participants

The total amount of respondent in the survey was 149 participants. Eight participants were eliminated due to inconsistent answering patterns or due to failed attention checks in the measurements of the variables. The final sample ($N = 141$) consisted of 44% male, and 56% female gender. The gamified condition ($n = 75$) had a mean age of ($M = 32.1$), and the control

condition ($n = 66$) had a mean age of ($M = 35.4$). English was the most reported native language ($n =70, 50\%$), followed by other ($n=26, 18\%$), and then Swedish ($n=21, 15\%$). The last participants reported either German or French as their native language ($n=12, 9\%$). Furthermore, most of the sample (64%) was employed, followed by 18% students, and 16% answered that they were either businessowners or unemployed. The remaining participants indicated that they rather not say.

Materials & Study Design

The control condition: The foundation of the experiment was set as an information processing task consisting of four short texts containing information about hummingbirds. Each text was paired with a multiple-choice question with three alternatives (figure 3). The participants task was to answer the multiple-choice question by using the information text directly below.

Figure 3.

To the left: Question one in the control condition of the information processing task.
To the right: Question four in the control condition of the information processing task.

The participant needed to process the information to be able to correctly answer the question. The information texts were taken straight out the (Wikipedia entry, dated 25/3-2021) on hummingbirds, see example below:

> *Hummingbirds are birds native to the Americas and constitute the biological family Trochilidae. There are about 360 species. They occur from Alaska to Tierra del Fuego but the vast majority of the species are found in the tropics. They are small birds, most species measuring 7.5–13 cm (3–5 in) in length. The smallest extant hummingbird species is the 5 cm (2.0 in) bee hummingbird, which weighs less than 2.0 g (0.07 oz). The largest hummingbird species is the 23 cm (9.1 in) giant hummingbird, weighing*

18–24 g (0.63–0.85 oz). They are specialized for feeding on nectar, but all species also consume insects or spiders.

The texts were divided into four segments featuring one question each. None of the texts was altered in any way from the original content. All the texts were academical in the way they were written. The text above was used to answer the following question: *"Which is the smallest extant species of hummingbirds?"*

The following alternatives was provided: The *bee hummingbird*, the *midget hummingbird*, or the *bumble hummingbird*. All four questions followed upon each other without feedback on progress or correctness given between them.

The independent variable (Gamification)*:* The gamification system in study two was based on the same five game design elements as in study one: *narrative storyline, avatars, challenge*, *feedback*, and *arbitrary rewards*. However, in study two, these were applied in a different way than in study one.

*Avatar***:** The participant was first presented with a choice of one out of three avatars to represent them in the game. The concept of the participants choice was a feature which constantly came back in the design of study two. This was done to fulfil the participants need for autonomy by making them feel more in control (Ryan & Deci, 2000; Tondello et al., 2019). The avatar was then used as a representation of the participant when navigating through the narrative storyline (figure4).

*Narrative***:** The narrative in study two was not divided into small segments like in study one. Instead, the narrative in study two worked as an umbrella by introducing the participant to a narrative that connected the four questions with each other.

The narrative started with the participant waking up and realising that it got locked up in a museum. Unable to get out, the participant eventually finds a service door with a code lock. Beside the code pad there is a note saying:

Dear forgetful janitor. This quiz reveals the code for opening the door. Each question has three answering alternatives, but only one of these are correct. Once you find the correct answers to all the questions you may use the code to exit the building. You will find all the answers you need in the hummingbird section of the museum. Now, please refrain from setting off the fire alarm again. Last time they promised to bring the police if need be. Dr. Martin – Museum curator

After this message, a challenge was introduced:

Follow the instructions from the note. Your task is to help "John" decipher the correct code by answering the quiz. Each right answer will give you a digit, and

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once you have all four digits you will be able to use the code to let John out in the free.

John is completely dependent upon your help, and if you can't help with the quiz, the only available option is to sound the fire alarm. However, this might lead to unwanted consequences for John.

CHALLENGE!

Answer correct to the quiz, and help "John" exit the museum

At the moment, Jamie is the fastest avatar to exit the museum. You have a chance of changing that.

The narrative in study two was primarily there to create a context around the quiz. Successful execution of all four quiz questions revealed the code, that was then used to open the door. If the participant answered wrong to any of the questions it was gently redirected to try again. To better cater for the possibility of choice, an alternative ending was also created within the narrative. After each correctly answered question, the participant got access to a digit in the code. This was shown on a follow up screen displaying feedback to the participant between the questions.

