‘An Exploratory Study on the Influence of Self-Efficacy Beliefs and Player Types on Perceived Motivation in Gamified Exam Preparation’

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July 5th, 2021

Abstract

Literature shows that students often resort to ineffective learning strategies for exam preparation even when good alternatives are facilitated. An effective learning strategy is the use of practice tests. However, studies indicate that students often do not use these, or if they use them, they do so ineffectively. The current study explores how students' motivation to engage in practice tests can be facilitated. It is hypothesised that gamification (i.e., leaderboards and individual scores) can be employed to reach this goal. However, research suggests that students' responses vary towards the different elements in gamification and are dependent on student preferences, so-called player types. This study applied the typology of Marczewski to assess students' player types. The study consisted of a player type questionnaire and a structured interview. In these interviews, students (N = 14, M_{age} = 23.36, SD = 2.89) took four practice tests before which the self-efficacy beliefs were assessed. At the end of two tests, students were presented with a leaderboard, while at the end of the other two tests, students received an individual score. Both gamified elements were manipulated, so students were shown the same results regardless of their performance. The study researched the two different gamification elements and their influence on perceived motivation within exam preparation. Furthermore, it was assessed if the different classified player types would influence this. The study revealed that overall students found the individual scores more motivating within practice tests but asked for more feedback. There was no strong effect of the self-efficacy beliefs on the motivation in specific gamified conditions. Implications of this study are that future research should assess which forms of feedback can motivate students to engage in practice tests and if this motivation is facilitated by individual scores.

Keywords: learning strategies, gamification, motivation, self-efficacy, player types, practice tests

An Exploratory Study on the Influence of Self-Efficacy Beliefs and Player Types on Perceived Motivation in Gamified Exam Preparation

Students at the university must prepare for exams and there exist ineffective and effective strategies to do so. The problem is that a lot of students use ineffective learning strategies such as rereading (Blasiman et al., 2016). Blasiman and colleagues (2016) found that there are strategies that are useful and effective such as practice tests. Karpicke et al. (2009) identified repeated testing as more effective for learning than rereading. Testing can be used to improve learning and is especially useful when one is required to retrieve knowledge from their memory (Davis et al., 2020). Thus, the effectiveness of testing is dependent on the usage of students. Students need to actively recall information and think about a question instead of just rereading and its solution. They must use practice tests thoroughly by actively recalling information to be an effective strategy. The by many students applied and ineffective learning strategies do limit their performance and thus the question arises: How is it possible to motivate students to efficiently use more effective learning strategies such as practice tests?

When looking at students' learning strategies, it has been found that the mechanics that attract learners to engage in a learning strategy might differ from student to student (Kocadere & Çaglar, 2018). And thus, different students might respond differently to certain elements of gamification such as leaderboards and points. Werbach and Hunter (2012) reported that the characteristics of different player types must be considered while designing a gamified learning environment. These characteristics can range from the elements one enjoys in a game, for example, if one is a competitive or collaborative player to the preference of intrinsic or extrinsic rewards. In earlier research, it was shown that different player types experience gamified tasks differently and that gamification can influence their experience depending on the chosen gamification element (Werbach & Hunter, 2012).

Gamification

Gamification describes using elements that are typical for game design in a non-gaming context (Baptista & Oliveira, 2018). For example, a lot of shops and companies offer the possibility to collect points or stickers in a save up system to achieve a reward or get a discount. In educational contexts, online sites such as khanacademy.org make use of game elements to engage their users. Users earn more badges the more lessons or courses they complete (Dicheva et al., 2015).

There are several strong arguments for the use of gamification in educational settings, especially in the case of exam preparation in the form of practice tests. It was found that gamification increases the engagement of students in exam preparation (Dehghanzadeh et al., 2019; De-Marcos et al., 2014; Lewis et al., 2008). In addition, studies showed that gamification leads to increased participation in learning environments (Hew et al., 2016; Iosup & Epema, 2014). Moreover, studies detected that the blending of game elements and learning experiences leads to an increase in motivation (Dehghanzadeh et al., 2019; Kocadere and Çaglar, 2018; Lewis et al., 2008). Besides, game mechanics that are used in a gamified learning environment led to a higher level of entertainment (Hew et al., 2016), intensified the flow of the learning process (Kocadere and Çaglar, 2018), and increased the performance outcomes in learning activities (Dehghanzadeh et al., 2019). Furthermore, Hew et al. (2016) encountered that gamification motivates learners further while performing difficult learning tasks, and it can decrease the time of teaching and promote learning in general (Grobben, 2020). The above-mentioned arguments indicate the beneficial use of gamification in an educational learning setting.

Self-Evaluation through Gamification

Besides, positive effects on engagement, motivation, and flow gamified educational games offer the opportunity for self-evaluation (Suls et al., 2002 as cited in Grobben, 2020). Self-assessment and self-evaluation are frequently included in educational games because individuals are inherently drawn to social comparison. Self-evaluation is an important part of learning as it fosters engagement and can be facilitated through gamification elements such as individual scores and leaderboards as these offer a possibility to compare one's performance with the performance of others or the self (Suls et al., 2002 as cited in Grobben, 2020).

Leaderboards

Naturally, people compare themselves with their social world; gamification can take advantage of this (Grobben, 2020). The use of leaderboards can ensure that students stay motivated to improve their performance and further challenge themselves. It can motivate students to score higher compared to their fellow students. According to Nah et al. (2014), the goal of a leaderboard is to create a sense of eagerness to advance users' names for the accomplishments they have achieved and to keep learners motivated. Thus, leaderboards create a competitive environment among students. O'Donovan et al. (2013) suggested that leaderboards rank the highest in comparison to other gamification elements when it comes to the motivation of students. It was found that the learner's outcomes were more engagement, better performance, and higher participation (Nah et al., (2014).

Individual Scores

Individual scores allow students to discuss their performance with their peers, but also to evaluate their development over time or to a goal or standard Nah et al. (2014). Nah and colleagues found that the learning outcomes under the usage of scores were: more motivation, higher engagement, increased enjoyment, as well as a productive learning experience. When talking about these two strong gamification elements it is crucial to mention that people might respond differently to them. According to studies, students' reactions vary, for example, Jia et al. (2017) found that the personality of people influences their preferences for leaderboards. Specifically, game research has shown that player types can be identified which can be used to predict what elements trigger a student in what way. A problem that might arise is that if someone does not find the chosen gamification element appealing, they might not find them motivating (Werbach and Hunter, 2012). Thus, to design motivating gamified educational practice tests it is important to classify ones playertype and the corresponding needs and interests.

