Bachelor Thesis

"The Effect of Self-efficacy and Player Type on Students' Engagement with Practice Tests using Gamification: An explorative Study"

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Abstract

Practice tests are offered with the intention of helping students to check and enhance their knowledge and skills before they take an exam. However, students either misuse or disregard the use of practice tests, this often being due to a lack of engagement. Gamification has gained educators interest, due to its enhancement of engagement and motivation in students. In order to counteract the diminished engagement of students in the use of practice tests, gamification can be implemented. This study focuses on exploring how students use practice tests and whether implementing the gamified element of a leaderboard leads students to more engagement towards using practice tests. Because literature argues that gamified elements should be individualized, the variables of self-efficacy and player type were further taken into consideration. Students participating in the study were given two questionnaires, one measuring their Hexad player type and the other measuring their level of self-efficacy. Students continued with taking the practice test and were then asked about their engagement towards the use of leaderboards. Results showed that student participation in practice tests did not increase with the implementation of a leaderboard compared to non-gamified practice tests. To account for student's individualization, self-efficacy and player type were further investigated. The results indicated that the player types Achiever, Socialiser and Player had higher engagement towards using leaderboards in practice tests than the other player types, as was assumed based on literature. Students with high self-efficacy did not show more engagement using leaderboards in practice tests than students with low self-efficacy. It was assumed that students self-efficacy beliefs would match with their outcome score, in that students with high self-efficacy would score higher due to their perception of their capabilities, as if they believe they are capable it was assumed they would then also score accordingly on the practice test, the opposite being the case.

Keywords: gamification, learning, leaderboard, engagement, self-efficacy, player type

"The Effect of Self-efficacy and Player Type on Students' Engagement with Practice Tests using Gamification: An explorative Study"

Importance of Practice Tests and the Best Way to use them

To assess students' progress whilst taking a course or to help students identify missing areas of knowledge, practice tests and quizzes can be used. A practice test is a diagnostic form of assessment used to measure skills and knowledge levels of the students participating for the purpose of informing the students of their current level (Adesope et al., 2017). Practice tests are offered in order to help students prepare for their upcoming exam and test their current amount of knowledge (Roediger & Karpicke, 2006a).

A practice test is a preliminary examination used to prepare for a more formal and official exam (Collins English Dictionary, 2021). Within practice tests there is the so-called testing effect which is a term used to describe that practice tests, compared to other known strategies of learning, offer a more substantial amount of retention and learning for students (Adesope et al., 2017). When investigating retrieval processes, test-taking strategies encourage stronger impacts on long-term retention and learning overall (Phelp, 2012 as cited in Adesope et al., 2017). A review of research showed that when investigating qualitative and quantitative studies a moderate to substantial effect was found in favor of utilizing practice tests for student learning. It was discovered that practice tests, when used in combination with feedback, have a more extensive effect through their combined use (Roediger & Karpicke, 2006b). Practice tests not only test student learning but can also enhance it (Rawson & Dunlosky, 2012). The terms practice test and practice quiz are used interchangeably within this research.

The intention behind practice tests is for students to receive an opportunity before an exam to test their gained knowledge and ultimately see if they are able to answer the questions (Rawson & Dunlosky, 2012). This is an important learning principle as it gives students the option to practice before the final examination, therefore offering students insight into their already available knowledge, as well as what knowledge is missing. Literature has shown that a practice test is most effective when students use it repeatedly over an extended period of time, before the final exam (Rawson & Dunlosky, 2012). Research has also indicated that long-term retention is considerably higher with retrieval practice than with the use of repeated study, therefore encouraging the use of practice tests (Roediger & Butler, 2011). In order to profit from these positive effects, practice tests are implemented in students' education.

However, one issue lies in students either using ineffective study strategies all together, or they do not use practice tests effectively (Blasiman et al., 2017). Students seem to use less effective strategies such as rereading study material as it is the most time efficient form of studying. They seek the most time efficient form of studying as students tend to leave studying until the last possible moment (Blasiman et al., 2017). Blasiman et al., (2017) states that students do not correctly distribute the amount of necessary studying over their available amount of time. Research in this area finds that students leave the majority of their studying until shortly before an exam will take place and that when they do invest time it is too little and seemingly too late (Blasiman et al., 2017). It should also be mentioned that students seem to want to spend more

time using more effective strategies, however do so a lot less than they had predicted (Blasiman et al., 2017).