Figure 4
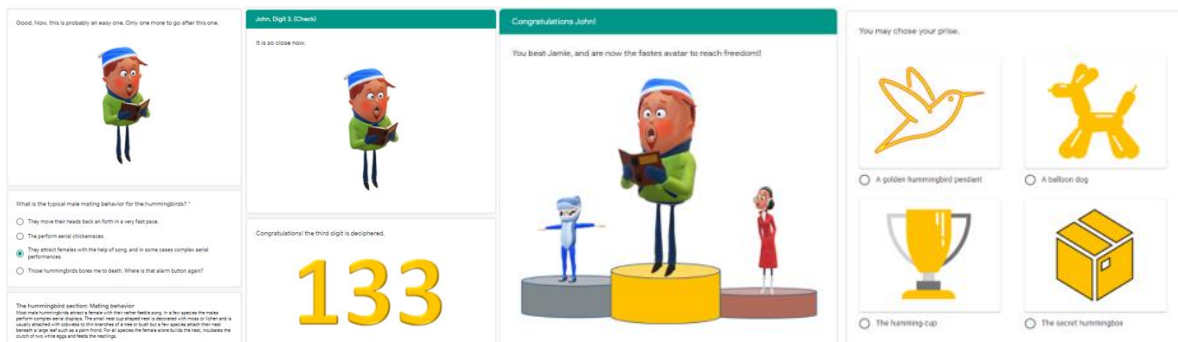
From left: (1) Question three in the gamified condition of the information processing task. (not that the question and the informational content is identical to the control condition. (2) The follow up screen for question three in the gamified condition of the information processing task. (3) Prise ceremony in the gamified condition. (4) Participant selection of an arbitrary prise for their effort.

Challenge, rewards & feedback: The primary challenge in study two was to collect the digits needed to exit the museum. There was also a secondary challenge. Previous research has found hinting of a challenge has proven to increase productivity (Landers et al.,

2019b). By informing the participant that someone before them had been the fastest so far should therefore trigger the participant to try harder in their effort. This also has potential to foster intrinsic motivation by social challenge by satisfying the participants need for relatedness when competing with a peer (Tondello et al., 2019). Upon completion the participant was also presented with a prise ceremony, and a choice of an arbitrary rewards.

Measures

Personality: To measure personality the IPIP-NEO-30 scale was used. This was the same scale as previously used in study one, except that this was used in the original language validated by Johnson (2014). Cronbach alfa: openness (α=.71), conscientiousness (α=.81), extraversion (α=.79), agreeableness (α=.63), and neuroticism (α=.89), often referred to as the Big 5.

Motivation (SDT): The same situational motivation scale (SIMS) developed by Guay, Vallerand, and Blanchard (2000) was reused in study two. Cronbach alfa: intrinsic motivation (α=.91), identified regulation (α=.71), external regulation (α=.79), and amotivation (α=.85).

Data Analysis

All statistical analyses were conducted with JAMOVI version 1.6.23 (The Jamovi project (2021), retrieved from https://www.jamovi.org. For all statistical tests, an alpha level of .05 was used. Table 8 gives an overview of the hypothesises, and whether they are confirmed or not. Preliminary testing or gender effects was done with no significant effects on *intrinsic motivation, amotivation, or performance score* found.

Independent sample t-tests were used for primary analysis of effects of gamification on participants performance score, intrinsic motivation and amotivation. Levene's test for homogeneity of variance gave, *Intrinsic motivation (F (1, 139) = 2.1, p = .149), amotivation (F (1, 139) = .08, p = .781), performance score (F (1, 139) = 3.50, p = .063)* which was considered ok. Shapiro-Wilk test was used to assess assumptions of normality, *intrinsic motivation (W = .97, p = .001), amotivation (W = .96, p <.001). performance score (W = .36, p < .001)*. To control for the unfulfilled assumption of normality all tests was parallelly conducted as both independent sample t-tests and non-parametric Mann-Whitney U tests. Since no notable differences appeared between the parametric and non-parametric versions of tests the decision was made to stick with the parametric tests for reasons of continuity with study one.

A correlations table are found in table 7. The personality hypothesises was investigated by dividing the personality dimensions of *openness, conscientiousness*, and

extraversion by the median. This created a factor variable in two levels (*high & low*) of each personality dimension. For each personality trait, a 2x2 factorial ANOVA was conducted revealing effects of *personality * gamification* on *intrinsic motivation*.