Player Types

Considering the evaluation of player types there are two common typologies: the typology of Bartle (1996) and the typology of Marczewski (Hexad) (2015). Most of the scientific studies performed so far refer to the typology of Bartle (1996) to classify users of gamification within the typology. This player typology was created for Multi-User Dungeons (MUDs). The corresponding questionnaire of Bartle's player typology uses a specific gaming vocabulary as it is asking for gaming preferences and style elements that are not known to non-gamers. According to (Chou, 2019), Bartle himself said that the typology of the player types that he developed may not be appropriate for an environment outside virtual voluntary worlds. Therefore, Bartle's typology is less suitable for application to game-based learning or gamification within the educational context as there are no MUDs. To solve this problem the Gamification User Type Hexad framework (Hexad) was developed by Marczewski (2015). This framework is based on research regarding player types, human motivation, and practical design experience.

User Type Hexad Framework

The Hexad model (Marczewski, 2015) consists of six player types. Namely: *Socialiser, Free Spirit, Philanthropist, Disruptor, Player, and Achiever*. This model helps to segment users based on preferences regarding the interaction with gamified systems. It is important to mention that the six player types are not exclusive. In most cases, users will be described by a whole profile rather than one single gamification player type (Diamond et al.,

2015). In the following the six-player types will be shortly introduced and it is shown that different player types experience different elements as motivating:

- The *Socialiser* wants to create social connections and thus is motivated by relatedness. They like to be part of a group within the system.
- The *Free Spirit* is motivated by self-expression, agency, and autonomy. This player type likes to explore and dislikes restrictions. They embark on their journey or like to create.
- For the *Philanthropist* a sense of purpose, altruism, and meaning is important and motivates them.
- The *Disruptor* needs to disrupt the system by either directly acting on it or by influencing other users. This can lead to the benefit of the gamified system and other players, or it just serves the personal enjoyment of the player themselves.
- The *Player* is motivated by extrinsic rewards. They gain these through a variety of different strategies. There is no need for additional motivation besides these extrinsic rewards.
- For the *Achiever*, the ultimate goal is mastery. They want to overcome challenging obstacles and try to complete every task. They like to learn new skills and want to reach 100%.

Self-efficacy

From a psychological educational perspective self-efficacy beliefs should be considered as these might impact how motivating a student experiences a gamified practice test. It might be that the assessment of player types solely cannot exclusively explain why students find a gamification element motivating or not. Self-efficacy describes the perception of an individual regarding their capacity to perform some sort of behaviour, action, or task. It is positively influenced by successful experiences in the past and negatively by past unsuccessful events (Bandura, 1977). It is important to mention that self-efficacy does not just reflect one’s beliefs about their abilities, but also how this individual behaves and makes choices. In general, individuals with low self-efficacy tend to avoid situations in which they feel less skilled or experienced. Whereas people with high self-efficacy beliefs easily start tasks that they think they are capable of (Bandura, 1977). Zimmermann (2000) and Cosgrove (2016) identified that self-efficacy is a highly effective predictor of the motivation of a student as well as their learning behaviour. Students' beliefs about their capabilities in an educational context play a central role regarding their motivation. Furthermore, self-efficacy

does predict the engagement with a task and the expended effort (Pajares, 1997, 2002). This makes apparent why self-efficacy might play a central role in gamified learning environments as it can influence motivation, duration, and engagement.

Current Study

The current study aimed to investigate the impact of self-efficacy beliefs and player types on student's motivation to engage in gamified practice tests. It is assumed that the six different player types have an impact on the response of students as not one approach might fit all needs and interests. However, other students' characteristics might also play a role in rendering the impact of player types. Literature shows that not every student reacts the same to gamified elements. To optimize the design and implementation of practice tests, it is crucial to understand whether and how different forms of gamification motivate different students. Therefore, in the current study self-efficacy and player type were taken into account. In total, four research questions were addressed:

1. What are students' preferences concerning the design of practice tests?
2. Is there a relation between the gamification elements (leaderboards/individual scores) and students' motivation to engage in a practice test?
3. Are specific gamification elements preferred by different player types?
4. Is there an influence of self-efficacy beliefs on the relation between gamification elements and motivation?

Method

Participants

All 15 participants of the pre-master course 'Introduction to Psychology' of the University of Twente were invited to participate in this study. Two students mentioned that they would not participate in the exam and thus would not be interested in the practice tests. Three students did not respond at all. Hence, ten students participated in the study. All students from this course that participated later took part in the examination.

To have a bigger sample four more students were acquired using convenience sampling. The total sample consisted of people that either had done a bachelor's in psychology at the University of Twente in the last three years (N = 4) or were currently doing their Premaster to do a Psychology Master (N = 10). The final sample of this study consisted of 14 students (N = 14). Inclusion criteria were being older than 18 years, being able to read and write English, having internet access and currently studying Psychology in the pre-master or having done so in the past. The participants consisted of six females (42.9%) and eight

males (57.1%). The age ranged from 18 to 29 years (M_{age} = 23.36, SD = 2.89). Ten (71.4%) participants were Dutch, three (21.5%) German, and one (7.1%) of other nationality .

Design

This research was an exploratory study that used a mixed-method design. A quasi-experimental within and between model design was applied. A questionnaire and a semi-structured interview were used to collect data. This study contained three independent variables. The first independent variable was ‘player types’ consisting of six continuous subscales that were based on the Hexad: Socialiser, Free Spirit, Philanthropist, Disruptor, Player, and Achiever (Marczewski, 2015). Thus, it was possible to compare the different player types participants identified with. The second independent variable was ‘self-efficacy beliefs’ which was a continuous variable. Accessing these beliefs was necessary to compare them within a participant as well as how they felt compared to the other participants. The third independent variable was ‘gamification’ and had two levels: leaderboards or individual scores. The conditions thus were that every participant was twice facing a practice test that showed a leaderboard in the end and twice an individual score was presented after finishing.

Different conditions were used to research the dependent variable of the current study which was ‘motivation to engage in practice tests’, a continuous variable. The motivation of students after they faced the different conditions were compared within their own felt motivation as well as the motivation felt by other participants in the same situation. This study was ethically approved (210235) by the ethics committee of the Faculty of Behavioural, Management and Social Sciences of the University of Twente.

Materials

Player Type Questionnaire

In a project of Tondello, Wehbe, Diamond, Busch, Marczewski, and Nacke (2016) they developed a survey response scale to score the preferences of users oriented on the Hexad player type scale by Marczewski (2015). The 24 statements (Appendix A) were assessed with the help of a 7-point Likert scale and the usage of the online program Qualtrics. The scale ranged from “strongly disagree” (one) to “strongly agree” (seven). Thus, a participant could indicate how much they identified with a statement and the corresponding player type. Meaning that scores one and two were counted as negative regarding the identification with a player type. Scores three, four and five were assessed as an indifferent value whereas scores six and seven were counted as a positive agreement with the statement. This measurement was used to assess the fitting player types for each student.

The six player types were assessed as follows: *Philanthropist* with statements such as: "It makes me happy if I am able to help others", *Socialiser:* "It is important to me to feel like I am part of a community", and *Free Spirit* presenting statements such as: "It is important to me to follow my own path". Then, for *Achiever* statements like: " It is difficult for me to let go of a problem before I have found a solution" were presented, while a statement for the player type *Disruptor* was: "I like to question the status quo", and "If the reward is sufficient I will put in the effort" for the player type *Player*. Each variable contained four statements fitting for this player type.