In order to convince students to engage with practice tests, engagement should be enhanced, as this has been found to encourage student participation and may therefore encourage students to take the practice quiz. Engagement is defined in students' effort to participate, enhance their learning and invest their time and effort (Krause & Coates, 2008). This provides a direct link between engagement and the increase in the participation of individuals. Literature has also found a direct effect of student engagement on academic performance (Pascarella et al., 2010). Therefore, proving the necessity to increase student engagement (i.e. in participation in practice tests) in order to give students the chance to increase their academic performance.

A possible solution to the issue as suggested by Lopez & Tucker (2019) is gamification. Gamified applications aim to increase students' understanding by incentivizing them to engage in the content (Lopez & Tucker, 2019). The suggestion would be to add a gamification to practice quizzes to convince students to participate and use the practice test in the intended way as to encourage student learning. Gamification is described as the use of a game element incorporated into a non-game environment (Deterding et al., 2011). Typically used gamified elements include badges, points and leaderboards (Mekler, 2015). It was found that by using gamification in an educational context an increase in the development of knowledge can be accomplished (Kapp, 2012), this aids students' learning (Ortiz-Rojas et al., 2019; Ninaus et al., 2020).

However, as students differ, the gamification aspect can have varying effects. Studies state that different types of gamified elements achieve different effects due to differences in how students perceive them (Barata et al., 2017; Hamari & Tuunanen, 2014). Therefore, it is important to include student characteristics. A reason for the differences in student's perception in gamified elements can be their player type. Player type describes a classification that has been found in gaming to categorize students based on their perception and personality (Tondello et al., 2016). This can also be applied to gamified elements. It is for this reason that the Hexad player type questionnaire is used to understand what appeals to which student (Tondello et al., 2016). Additionally, when investigating student engagement the variable of self-efficacy is mentioned, as this is seen as a motivational factor in engaging students in participation and increasing student learning (Schunk, 2003).

With the aim to attract students to the effective use of practice tests, the following research will investigate students' use of practice tests when gamified with a leaderboard. Whilst also investigating students' perception and their characteristics such as player type and self-efficacy to account for individual differences. The following paragraphs detail further the intent of practice tests, the gamified element of a leaderboard, including the necessity to investigate the concepts of player type and self-efficacy.

Gamified practice tests including Leaderboards

A leaderboard visually displays students ranking based on their scoring. They are often created and distributed in order to encourage competition and display the cumulative progression

of students (Ortiz-Rojas et al., 2019). Leaderboards have also been found to have motivational competency in student participation (Ninaus et al., 2020). Research found that students were more inclined to interact with their project in education than those students who did not have the opportunity to interact with the leaderboard. As such leaderboards have been shown to have an improving effect on course performance (Landers & Landers, 2014).

The grounds for choosing a leaderboard are that the aspect of competition and social comparison evoked by leaderboards can increase students' participation (Aleksic-Maslac et al., 2017; Göksün & Gürsoy, 2019). Leaderboards offer competition and comparing oneself to others which can help motivate students to succeed in their exams (Barata et al., 2017). In offering a leaderboard students receive a combination of assessment as well as conflict and challenge, these then influencing the amount of effort and time a student invests in the task (i.e. in the practice test) at hand (Landers et al., 2017).

However, not all students may react to the same form of a gamified element. Studies have found that students distinguish and acknowledge gamified elements differently and that their effect then varies on students (Hamari & Tuunanen, 2014; Barata et al., 2017). Furthermore, it was found that a gamified application can be perceived as enjoyable and motivating, however it does not automatically produce a significant effect on students behavior (Fitz-Walter et al., 2017). Literature suggests that students' perceptions of gamified elements vary on an individual level (Barata et al., 2016).