For exploratory purposes, an ANCOVA was used to test the effects of gamification on intrinsic motivation while controlling for age. This was made due to the negative correlations of *age* on *gamification* and *intrinsic motivation*.

Results

Manipulation Check & Performance Points

First, a manipulation check was conducted to assess if there was a difference in perception of having participated in a game between the gamified condition (M=3.99, SD=0.97), and the control condition (M=2.26, SD=1.1). An independent sample t-test was conducted to check the difference between the means ($t\,(139) = -9.94, p < .001, d = 1.68$). However, none of the assumptions of normality and equal variances were met. To account for this a non-parametric Mann-Whitney U test was conducted with similar result ($U=670, p < .001$). The difference indicates that the participants in the gamified condition experienced an overall higher awareness of participating in a game compared to the control condition leading to conclude that the manipulation was successful.

To test **H1**, an independent sample t-test was conducted to check for differences of performance score between the gamified and the control conditions ($t\,(139) = .96, p = .338, d = .16$). The lack of significant difference suggests that **H1** could not be confirmed.

Table 5

Descriptive statistics for all experimental outcomes.

Condition	N	Performance score		Intrinsic motivation		Amotivation	
		Mean	SD	Mean	SD	Mean	SD
Gamification	75	3.93	.30	5.58	1.36	2.42	1.23
Control	66	3.88	.37	4.56	1.36	3.01	1.26

Motivation

When testing **H2** and **H3**, Self-reported intrinsic motivation turned out significantly higher in the gamified condition then in the control condition ($t\,(139) = -4.71, p < .001, d = .80$). A similar result turned out when testing for levels of self-reported amotivation between the conditions ($t\,(139) = 2.81, p < .01, d = .48$). This indicates that participants in the gamified

condition reported significantly higher levels of self-reported intrinsic motivation and significantly lower levels of self-reported amotivation compared to each control conditions. **H2** and **H3**, was confirmed.

Personality

The data output from the 2x2 factorial ANOVAs is shown in table 8. As expected, gamification * conscientiousness showed a significant interaction effect on intrinsic motivation. A post hoc Tukey test (t (137)=3.67, M_{diff} =-1.17, p= .002) was significant for the control, low-conscientiousness * gamification, high-conscientiousness interaction. Post hoc Tukey test (t (137)= -3.02, M_{diff} = -.87, p= .016) was significant for the control, high-conscientiousness * gamification, low-conscientiousness interaction. Lastly, a post hoc Tukey test (t (137)= 4.85, M_{diff} =-1.445, $p < .001$) was significant for the control, high-conscientiousness * gamification, high-conscientiousness interaction. **H4** was then confirmed.

None of the personality dimensions *extraversion* or *openness* showed significant interactions with gamification on *intrinsic motivation*, **H5**, **H6** was not confirmed.

Table 6
*ANOVA output for gamification * personality variables*

Factor	Intrinsic motivation		
	F	p	$\eta^2 p$
Gamification	**34.88**	**<.001**	**.14**
Openness	2.76	.099	.02
Gamification*Openness	5.58	.063	.03
Gamification	**22.49**	**<.001**	**.14**
Conscientiousness	.47	.493	.00
Gamification*Conscientiousness	**4.01**	**.047**	**.03**
Gamification	**21.59**	**<.001**	**.14**
Extraversion	.01	.929	.00
Gamification*Extraversion	.17	.682	.00

Exploratory Analysis

A one-way ANCOVA was conducted to establish if the effect of *gamification* on *intrinsic motivation* remained after controlling for influence of *age* (F (1, 136) = 15.49, $p < .001$, $\eta^2 p$ = .10). A post-hoc Tukey test gave (t (136) = -3.94, M_{diff} = -0.85, $p <.001$, d = -.63). After controlling for age, the effect of gamification in intrinsic motivation was still significant.

Table 7

Correlation Matrix

	1	2	3	4	5	6	7	8	9
1-Gamification	—								
2-Age	-.20 *	—							
3-Gender	-.02	-.30 ***	—						
4-Performance score	.08	-.01	.01	—					
5-Intrinsic motivation	.37 ***	-.30 ***	.16	-.03	—				
6-Amotivation	-.23 **	.20 *	-.04	-.17 *	-.60 ***	—			
7-Openness	.11	-.06	.10	.11	.27 **	-.21 *	—		
8-Conscientiousness	-.14	.17	.12	-.05	.04	-.04	.13	—	
9-Extraversion	-.09	.19 *	-.03	.04	-.11	.01	.01	.15	—

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

Table 8

Overview of hypothesises and results.