A final score per player type was calculated. Per student, the median for each player type of all four fitting statements was calculated. This means that each participant received six scores. If the median was 5,5 or higher this participant could be classified with the corresponding player type. If the score was lower than this value a student was not classified with the corresponding player type. Thus, it was possible to assign each participant to one or more representing player types.

The questionnaire was created with the help of the online program Qualtrics (https://www.qualtrics.com) and administered in English. It was developed by the researcher to assess the demographics of the participants as well as their player-typology. The questionnaire was accessible from the 19th of March to the 15th of April 2021 and administered online. Participants had to indicate that they were consenting to participate in this study and their agreement with the interview being recorded (Appendix B). The following questions asked for the demographics of the participants. They had to indicate their age, gender, and nationality. The questionnaire was filled out by the participants individually and online, which allowed them to choose the moment in time and place for their participation. No time limitation for finishing this questionnaire was given.

Structured Interview

The interviews were conducted online with the help of Canvas Conferences for the pre-master students and Skype for the additional participants. They were executed in English and recorded with a laptop. The complete interview scheme can be seen in Appendix C. The Interviews were joined only by the participant and the researcher. The interviews took place in the same time frame as the questionnaire and each interview was conducted shortly after the participants filled out the player type questionnaire.

At the beginning of the interview, the researcher thanked them for their participation and asked the participant once more for the consent of being recorded. Following, the topic was shortly introduced and two questions regarding learning strategies were asked. The goal

of this was to assess if students indeed use ineffective learning strategies and how they use practice tests if they do so. It was questioned if they use practice tests to actively recall information or to read the questions and answers. These questions were posed to investigate the first research question regarding their preferences for practice tests. Before the implementation of each practice test, the self-efficacy beliefs of students concerning the following topic of the test were explored. The goal of this interview element was to control the influence of self-efficacy beliefs on the perceived motivation felt after a test. This was done to test if the self-efficacy beliefs might influence the motivation next to the presented gamification element (leaderboard or individual score).

Within the interview, four practice tests were conducted which were created via Qualtrics. All practice tests were administered in English and without a time limitation. After every test students were asked queries about their perceived motivation. The goal of this element was to assess the possible influence of the gamified environment on the perceived motivation. After all practice tests were done students were presented with more information about gamification and afterwards asked which gamification element they found more motivating and for what reason. This was done to find out which element they experienced as more motivating no matter the topic of a specific test. The interview ended with a debriefing about the manipulation and students were offered the opportunity to ask questions and state their opinion. This allowed the researcher to note feedback next to the given questions and to receive ideas and tips for improvement of the study but also practice tests in general. One interview session lasted 40 minutes on average.

Learning Strategies. To assess the preferred learning strategies of students they were asked which learning strategies they use for exam preparation and how they use these. To investigate this, two questions were asked: “What learning strategies do you use?” and “When you use practice quizzes do you use them to check your understanding, or do you read the questions and answers?”. These questions were formulated in an openly and students could name and elaborate on as many study strategies as wished.

Self-Efficacy. To assess students’ self-efficacy beliefs an online questionnaire containing five iterative statements were used. These statements were presented before every practice test. Thus, the self-efficacy beliefs concerning every practice test were assessed. The statements were: *“*I'm certain I can understand the most difficult material presented in the readings of this chapter”, “Considering the difficulty of this course, the teacher, and my skills, I think I will do well on this practice quiz”, “I'm confident I can understand the basic

concepts taught in this chapter", "I'm confident I can do an excellent job on the practice quiz of this chapter", and "I expect to do well on this practice quiz".

The participants had to evaluate each statement on a five-point Likert scale. On this scale, one was the lowest score and represented "disagree" while five represented the highest score: "agree". To determine the reliability of this questionnaire Cronbach's alpha was calculated $\alpha = .75$. When taking the tables of Taber (2017) into consideration excellent reliability is represented with a Cronbach's alpha of >0.9. Good reliability is given with a Cronbach's alpha >0.8, while >0.7 is acceptable, and >0.6 is questionable. Any scores below this value are unacceptable. This measurement was done to assess the beliefs of each participant regarding their performance on one specific topic. The final score for the self-efficacy belief per topic was calculated with the mean of the five statements per participant. A high score meant that a student felt able to perform well on this practice test while a low score meant that the student did not feel confident about performing well on this test.

Practice Tests. Each practice test consisted of ten randomised multiple-choice questions with four randomised answers each. The four practice tests contained questions regarding one specific chapter that had to be learned by the students of the pre-master course for their examination. Before the practice tests were started all participants were asked two questions regarding their learning strategies. Participants were asked: "What learning strategies do you use?" and "When you use practice tests do you use them to check your understanding, or do you read the questions and answers?". These questions were asked to determine the preferred learning strategies and to understand how they use practice tests if they do so. The questions were asked openly, so participants had to elaborate on their answers.

Individual Score. After the first and third practice tests, a picture with the manipulated individual score was presented (figure 1). Viciana et al. (2007) found in their study that positive feedback (in this case a high score) had a positive effect, and negative feedback (in this case a low score) harmed learning-oriented motivation. Thus, the presented individual score was manipulated and showed an average score, so every participant experienced the same situation. This was done to limit the influence of the individual score itself on the perceived motivation as this situation was created to assess the perceived motivation due to a specific gamification element and not the feedback itself. Meaning that the causal connections between this independent variable (gamification) and the dependent variable (motivation to engage in practice tests) could be investigated (Allen, 2017).

Leaderboard. After the second and fourth practice test, a picture with a manipulated leaderboard was shown to the participant (figure 2). This gamified element was manipulated as well, so every participant would experience the same conditions. This was done to assess the perceived motivation due to the specific gamification element in a more objective manner.

Figure 1

Gamification Element Individual Score

Figure 2

Gamification Element Leaderboard

Perceived Motivation. After each practice test, three iterative questions were asked. The measurement goals of these queries were to assess the perceived motivation of a participant after being confronted with a specific gamification element. These questions were: “Do you want to do it again?”, “If the questions were endless how many tries would you

spend on this?", and "How motivated do you feel on a scale from 1-10?". The last question had to be answered with the help of a Likert scale ranging from one to ten, ten being the highest. Participants were asked to assess their motivation on this scale, so it would be possible to compare their given scores within their different test situations but also to compare them with their fellow participants.

Perception of Gamification. Finally, after the participant had completed all practice tests, they got a short introduction about gamification. Afterwards, four questions were asked to learn more about the perception of individual scores and leaderboards as gamification elements in exam preparation. The questions were: "Which gamification element (individual score or leaderboard) did you find more motivating and why is this the case?", "Which of the two gamification elements triggers you to actively recall information?", "How could we engage you more?", and "Is there anything else you would like to say?". In order to learn from an interview, it was indicated by Roulston (2018) that an interviewer should be willing to listen intently and to learn from the responses of the participants. Therefore, students were asked openly to give them room to elaborate on their experience and to inform the researcher about remarks or insights.