Player types from a game perspective

Students enjoy different settings in gaming, with not all individuals responding to the same form of a gamified application (Hamari & Tuunanen, 2014). As within education, not all students respond the same or in the intended way to one form of education or teaching (Yonezawa et al., 2009). It is intended to use a leaderboard to engage students to participate in the practice test, however there may be differences amongst these individuals as well. As we are using gamification it is necessary to look into investigations of individualizing people in games, because this will help in analyzing the reasoning behind the assumption that a leaderboard will motivate students to participate in the practice test.

One possible classification is the "Gamification user types Hexad Framework", which evaluates the preferences of individuals for gamified design elements in applications. In this research specifically it would be the investigation into the effect that "Player-type" has on engagement in practice quizzes using leaderboards. The Hexad framework states six types of players including: Philanthropists, Disruptors, Socialisers, Free spirits, Achievers & Players (Tondello et al., 2016).

A "Philanthropist" player shows altruistic characteristics by wanting to give without the idea of a reward, they are mainly motivated by meaning and purpose. "Disruptors" challenge the system, they test out the limitations and are motivated by change. "Socialisers" are interested in creating social connections wherein they interact with others, motivated by relatedness (Tondello et al., 2016). "Free spirits" enjoy the experience within the given system whilst continuing to know the meaning of freedom and acting without control, being motivated by their autonomy and

self-expression. “Achievers” are intent on proving worthiness by completing tasks and progressing whilst being motivated by the feeling of mastery and competence. Finally, the “Player” needs to be rewarded no matter the activity or how they tackled it, they are motivated by extrinsic rewards (Tondello et al., 2016). Depending on the type of player an individual is, the more likely they are to be impacted by a certain gamified element (Ašeriškis & Damaševičius, 2017).

Literature continues to examine the effect of individualizing gamified elements in order to tailor it to the students who use it (Tondello & Nacke, 2018). Students are more motivated when they think they are making progress in their academics. A consequence is, as they work on projects and develop greater skills, students maintain a sense of self-efficacy for achieving (Schunk, 1991). Students self-efficacy impacts how they might respond to the practice test and its use of a gamified element. For this reason, another factor that will be investigated in this study is self-efficacy and its effects on students' engagement towards leaderboards in practice tests.

Self-efficacy from a psychological perspective

Self-efficacy is the person's assessment of their ability to plan and carry out the steps necessary to achieve specific results (Bandura, 1999). It is the belief about one's own capability and the use of this to achieve a goal, it affects to what extent students choose to participate, invest effort and persistence (Bandura, 1999). Depending on the amount of self-efficacy a student has the more likely they are to participate or choose to avoid participation. When a student portrays little self-efficacy a process of self-limitation is established (Artino, 2012). What is meant by this, is that students with little self-efficacy can not reach their full potential and are limited in their success (Pintrich & Schunk, 2002). Literature also suggests that an increased sense of context-specific self-efficacy is necessary for an individual to succeed (Artino, 2012).

Individuals with higher self-efficacy have been found to persist longer, assert more effort and are also more likely to maintain their goals and recover from frustrations (Karimi & Nickpayam, 2017). Depending on the amount of belief an individual conveys for their own effectiveness, the more likely they are to influence whether or not they make an attempt to deal with a particular situation (Bandura, 1978). Additionally, it has been found that self-efficacy is a crucial factor in influencing learning in students, due to its motivational influences (Schunk, 2003). Students need to feel confident in their ability to master the practice test. If students do not feel confident in their ability to accomplish a task, their chances of participating are weakened (Pajares & Miller, 1994). For these reasons, self-efficacy is investigated as a student characteristic, possibly affecting students’ participation in practice tests.

Current study

Based on the above-mentioned issues of participation in practice tests often not being used, or being misused (i.e. too late), ways of engaging students need to be found (Blasiman et al., 2017). Gamification (i.e. adding a leaderboard) could be the solution to this problem as it offers assessment in the form of competition and challenge, which engages students to interact with learning (Landers et al., 2017; Huang & Soman, 2013). Both self-efficacy and the

investigation into students' player type could help in differentiating students based on their individual differences as well as explain their receptiveness to the use of leaderboards in practice quizzes. Therefore, in the current study we explore students' participation in the practice test as well as whether students' self-efficacy beliefs and player type affect their engagement toward the leaderboard. Furthermore, it is investigated whether students' self-efficacy belief is in line with their outcome on the test, thus giving them information in regards to their perception of knowledge. To investigate this students received two questionnaires (i.e. one for player types and one for self-efficacy), were then presented with the practice test and asked two questions in regards to their engagement towards implementing leaderboards in practice quizzes. The present study aims to analyze the effects of leaderboards in the educational setting of a practice test and poses the following research question:

RQ: "Does participation in practice quizzes implementing leaderboards differ when taking different student characteristics into account?"