Hypothesis	Confirmed?
H1; *Participants in the gamified condition will have higher performance points then participants in the control condition.*	No
H2; *Intrinsic motivation will be higher in the gamified condition then in the control condition.*	Yes
H3; *Amotivation will be lower in the gamified condition compared to the control condition.*	Yes
H4; *Conscientiousness will interact positively with gamification on intrinsic motivation.*	Yes
H5; *Openness to experience will interact positively with gamification on intrinsic motivation.*	No
H6; *Extroversion will interact positively with gamification on intrinsic motivation.*	No

Discussion Study 2

Study two intended to use gamification to improve performance and foster intrinsic motivation simultaneously as decreasing amotivation to interact with an online learning task. Another intention was to explore how the impact of gamification on intrinsic motivation is influenced by extraversion, conscientiousness, and openness to experience. Even if no significant difference in performance was noted between the groups, there was significant differences found on both decreased amotivation as well as increased intrinsic motivation in the gamified condition. Gamification was also moderated by conscientiousness.

The lack of effect of gamification on performance score was understandable. A ceiling effect made the groups indistinguishable. One should be careful to draw any conclusions from this result alone. For example, a longer test procedure together with higher grade of complexity in the questions might have resulted in another outcome.

The large effect size of gamification on intrinsic motivation together with the small effect of gamification on decreased amotivation showed that gamification can be a potent tool in increasing users' intrinsic motivation as well as decrease their amotivation to interact with an online learning task. An interesting point was that age seem to have a negative impact on the effect of gamification on intrinsic motivation. No subsequent effect was found in study one.

General Discussion

This study started out with two aims. *First*, to use gamification to increase performance and foster intrinsic motivation simultaneously as decreasing amotivation to learn when interacting with an online learning task. *Second*, to research if the impact of gamification on intrinsic motivation is influenced by personality.

Both studies were successful in increasing intrinsic motivation to learn and interact with the learning task. The results also show that gamification may be successful in decreasing amotivation. However, none of the results show any differences in performance score between the conditions. Study two also showed an interaction effect between gamification and conscientiousness on intrinsic motivation. Another indication from study two was that age might be a factor to consider in future gamification research.

Performance

Neither of the studies showed any significant effects of gamification on increased performance score. In study two, there was a ceiling effect with both groups being close to perform perfect scores. It is quite possible that this would have changed if the number of tasks or the complexity of them would have been greater. In study one the results of performance score did not vary significantly between conditions. Earlier research in gamified learning is split regarding evidence that gamification is effective in increasing performance related outcomes. Often learners in gamified conditions show equal results to the non-gamified control groups (e.g., Stansbury & Earnest, 2017; Tan & Hew, 2016). However, some researchers also report increased performance results derived from gamification (e.g., Landers & Armstrong, 2017). In this matter it is hard to disregard that many other factors besides gamification intervene regarding actual learning and knowledge attainment. For instance, intrinsic motivation is a good predictor for future learning (Deci & Ryan, 2000). Caution is therefore needed when assessing performance score as results of gamification. Learning is about more than just how much information a person can memorise in a short time span. However, if gamification can be used to engage people into spending more time learning then the chance to learn also increase (Landers & Landers, 2014). Therefore, it is important to understand how gamification can be used to influence motivational aspects of learning, and to interact with learning-tools.

Gamification and Motivation.

The most important finding in this study is that gamification can be used to foster intrinsic motivation to learn, and to interact with an online learning material. Earlier research suggests that intrinsically motivated users of gamified work promoting apps also shows

positive behaviour intention towards keep using these (Mitchell et al., 2020). However, other research that has focused on using singular game design elements has not been able to foster intrinsic motivation in their research participants (e.g., Landers et al., 2019b; Mekler et al., 2017). This points towards the auspiciousness of viewing gamification as a systems concepts where the effects come from game design features working together. This is further underlined by the differences in effects between studies one and two indicating that context and gameful design matter for the efficiency of gamification.