Procedure

The students of the pre-master course 'Introduction to psychology' were informed by their teacher Dr J. ter Vrugte that a study would take place that would give them the opportunity of additional exam preparation in the form of practice tests. This was done via an announcement on Canvas and verbally in a lecture given by her. The students then could choose a timeslot out of several that were presented on the Canvas calendar. Once a student had signed up, they received an email with the instructions on how to prepare for the interview and were thanked for their willingness to participate in this study. This email included a link for the *"Player Type Questionnaire"* which had to be filled out before the interview took place. Additionally, a Canvas Conference was planned for every participant at their preferred time slot. The time and place were confirmed in this email. On the arranged date the participant had to join the prepared conference.

Then the *"Structured Interview"* started. First, the *"Self-Efficacy"* beliefs of each student on a specific topic were assessed then the corresponding *"Practice Test"* took part. The first practice test about the topic "Motivation and emotion" was conducted. A used question was: "Which theory states that a stimulus triggers physiological changes that produce emotion?". Students were then presented with a manipulated individual score and asked the three iterative questions regarding their "*Perceived Motivation*". Once the

participant had answered all questions, they conducted the next practice test about the topic "Social psychology". A used example question for this topic was: "What do we call judgments about people, situations, objects, or thoughts?". After this, the participant was presented with a manipulated leaderboard and asked the same three questions regarding their "*Perceived Motivation*". Subsequently, the same procedure was done for the topic "Learning". Here questions like: "For every 5 times that you go to the gym each week, you reward yourself with a treat. This best illustrates which of the following schedules of reinforcement?" were used, and an individual score was presented afterwards, then the questions concerning "*Perceived Motivation*" were asked. Lastly, the topic "Sensation and perception" which offered questions like: "The tendency to interpret an object as always being the same physical dimensions, regardless of its distance from the viewer, is known as " was assessed, and a leaderboard was presented subsequently. Once more the iterative questions about "*Perceived Motivation*" were asked.

Finally, the debriefing took place and the questions regarding the *"Perception of Gamification"* were asked. Students were thanked for their time and offered to receive some indication about their real performance via email.

Data Analysis

After all interviews had taken place, they were converted from the video format to an mp3 format with the help of NCH Switch v.9.14. Afterwards, they were transcribed using Express Scribe v.10.08 and the free online program otter.ai. Then, the transcribed interviews were coded with the help of Atlas.ti 9. A content analysis was conducted, and the participants' answers were scanned and filtered for relevant information. Various sentences within the interviews were given codes corresponding to the different topics that were addressed (learning strategies, motivation, gamification elements).

Motivation to Engage in Practice Tests

To assess the dependent variable 'motivation to engage in practice tests' two calculations were done. First, to research how likely a student was to do the same practice test again all answers concerning this were grouped by their gamification element. Per gamification condition, all rejections of the offer to do the same test again were summed up and divided by 28 (each condition was twice presented to each student). The same was done for all acceptances of the offer to do the same test again. The arrived values were then multiplied by 100 to receive the percentages of the participants indicating that they would like to do the same practice test again within a specific condition. This calculation was done to arrive at a value indicating how likely a participant was to do the same test again in either

the leaderboard or the individual score condition. This way the values for each condition could be directly compared.

Secondly, to calculate how many more tries a student would spend on a practice test within a gamified condition all responses were collected. The attributed numbers of extra tries per condition were then summed up and divided by 28 as each gamified element was presented twice to every student ($N = 14$). This calculation was done to assess how many further tries on average a participant would spend within a specific gamification condition. Thus, it was possible to compare the leaderboard and individual score conditions concerning the motivation to spend more tries within this condition.

Results

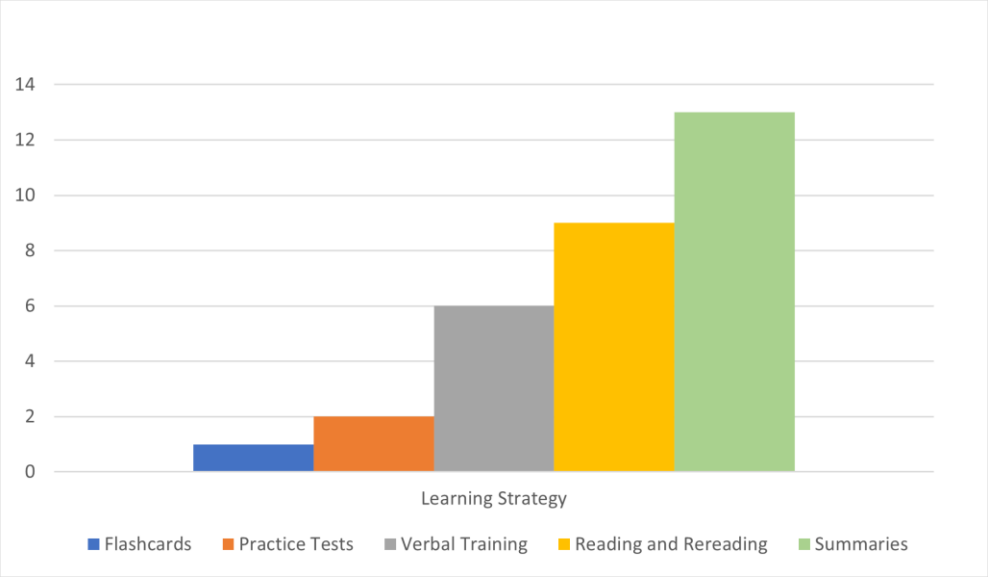
To begin with, it is to mention that no data had to be removed. Meaning that there were no students that discontinued the study or had to be excluded from it for another reason. The results of all 14 participants were used for the analysis.

Learning Strategies

To explore the first research question: "*What are students' preferences concerning the design of practice tests*?" participants were asked at the beginning of the interview which learning strategies they use to prepare for an exam. This was done to assess if practice tests are a common way to prepare for upcoming examinations. Overall, based on the responses, it was concluded this is not the case. Some participants named several methods as being part of their learning strategy. See figure 3 for the least to most used learning strategies.

Figure 3

Used Learning Strategies to Prepare for Examinations



Note. All the 14 Participants declared their used learning strategies. Some participants indicated to use several learning strategies.