One aim of this study is to evaluate how students interact with a practice quiz that contains a leaderboard. It is expected that students will be more motivated to engage early on when triggered by a leaderboard. The presumption is made based on research on gamification providing evidence for increased engagement and participation in students when a gamified element is implemented into educational aspects (Aleksic-Maslac et al., 2017). This premise may however not occur due to literature suggesting that students' perceptions vary on individual levels and that this means that not all students will feel more engaged by the specific gamified element of a "leaderboard".

H1: "Students will be motivated to engage early on in the practice test due to being engaged by the leaderboard".

The second aim was to evaluate students' perception of leaderboards, to check the relation of students' reported perception and their self-efficacy and player type. It is expected that students with the player type Achiever and Socialiser will feel more engaged to participate in the practice test than other player types. This assumption is made based on literature stating that these player types have been found to be more engaged by a leaderboard than other player types (Tondello et.al., 2016). The player type Achievers seek progression with a system, they are motivated by mastery and competence (Lopez & Tucker, 2019). The player type Socialiser needs to be able to relate and interact with others (Lopez & Tucker, 2019). Finally, the type Player is generally more engaged by the implementation of gamified elements (Lopez & Tucker, 2019). These player types specifically should be motivated through implementing a leaderboard.

H2a: It is expected that students with the player type "Achiever" will indicate engagement towards implementing leaderboards in practice quizzes.

H2b: It is expected that students with the player type "Socialiser" will indicate engagement towards implementing leaderboards in practice quizzes.

H3c: It is expected that students with the player type "Player" will indicate engagement towards implementing leaderboards in practice quizzes.

Students with high self-efficacy believe they are more capable of fulfilling the task at hand. If students believe they are going to do well and want to succeed then it could be expected that students will respond more positively towards aspects such as a leaderboard, aimed at engaging and improving students participation in practice quizzes. This assumption is made because students with high self-efficacy choose to participate in activities that encourage the development of their abilities, skills and knowledge in all different academic domains (Artino, 2012). However, this may also not be the case due to self-efficacy being found to be domain-specific. This means that people will perceive their self-efficacy level on a certain functioning of a domain (Artino, 2012). That would then imply that students may not have the same level of self-efficacy towards all gamified elements.

H3: Students with high levels of self-efficacy will find the aspect of a leaderboard more engaging than students with low levels of self-efficacy.

It is expected that when self-efficacy is high students will put in more effort into their goals, e.g. getting a good grade, therefore high self-efficacy should result in higher scores in the practice quiz. This assumption is made due to the fact that students who portray high levels of self-efficacy were found to have more success in academic performance (Artino, 2012; Pintrich & Schunk, 2002). Students with high self-efficacy were also found to be more incentivized to spend time and effort on a task if they thought they would succeed (Toharudin et al., 2019). This assumption may however not come into effect, as self-efficacy is known to have a motivational effect, but it is not known to what extent the student may be motivated and if all students react the same way (Artino, 2012).

It is important to investigate this assumption, as in giving students these practice tests, it is key that their performance match their beliefs. This is because, based on their self-efficacy beliefs towards their preparedness, students can check their presumed level of knowledge. Students then either feel confident enough in their ability and will remain at their current level of studying or they will find out their beliefs are not correct and must continue or better their studying scheme (Pajares & Miller, 1994). By providing the practice test and investigating whether self-efficacy of students matches their outcome, it can lead them to the knowledge whether they need to invest more time in learning or not, which is important for students to know in preparation for their exam.

H4: Students with high self-efficacy will score higher on the practice test than students who have low self-efficacy.

Method

Participants

Participants included 27 students between 18 and 23 years old (*M*= 18.55) within their first year of their psychology bachelor. With seven students being male and 20 being female. All students were taking part in the first year of their Psychology bachelor at the University of Twente. Inclusion criteria for the current study were being above the age of 18, being able to read and write in fluent English as well as having internet access and currently taking part in the course of "Development and Cognition" in the first year of psychology.