Context Dependent Gamification

The differences in effects between studies one and two indicates that context matters to the efficiency of gamification. The predominantly inexplicit results of study one compared to the more explicit results of study two may partly be explained by the context around the informational content in the learning task. In study one, it is possible that the severity in the situation catered towards the need for competence in both the gamified condition and the control condition simultaneously. This may have diluted the effect of gamification on intrinsic motivation. However, amotivation was almost equal between the conditions. Since amotivation is described as a counterbalance to intrinsic motivation (Deci & Ryan, 2000) it seems strange that the means of self-reported amotivation between the conditions was so equal. A possible explanation is that the context which engulfed the informational material was enough to make sure that the participants levels of amotivation to appropriate the material was low independent of condition. The same was not found in study two in which a significant effect of both intrinsic motivation and amotivation was found between the gamified and control conditions. This finding suggests that the setting, or perceived importance of the informational content of the learning task is a relevant factor to decrease the level of amotivation to engage with the information content.

Gameful Design Application

Both studies used a narrative storyline together with avatars to create a representation of the participants in the gamified world. However, between the studies this narrative was applied in different ways. Previous research has showed that narratives and avatars have potential in gamified learning contexts if correctly designed (Aldemir et al., 2018). The narrative in experiment one was linear and did not offer any chance of exploring other possibilities then the intended route. The only purpose it served was to create a context for the learning material. In contrast, study two was constructed around the principle of choice which is a fundamental principle within the building for gamified systems that foster intrinsic motivation (Tondello et al., 2019). The participant was continuously faced with situations

where the game environment changed depending on the choices the participants made. Choice even manifested in the possibility for participants to choose an alternative route leading to an alternative ending of the game. To be able to alter and affect the virtual world of the game is an important factor to create engagement and foster intrinsic motivation in a gamified world (Deterding, 2015; Robson et al., 2015; Tondello et al., 2019). The ability for someone to choose their own path cater towards the need for autonomy (Tondello et al., 2019). This factor was the main difference regarding the composition of the game design elements between studies one and two. Thereby, it is possible that a narrative that integrates the possibility of choice may also have been a big contributor to the higher effect sizes seen on intrinsic motivation in study two.

Previous research has shown that fostering of intrinsic motivation by means of competition and reward strategies are filled with complexity. For example, leaderboards and competition game designs tend to have problems to trigger intrinsic motivation in research participants (Mekler et al., 2017; Zimmerling et al., 2019). For this reason, the settings for competition, challenges, and rewards were similar in both studies. The idea was to create a competitive setting in which the participants was intrinsically triggered to perform without the need for extrinsic rewards. One of the approaches utilised in both studies was to anonymise the co. competitors. This was made to challenge the participants to keep going while triggering them to outperform the mass of others. The rationale behind this is anchored in prior research which show that game design elements like leaderboards where competitors are triggered relative towards each other are most effective for the top performers. The mid- to bottom performers may even be negatively impacted by the leader board (Jia & Voida, 2017). In studies one and two no feedback of positioning relative to other competitors was given. Instead, all participants got the same feedback of performing above average compared to the rest. Therefore, no one really had any reason to feel useless or not good enough. However, since both studies had similar compositions of challenges and rewards, it is not likely that this factor contributed much to the difference in effect sizes of gamification on intrinsic motivation between the studies.

The difference between the studies regarding the impact of age was interesting. The high negative correlation between age and both gamification and intrinsic motivation indicates that older people did not feel as motivated by the gamification as the younger participants. The fact that the same correlations did not appear in study one is strange since both studies had relatively even demographics regarding age. A possible explanation may be that study two utilised a set of very colourful avatars to chose from, which was displayed

throughout the story. This might have upset some of the participants in the older cohorts. Nevertheless, this finding is interesting to consider in future research in gamification.

The Role of Personality

In study one, personality did not seem to interfere with the impacts of game design elements on any of the independent variables since the only independent variable to really be affected by game design elements were intrinsic motivation. Since none of the personality traits showed any significant correlations with intrinsic motivation none of the hypothesis about the impact of gamification could be confirmed. In study two, gamification affected both intrinsic motivation and amotivation.

Openness to experience is a personality factor which properties often is referred to as being curious, open minded and imaginative (Rothmann & Coetzer, 2003). This was the main personality trait to affect intrinsic motivation and amotivation in study two. However, the ANOVA checking for interaction effects between high and low openness vs. gamification did not reveal any significant interactions. A possible explanation to this is that highly open people tended to be intrinsically motivated by learning novel things about hummingbirds in general. This possibility is somewhat in line with Armstrong & Landers (2017), who discussed the potential of openness to experience being a predictor of attitudes towards both game-based learning and learning of novel things in general (Armstrong & Landers, 2017). Lack of novelty towards the topic of learning may also explain why openness was not a factor that showed in study one.