The interviews showed that the least used learning strategy was the usage of *Flashcards*. The participant who mentioned this method explained that it is a thorough method for her to learn as she writes down information herself and goes through them until she is a hundred per cent sure that she knows all the cards and corresponding information. Regarding the method *Practice Test*s for exam preparation, it was mentioned by a participant that he likes to do them to check his mistakes and to evaluate his progress. *Verbal Training* as a learning strategy was named by nearly half of the participants, meaning talking about the content with others/oneself or reading out loud. *Reading and Rereading* the assigned material as preparation was mentioned as a learning strategy by nine participants. Some participants indicated that this was their main method of learning and that they mostly derived knowledge by reading the assigned materials. The most common learning strategy was *Summaries* to prepare for examinations. All but one participant said to use them. These findings indicated that students indeed often used ineffective learning strategies which were in line with the expectations.

On a follow-up question participants were asked how they use practice tests if they use them. All 14 participants indicated that if they are provided with practice tests, they use them to deeply think about the question and to actively recall the information. When asked

about why and how one uses practice tests this was the response of a participant who indicated a way of using it that was mentioned by several students:

> I really want to understand what it's about. So that's why I learn the things that I have difficulties with again so that I can make the test again in a few days and see the difference.

All participants indicated that they spend time deeply thinking about the question before choosing an answer. This indicated that if students use practice tests they do so in an effective way. Regarding the preferences for the design of practice tests 11 out of 14 participants addressed the wish for additional or more precise feedback. The following quote represents what many participants indicated:

> But I would like to know which questions I answered correctly and which wrong. Because that's what's not coming back now. I am curious about how I performed. It is not about score for me, it's about the feedback whether I learned or not
> I don't know if I did well or did not do well and I don't know, if like, I don't understand the concepts…

Another topic that was raised by 9 out of 14 participants within the interviews were ideas on how to improve practice tests to make them more motivating and learning enhancing. Participants for example had the idea to combine the individual scores and the leaderboards to give an even more accurate form of feedback and impulse for further learning. It was important to 11/14 participants to receive more feedback to be motivated to engage in practice tests. They asked to see their wrong answers and for tips to enhance their understanding, further they wanted to understand why certain things were false and expected an explanation to check their understanding. To conclude, students wish for more and precise feedback when doing practice tests.

Perceived Motivation

To answer the second research question: *"Is there a relation between the gamification elements (leaderboards/individual scores) and students' motivation to engage in a practice test?"* four different measures were taken. The first measurement was that, after a practice test, students were asked if they would like to do the same test again. Most of the participants were not interested in doing the exact same test again; Even though all 14 participants said to have the in-depth approach to taking practice tests 6 out of 14 participants did not want to do a practice test again.When grouping the answers to this question per condition it became apparent that attendees were more likely to do the same practice test again when confronted

with their individual scores. If the individual score was presented at the end of the practice test 35.7 % of the time a participant indicated to do the test again while it was 14.3 % for the leaderboard condition.

To assess the perceived motivation a second question was asked after every practice test: “How many tries would you spend on this chapter if the questions were endless?”. The number of added tries differed per person and condition. On average, after being presented with an individual score, participants said to do the same practice test 2.1 more times. Compared to this, attendees said to try the same practice test 1.5 times more when being presented a leaderboard at the end.

Concerning both questions, it is noteworthy to mention that, during the interview, students gave different reasons why they would or would not spend more tries on a practice test. Participants were for example satisfied with the outcome (N = 3), felt a general lack of motivation (N = 1), or would spend more tries on the practice tests if it would prepare them for their examination (N = 3). In total, in both conditions, 11/14 participants mentioned feedback to be an important factor for their motivation. A missing feeling of motivation due to little feedback was experienced by three students and can be shown with the following quote:

> I don't have like the motivation to do it again. … I don't know what my score is. And that kind of makes me upset because I did good. So if I don't know what my score is, I don't really have motivation because I don't have any feedback. I can't check if I did better or worse if I would do it again.

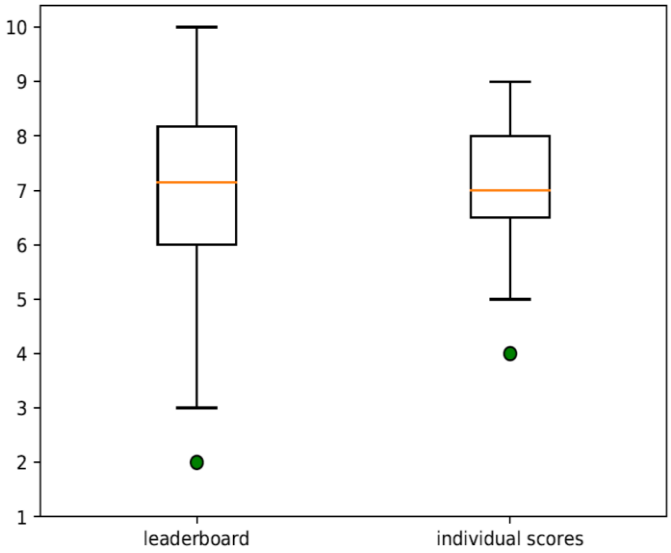
The perceived motivation after each chapter was assessed with the help of a third question. The participants were asked to give their perceived motivation a number on a Likert scale from one to ten. This was done for every participant after all four practice tests. The outcome of this investigation can be seen in figure 4.

When participants were asked which of the presented gamification elements they found more motivating overall, 7 out of 14 indicated the individual score, 4 out of 14 mentioned the leaderboard, and 3 participants declared that it would not make a difference to them. Afterwards, participants were asked which gamification element triggered them more to actively recall information. No specific expectation about one gamification element was given but 10/14 participants said that this would be the case for them when being presented with their individual score. Next, 1/14 participants indicated to be triggered more by the leaderboard to actively recall information within a practice test. For three participants it made no difference which gamification element would be displayed at the end of a practice test. To

summarise, students were more motivated to engage in a practice test and to actively recall information when being presented with an individual score.