Design

The present study utilized an explorative research study design. The independent variables were player type and self-efficacy. Looking at the variable of player type, students could be identified as philanthropist, socialiser, free spirit, achiever, disruptor or Player. The dependent variable was engagement. Both self-efficacy and engagement were continuous variables.

Materials

Player type questionnaire

The Hexad player type questionnaire (Tondello et al., 2016) embodied 24 items and regarded the identification of each student's player type (i.e., Philanthropist, Socialiser, Free-Spirit, Achiever, Disruptor & Player). Students completed a series of questions (i.e., items) asking them to indicate to what extent a statement matched them (for example: "Rewards are a great way to motivate me"). The player types' statements were assessed on a 7-point Likert Scale. The used 7-point Likert scales were scored as follows: 1 = strongly disagree, 2 = disagree, 3 = somewhat disagree , 4 = neither agree nor disagree, 5 = somewhat agree, 6 = agree, 7 = strongly agree. Each player type was measured with 4 items. An example of an item for Philanthropist would be "It makes me happy if I am able to help others", for the player type Socialiser it would be "I like being part of a team". An item example for a Free-Spirit is "I like to try new things", for Achiever it would be "I like defeating obstacles" and Disruptor is "I like to question the status quo". Finally, an example of a Player item would be "If the reward is sufficient I will put in the effort".

Reliability was tested using Cronbach's alpha for each player type individually. The alpha coefficient for the player type "philanthropist" was 0.852, for "socialiser" it was 0.853, for "achiever" it was 0.798 and for "disruptor" it was 0.782. These scores indicate that the items have relatively high internal consistency. The alpha coefficient for the player type "free-spirit" was 0.631, suggesting an acceptable level of reliability. The final player type "player" had a score of 0.357 indicating insufficient level of reliability. Finally, the overall reliability of the Hexad questionnaire, with an alpha coefficient of 0.796, also indicates a high internal consistency.

Each player type has four questions allocated randomly within the questionnaire. Scores from all four questions per player type are added together. A student qualifies as being a player type when they score higher than 20. Students can score high on all available player types. In nearly all cases, students can be categorized as multiple player types.

Self-efficacy questionnaire

Student's self-efficacy was measured using a questionnaire. Self-efficacy is measured by asking students about the extent to which they felt prepared and confident in their ability to master the practice quiz and exam (i.e. "I am confident I can understand the basic concepts of the questions posed"). This questionnaire consisted of a 7-item survey response scale, assessed with a 7-point Likert Scale. Questions asked students opinions about their feelings of being prepared or capable for the practice quizzes at hand (for example "I am confident I can understand the basic concepts of the questions posed"). Participant's scores were added and the sum score was used for further investigation. The minimum a student could score was a seven and the highest a student could score was a 49. The higher the score the higher the level of self-efficacy that student perceives of themselves. Cronbach's alpha was used to test reliability for all seven items of the self-efficacy scale. The alpha coefficient was .914, indicating a high level of internal consistency.

Practice quiz

The practice quiz was designed to assist students' self-evaluation on the content of the course "Cognition and Development". The quiz was categorized by three topics: 1) psychological theories on the development of motoric skills and early learning, 2) the development of language skills and 3) the development of cognitive skills that they needed to know for their exam. All questions of the practice quiz were multiple-choice questions with students having four answer options for each question. Overall, there were 24 questions divided into eight questions per chapter.

The practice quiz was administered online via Qualtrics. Questions were randomly presented via three individually shown pages on the screen with the heading "Practice Quiz". Each page contained four of the eight possible questions students could receive. The students were informed prior to taking part of the possibility to retry the practice quiz and the possibility of receiving varied questions, as well as at the end of the study.

Leaderboard – student perception

Following their participation in the practice quiz students were asked to indicate to what extent they would feel engaged to participate in a practice test using a leaderboard. Additionally, whether the leaderboard would encourage them to engage in another attempt with the practice test to improve their scoring. Students were asked to evaluate two statements on a 7-point Likert scale: 1) "I find the aspect of a leaderboard engaging", 2) "The aspect of the leaderboard makes me want to retry the practice quiz, to improve my ranking". Reliability was tested using Cronbach's alpha for both items. The alpha coefficient for the two items is .853, suggesting that the items have relatively high internal consistency.