Conscientiousness is highly connected to high self-control, sense of organisation, and dutifulness (Rothmann & Coetzer, 2003). The finding that conscientiousness had a significant negative correlation with amotivation in study one strengthens the notion that dutifulness towards learning more about the severe situation that constituted the learning topic was the main driver of decreasing amotivation to learn. The general lack of interaction of conscientiousness with gamification in study one was also in line with previous research (Ghaban & Hendley, 2019; Jia et al., 2016). This makes the significant interaction effect found in study two more interesting. The narrative storyline in study two was partly designed to enforce the progress of the participants through the story. It is possible that this type of narrative functioned as a defined progress feedback, which in previous research has shown to cater towards highly conscientious people (Ghaban & Hendley, 2019).

The lack of any interaction effects between gamification and extraversion on intrinsic motivation and amotivation to learn was unexpected. Previous research has shown that people high extraversion is attracted by leaderboards and competition related game design elements

(Jia et al., 2016; Jia & Voida, 2017). These are often designed to foster extrinsic motivation from rewards and the possibility to shine over others (Buckley & Doyle, 2017). The competition elements in studies one and two was designed to foster intrinsic cues by anonymising opponents and trigger the participants to anonymously compete against a mass of other anonymous participants. This might have taken away the incentives from highly extroverts to shine.

Limitations & Future Research

The present paper reveals interesting results regarding designing of gamified systems to foster intrinsic motivation to learn. The findings underline the notion that gamification is not a uniform concept. Instead, context as well as how the game design elements are applied is crucial factors to balance when designing a gamified system. However, this study is far from flawless. Below is a discussion of the main drawbacks identified in this study.

The novelty effect is often discussed in the context of gamification and a possible weakness of this paper. Both studies were cross sectional and conducted in a relatively short time span. There is no way of knowing if the effect on intrinsic motivation would last for much longer then the duration of the experiment. A longitudinal study by van Roy and Zaman (2018) concluded that motivation to learn followed a u-shaped pattern. They showed that the effect of gamification on intrinsic motivation attenuated over time, only to be regained towards the end of the measured period (van Roy & Zaman, 2018). The u-shaped pattern of intrinsic motivation was almost perfectly counterbalanced by amotivation in their study (van Roy & Zaman 2018).

People high in openness are generally open towards new experiences and novelties (Rothmann & Coetzer, 2003). The fact that openness correlates well with both gamification and intrinsic motivation in study two strengthens the concern of a possible novelty effect in that study.

A way forward to utilise the findings presented here would be to apply the same gamification system into a larger context. For example, by applying gamification to an e-learning tool within a larger organisation and test longitudinal effects of using the system. Such a test coupled with the ability to measuring motivation within subjects over longer timespans would give valuable information about the novelty effect as well.

Another limitation is that since both studies utilised a system of combined game design elements there is no way of knowing if any of the individual game design element was accounting for all the effects on its own. However, previous research using single game design elements to foster intrinsic motivation has largely proven unsuccessful in fostering

intrinsic motivation (e.g., Landers et al., 2019b; Mekler et al., 2017). Longitudinal research where game design elements are introduced sequentially over time could be a good way of moving forward to understand more about both the longitudinal aspect of gamification as well as efficiency of individual game design elements.

Practical Implications

Research within industrial settings have shown that information of health and safety regulations or more mundane instructions in how to apply protective gear often attracts very little attention (Burke et al., 2006). Digitalization makes this easier but getting people to engage with these digital sources of information is another matter. Prior research has seen promising results in the application of different types of game design in these contexts (Sirwan Mohammed et al., 2018). Göschlberger and Bruck (2017) found that gamifying a mobile microlearning platform led to higher engagement from workers during their off hours. This indicates that the platform was used for leisure as well as learning (Göschlberger & Bruck, 2017).

The present study gives more input to the cumulative knowledge of how gamification can be applied in circumstances like the ones described above. If gamification can be applied to foster intrinsic motivation to interact with e-learning tools, this makes useful knowledge for many types of communication within organisations.

Conclusions

The take-home message from the present study is *first,* that gamification has potential to foster intrinsic motivation to learn when used in an online learning task. However, when considering how to apply the gamification its essential to consider the *second* point. Context and composition matter to how the gamification is received. The differences between the studies reveals big differences in effects, and in how the game design features were synthesised to fit the context *Third*, individual differences are a factor to consider in future gamification designs.

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