Figure 4

Perceived Motivation after a Practice Test Assessed in both Conditions



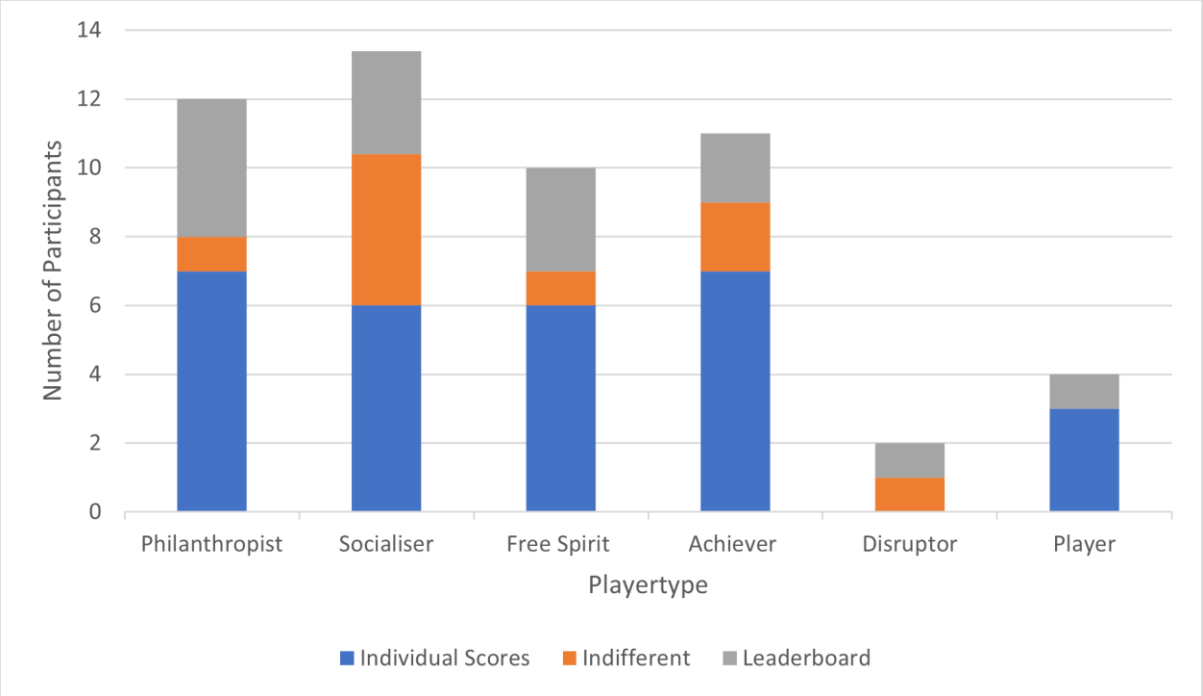
Note. N=14. Leaderboard M7.05, SD=1.97, individual scores M=6.98, SD=1.24, (t (54) = -.16, p < 0.872).

Player Types

To answer the third research question: *"Are specific gamification elements preferred by different player types?"* the participants of this study were classified within the typology of Marczewski (Hexad). For every participant, the gamification element which was experienced as more motivating was taken into account and evaluated together with the player types this participant was classified with. Thus, a grouping of the different gamification elements per player type was possible (figure 5). Concluding, it can be said that for all five player types, besides the *Disruptor*, the preferred and more motivating gamification element was the individual score. Still, it needs to be mentioned that for the *Socialiser* less than 50% found the individual score more motivating.

Figure 5

Preferred Gamification Element per Player Type



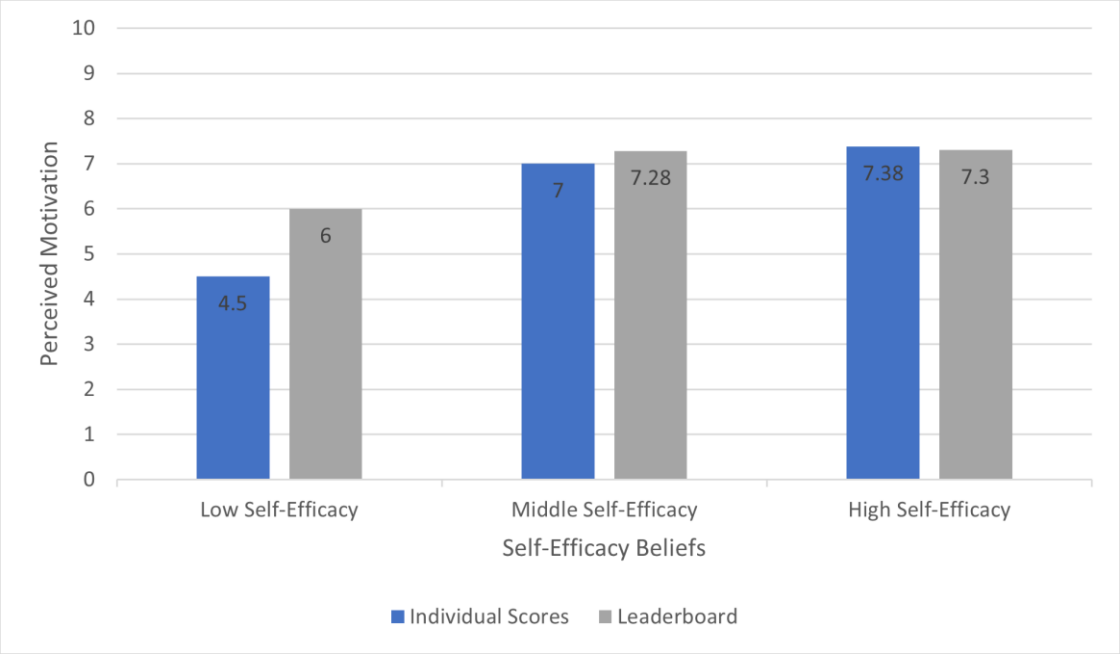
Note. 14 Participants filled out the questionnaire (*N* =14).

Self-Efficacy and Perceived Motivation

To answer the fourth research question: *"Is there an influence of self-efficacy beliefs on the relation between gamification elements and motivation?"* two measures were taken into consideration. First, the self-efficacy beliefs per chapter were assessed on a five-point Likert scale. Then, participants were grouped into three categories: low, middle, and high self-efficacy beliefs. While doing this, the presented conditions (individual scores/leaderboards) were considered. Thus, 6 groups were generated. Participants that scored between one and two on average were grouped into the low self-efficacy category. Those that scored between two and four were grouped into the middle category, and participants that scored four or higher were taken into account via the high self-efficacy category. Second, after every practice test, the participants were asked about their perceived motivation. Participants had to indicate their motivation on a ten-point Likert scale, ten being the highest. Then, the average score of perceived motivation of the participants that were grouped into a category was calculated. The result can be seen in figure 6.

Figure 6

Perceived Motivation Grouped by Self-Efficacy Beliefs and Gamification Element



Note. For the low self-efficacy beliefs, category one participant per condition was counted. For the middle self-efficacy beliefs condition, seven participants were counted in the individual score condition and six in the leaderboard condition. In the high self-efficacy beliefs condition, six participants were enumerated in the individual score condition and seven in the leaderboard condition.

Discussion

This study aimed to offer insights that could help to overcome the problem of students' use of ineffective learning strategies to prepare for examinations. At the beginning of the study, students were asked about their preferences regarding practice tests as these were found to be an effective learning strategy (Blasiman et al., 2016). The results indicated that in general students wish for more and precise feedback in practice tests. They would like to see their wrong answers and further get tips and ideas on how to improve their learning. Regarding the design students mentioned preferring a combination of leaderboards and individual scores to have the most accurate form of feedback regarding their performance This is in line with the findings of Kapp (2012) who found that the feedback's frequency and intensity are critical for maintaining engagement throughout the learning process. Thus, the provision of feedback but more crucial the providing of tests themselves could be a great way

to enhance the usage of practice tests. Students said that they would like to have more elaborate and learning enhancing feedback.