Procedure

The study was carried out in the course of Cognition & Development, the third module, during the first year of the Bachelor of Psychology program. The timeframe of the study was during the period of the 5th till the 11th of April 2021. Students were invited to participate in the practice quizzes at any given time and place to help them in preparing for their exam on the 12th of April.

Potential participants were invited via email to participate in the survey online using Qualtrics (www.qualtrics.com). An explanation was given for students to understand that they could voluntarily take part in the study and that it would benefit them, as they could use this opportunity to practice for their upcoming exam. The students that wanted to take part in the study could then use the anonymous link at any chosen time and location. All questionnaires and tests were available in English. No time limit was given, allowing students to take their time filling out the questionnaires.

Before being able to begin with, the questionnaires and practice quiz students were asked to give consent. They were also asked to provide their name for the leaderboard and their email address for identification in their use of the study. If they gave consent, they continued to the Player type questionnaire and after that the self-efficacy questionnaire. Directly after completing both questionnaires students started the practice questionnaire. Lastly, students were asked to answer two questions regarding their perception of the value of leaderboards and whether they are interested in their use in practice quizzes. Upon ending the survey students received recognition for taking part and were informed of the opportunity to take the survey as many times as they wanted in order to receive other sequences of questions, due to the randomization. When participants were taking the survey another time, it was not necessary to fill in the first two questionnaires; they were able to proceed to the practice quiz right away.

Due to late participation, it was not possible to distribute the leaderboard until the 11th of April (Figure 1). Originally, students would receive a leaderboard on the first and seventh of April. However, due to insufficient participation at that time that was not possible.

Figure 1

Gamified element of a Leaderboard

#	Name	Score
1	Ani	11 🏆
2	An	10
3	Hi	10
4	Nele	9
5	Merle	8
6	Julia	8
7	Olga	7
8	Iris	7
9	Laura	7
10	Romy	6

Results

In this section, the results of the data analysis are presented. Of the 47 participants who completed the initial survey, 20 participants were excluded, due to missing information in either one of the questionnaires or the practice quiz. These participants were removed because they either incorrectly filled out or failed to finish taking part in all aspects of the study. In order to test the expected outcome, ANOVA and t-tests were used. The following section is divided into each of the testable hypotheses. Starting with descriptive statistics, the mean quiz-, self-efficacy- and engagement scores for students were calculated.

Table 1

Descriptives for test, self-efficacy & engagement scores

	M	Max. Score	SD
Practice test	7.14	12	2.17
Self-efficacy	32.74	49	7.16
Engagement	8.55	14	3.35

Engagement to participate in practice test

To measure the first hypothesis that "Students will be motivated to engage early on in the practice test due to being engaged by the leaderboard", student participation numbers were investigated. The study was available for students on the fifth of April. Three students took part

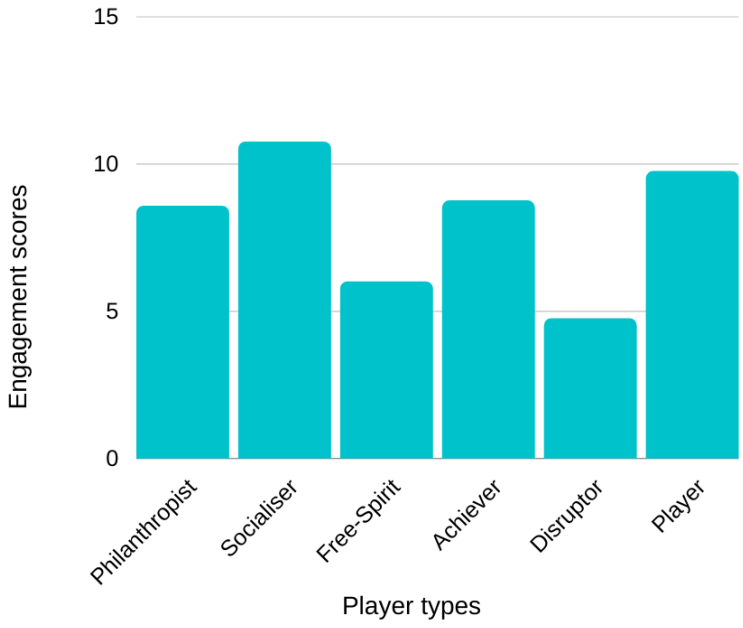
within the first two days. From the timeframe of the ninth to the 12th of April, 24 students participated in the study with some students not participating until a few hours before the exam. Furthermore, only 27 students out of 327 students fully participated in the study. These results show that the leaderboard did not motivate students to early participation in the practice test as was stated in the first hypothesis.