In line with earlier studies that students use ineffective learning strategies such as rereading (Blasiman et al., 2016), this study found that students indeed do read, reread, and prepare summaries. Practice tests were rarely used by the participants of this research ($N = 2$). Regardless, most of the students indicated that they would use practice tests if they would be made available to them. It seems as if students like to use practice tests, but they are not often enough made available to them. Furthermore, all participants indicated that when using practice tests, they decently employed them, namely using them to actively recall information. Davis et al. (2020) found that testing can be used to improve learning and is especially useful when one is required to retrieve knowledge from their memory. Meaning that practice tests are just effective if one actively thinks about the questions. Here it is to mention that 10/14 participants said to be more triggered to actively recall information when being presented with an individual score at the end of a practice test. Thus, individual scores seem to be a good gamification element to ensure adequate usage of practice tests.

Next, the current study researched how the gamification elements leaderboards and individual scores affect the perceived motivation of a student to engage in a practice test. The interviews suggest that students find gamification in general motivating, which is in line with the findings of Hew et al. (2016), Kocadere and Çaglar (2018), and Lewis et al. (2008). This became apparent as most of the students complimented the study and its gamification elements.

Besides, it was indicated by many participants that a combination of both addressed gamification elements in this research would provide a more accurate form of feedback. This would give the students more insight into how they performed compared to their peers as well as considering their development. In addition, the data suggested that students are more motivated to engage in a practice test when being presented with an individual score. This is justified in the finding that more participants did the same test again (35.7% compared to 14.3% in the leaderboard condition) and would spend more additional tries (2.1 additional tries compared to 1.5 additional tries in the leaderboard condition) when being presented with their individual score in the end. Further, more participants said to find the individual score overall more motivating and mentioned to be further triggered to actively recall information. The only indication that participants found leaderboards more motivating was when comparing the motivational scores on a Likert scale. The average values of the perceived motivation for the two conditions differed slightly. However, a paired t-test revealed that

there was no significant difference between the individual scores condition (M = 6.98, SD = 1.24) and the leaderboard condition (M = 7.05, SD = 1.97) in their scores regarding perceived motivation (t (54) = -.16, p < 0.872).

This study made apparent that especially individual scores were perceived as motivating by the participants which reflect the research of Nah et al. (2014). Participants often indicated that individual scores gave them more feedback about their performance compared to leaderboards. One participant made an elaborative statement regarding this matter:

> I think the points because, in my opinion, it's not about being better than others, but beating my own performance. So, growing and improving myself, because I think every person, every individual has different standards. So maybe some people that are better than me will always be better than me because they have different standards. I don't know, maybe they have different intelligence. So, I think I can never compare myself or my performance to other people because it will never be the same given. So, I think a leaderboard is motivating, yes. But I think that in a learning situation, the score is like, my own score is a lot more motivating, because there I'm not trying to beat somebody else, but I'm trying to improve my learning, again, trying to learn more. So, both are motivating, but I think that in a study context, the score is a lot more motivating.

According to Nah et al. (2014), the use of scores or points is to determine achievement or success. Scores can be utilized as a sort of reward, and incitement in furthering one's progress towards their goals or a way to show where one stands. Thus, scores give more insight into their performance and thereby provide more detailed feedback. Whereas leaderboards are more suitable for social comparison (Nah et al., 2014). This might explain why students found individual scores more motivating while they wished for more feedback.

In continuation, it was investigated to what extent the game elements leaderboard and individual score are preferred by different player types. Regarding the player types, the analysis showed that for all player types S*ocialiser, Free Spirit, Philanthropist, Player, and Achiever* besides *Disruptor* the individual score was found to be more motivating than the leaderboard condition. Still, it needs to be mentioned that for the *Socialiser* less than 50% of the classified participants found the individual score more motivating. A possible explanation for this finding is that the player types did not differ, and their characteristics are not important for the perceived motivation. Thus, it could have been the case that all students found individual scores more motivating no matter their classified player type.

Lastly, this study examined if self-efficacy beliefs affected the relationship between gamification elements and perceived motivation. Regarding this, it can be said that for students in the categories of middle and high self-efficacy beliefs there were nearly no differences regarding the perceived motivation after being presented with an individual score or a leaderboard. Concerning the participants in the low self-efficacy condition, no definite preferences could be stated as just two people were categorised as having these low beliefs.

Considering the findings regarding the self-efficacy beliefs, it needs to be mentioned that the manipulation of the gamification elements after the practice tests might have affected the perceived motivation. Viciana et al. (2007) found in their study that positive feedback had a positive effect, and negative feedback had a negative effect on learning-oriented motivation. Thus, the findings could have been affected in the way that students might have felt higher levels of motivation because of the manipulated gamification elements. It could for example have been the case that students had medium self-efficacy beliefs but then saw the sufficient results of the gamification element and thus may have felt more motivated than they would have with their original outcome provided. In this case, the manipulation may have impacted the extent to which the self-efficacy measurement in students cannot be seen as unbiased.

Furthermore, some participants studied for the examination that the practice tests were assessing while other participants were not very familiar with the materials. This of course might have affected the self-efficacy beliefs as some students were prepared for the practice tests while others were not. Bandura (1977) found that people with high self-efficacy beliefs start tasks that they feel capable of more easily and more motivated compared to people with low self-efficacy beliefs. As the participants of this study were a mixture of students preparing for the examination (N = 10) and external students without having learned the material (N = 4), they likely had different levels of self-efficacy beliefs regarding their performance in the practice tests. The difference between these two groups was not assessed, leading to an unclear picture of which gamification element was preferred under which self-efficacy beliefs. Concluding, the results of this study are not able to indicate if self-efficacy beliefs do influence perceived motivation to engage in practice tests.

Limitations

For the current study, some limitations need to be considered. The generalizability of the results is limited by their sample size. It is important to mention that just 14 participants took part in this exploratory study. Conclusions from underpowered research (with small sample sizes), according to Brysbaert (2019), might provide a wide range of outcomes owing to a higher chance of mistakes. As a result, it's unclear how a larger sample size might have

affected the results. This means that for example the difference of 35.7% that did the practice tests again in the individual score condition compared to 14.3% in the leaderboard condition can easily be affected by one or two students changing their opinion about it. Further, four out of the 14 participants did not prepare for the examination the practice tests were based on. Thus, the already small sample was divided into two groups with different backgrounds. These differences might have influenced the results and thus the findings can hardly be transferred to other samples.

In addition, it is noteworthy to mention that two participants doubted the manipulated individual score. This might have influenced their perceived motivation as Viciana et al. (2007) found that feedback affected learning-oriented motivation. There the results of these two participants might have influenced the overall outcome as the sample size was small.

Another limitation is that this study was not able to link a specific player type to a specific gamification element. Kocadere and Çaglar (2018) found in their study that when testing individuals with Bartles Typology (1996) the achievement of points was interesting for the *Killer* and the *Achiever* player type while just the latter was motivated by leaderboards. This study was not able to assess the preferences of specific player types but had a rather general finding, that all player types besides the *Disruptor* preferred the individual score. Therefore, it is questionable if the player typology of Marczewski (2005) was a useful instrument to assess the needs and interests of different player types.

Future Research

Additional research is needed to establish a better understanding of what sort of feedback students would like to receive to promote the effective usage of practice tests. Students in this study indicated that they would like to receive more feedback and therefore found individual scores more motivating as they received more information about their performance compared to leaderboards. Still, many asked for further feedback in the sense of showing the correct and wrong answers. Studies in the future could investigate if feedback is the real motivator no matter the gamification. It might be that player types and gamification do not have a big influence on the perceived motivation to engage in practice tests at all but that this motivation is dependent on the feedback one gets. Thus, future studies could focus on different forms of feedback provided within practice tests to assess how these influence the perceived motivation.

Conclusion

Concluding, it can be said that the current study contributed knowledge on the introduced issue in a way as it found that feedback matters a lot to students despite the

classified player type or self-efficacy beliefs. Individual scores were the preferred gamification element as they provided more feedback about the performance of students. An indication for practical implications for the future could be to provide more feedback to students within practice tests and to give tips and ideas on how to improve their learning within this learning strategy. Therefore, a practical implication for teachers and professionals at universities could be to offer question and answer sessions after students were allowed to learn with the help of prepared practice tests. Giving out practice tests to students and meeting afterwards to discuss upcoming questions or to give individual feedback to participants could be a learning enhancing experience.

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Appendix A

Hexad Player Type Statements

Philanthropist

It makes me happy if I am able to help others.

I like helping others to orient themselves in new situations.

I like sharing my knowledge.

The wellbeing of others is important to me.

Socialiser

Interacting with others is important to me.

I like being part of a team.

It is important to me to feel like I am part of a community.

I enjoy group activities.

Free Spirit

It is important to me to follow my own path.

I often let my curiosity guide me.

I like to try new things.

Being independent is important to me.

Achiever

I like defeating obstacles.

It is important to me to always carry out my tasks completely.

It is difficult for me to let go of a problem before I have found a solution.

I like mastering difficult tasks.

Disruptor

I like to provoke.

I like to question the status quo.

I see myself as a rebel.

I dislike following rules.

Player

I like competitions where a prize can be won.

Rewards are a great way to motivate me.

Return of investment is important to me.

If the reward is sufficient I will put in the effort.

Appendix B

Thank you for participating in this study!
I would like to ask you to answer the upcoming questions. It will take approximately 5 minutes to finish answering them. Please try to answer them appropriately, so that you stay honest when answering. Most of the time, it is best to indicate your implicit answer to the questions, instead of thinking too long about what to reply to. In the following, you will read through statements, which need to be answered. Before answering them, I would like to get some demographics of you, like your age and gender. Of course, this information is just for the statistics in the end. Your data will not be shared with anyone else besides the researchers.

Consent Form for Participation in a Survey about Gamified Practice Quizzes at the University of Twente

Description of the research and your participation

You are invited to participate in a research study conducted by Lisa Marie Graßmann. This research aims to test and better understand motivating factors within practice quizzes. This study is focusing on gamification, player types, and self-efficacy beliefs.

Your participation will involve joining in a survey and an interview. The interview will be recorded. All data(recording, results of the questionnaires and survey) will be deleted the latest 12 months after its production. All data will be handled confidentially.

Risks and discomforts

There are no known risks associated with this research.

Potential benefits

The known benefit to you that can result from your participation in this research is that you have an additional opportunity to study for your upcoming examination on the 15th of April 2021.

Protection of confidentiality

Your identity will not be revealed in any publication resulting from this study.

Voluntary participation

Your participation in this research study is voluntary. You may choose not to participate, and you may withdraw your consent to participate at any time. You will not be penalized in any way should you decide not to participate or to withdraw from this study. You are allowed to withdraw from the study at any time.

Contact information

If you have any questions or concerns about this study or if any problems arise or if you have any questions or concerns about your rights as a research participant, please contact l.m.grassmann@student.utwente.nl at the University of Twente.

Contact Information for Questions about Your Rights as a Research Participant

If you have questions about your rights as a research participant or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher, please contact the Secretary of the Ethics Committee of the Faculty of Behavioural, Management and Social Sciences at the University of Twente by ethicscommittee-bms@utwente.nl

Consent

I have read this consent form and have been given the opportunity to ask questions. I give my consent to participate in this study.

- o I agree
- o I disagree

Appendix C

Interview Scheme

Before the practice quizzes:

Hi XXX, I am Lisa. Thank you for taking your time today and for participating in my study. For this study, I will ask you to do four practice tests together with me. These practice tests will be a preparation for the upcoming exam on the 15th of April. Of course, everything we are doing today needs to be handled confidentially. This means that I will not share any information of yours, but I am also requesting you to not share any information about this study until it is done. And I hope you are okay with me recording this meeting?
Before we start with the practice tests, I would like to ask you two questions:

- What learning strategies do you use? (If the student does not know it…give examples: writing a summary, rereading information, using practice quizzes)
- When you use practice quizzes do you use them to check your understanding, or do you read the questions and answers?

These questions should prove my problem statement

Now we can start with the first practice quiz. I will send you the link as well as the password. I am asking you to fill out the questionnaire and I will ask you some questions afterwards.

After each quiz:

- Do you want to do it again?
- If the questions were endless how many tries would you spend on this?
- How motivated do you feel on a scale from 1-10?

After all practice quizzes:

As you have maybe noticed within these four practice tests there were two different elements in the end. You were either presented a leaderboard, so you saw your rank and that you scored within the 30 best %. Or in the end, you were presented with points. Both of them are a mechanic from gamification. What gamification is: it means that you apply game elements in a non-game context. So normally a practice quiz is not a game, but points and leaderboards are part of games. Badges for example are also a gamification element. Regarding these gamification elements I still have some questions for you:

- Which gamification element (scores or leaderboards) did you find more motivating and why is this the case?
- Which of the two gamification elements triggers you to actively recall information?
- How could we engage you more?
- Is there anything else you would like to say?

After the questions:

Okay, now as we are done with the official part of the practice tests I can and have to tell you that there was a manipulation within the tests. The points as well as the leaderboards were faked. I have done this, so everyone is experiencing a comparable situation. Because some people might have really good scores and therefore might not be very motivated to do it again. It could be that they already had all questions correct. Or maybe someone else did not score well at all and thus also do not feel motivated to do it again, as they feel like they will not be good anyways. So, therefore everyone got the same manipulation in the end. I have done this because I want to compare if people find leaderboards or points more motivating to learn. Also, I want to see if this is dependent on your self-efficacy beliefs and your player type. This is why I have assessed this beforehand. This way I can see if any of the two influences your motivation. Of course, everything that I have told you now needs to be handled confidentially because I am still doing the survey with others and thus, they should not be influenced. Finally, I want to ask you if you would like to know your scores?
If yes, I can send them to you via email. I am thanking you very much for your participation and if you have any questions let me know.