Player type indication of engagement towards leaderboards

To investigate the second hypothesis, the engagement scores of each player type were compared and further explored. The engagement scores for the player types Achiever (H1a), Socialiser (H1b) and Player (H1c) were the highest (Figure 2). Engagement was measured via two questions and player types were each measured via four questions, in a self-report. It is visible that the player type Socialiser has the highest score with 10.4 (*SD* = 3.04) and Disruptor has the lowest with 4.75 (*SD* = 2.88). The player types Player with 9.75 (*SD* = 3.01) and Achiever with 8.75 (*SD* = 4.57) were also high in engagement following the player type Socialiser. The player type Philanthropist scored 8.57 (*SD* = 3.08) and Free-Spirit scored 6 (*SD* = 2.94). This result points in the direction that the three player types, Socialiser, Achiever and Player are more engaged than the other player types of Philanthropist, Free-Spirit and Disruptor.

Figure 2

Engagement scores per player type



Self-efficacy indication of engagement towards leaderboards

In order to measure the third hypothesis, that students with high self-efficacy will be more engaged by a leaderboard in a practice quiz, the continuous variable of self-efficacy was coded into high self-efficacy and low self-efficacy. In total, 14 students were categorized as having high self-efficacy and 13 students categorized as having low self-efficacy.

An independent-samples t-test was conducted to compare engagement scores for students who have high self-efficacy and students who have low self-efficacy. There was no significant difference found in the engagement scores for students with low self-efficacy ($M_{engagement}$= 7.5, $SD_{engagement}$= 3.30) and students with high self-efficacy ($M_{engagement}$= 7.42, $SD_{engagement}$= 3.70) conditions; $t(24)= 2.08$, $p = 0.952$. These results suggest that students with high self-efficacy do not indicate more engagement towards implementing leaderboards in practice quizzes than students who have low self-efficacy. Therefore, the hypothesis that students with high self-efficacy indicate more engagement towards implementing leaderboards in practice quizzes cannot be accepted.

Self-efficacy level and practice quiz outcome

Finally, the fourth hypothesis, that students' with high self-efficacy will score higher on the practice test than students with low self-efficacy was investigated. This was done as an assumption check, to analyze whether a student's self-efficacy belief predicts a student's outcome in the practice test. An independent-samples t-test was conducted to compare the outcome score for students who have high self-efficacy and students who have low self-efficacy. There was a significant difference in the quiz scores for low self-efficacy (M= 7.78, SD= 1.76) and high self-efficacy (M= 6.17, SD= 2.21) conditions; $t(24)= 2.08$, $p = 0.048$. These results suggest that students' with low self-efficacy had an overall higher quiz score than students with high self-efficacy.

Discussion

The aim of this research was to examine students' participation in practice tests as well as to explore how certain student characteristics interact with students' engagement towards the gamified element of leaderboards in practice tests.

Firstly, it was hypothesized that students would be motivated to engage in practice tests early due to the addition of the leaderboard. The result from students' partaking in the practice test did not show the expected outcome of early participation in the practice test. Out of the 27 students that used the practice test, 24 students only used it two to three days before the exam on the 12 of April. Additionally, only 27 students completed the study out of a possible 327 students who were informed of the opportunity to participate. This result differed from previous research investigating the effectiveness of gamified elements, often finding that gamification improves participation (Göksün & Gürsoy, 2019). Literature also suggested that gamification encourages students to participate regularly (Fotaris et al., 2016). This finding can be explained by the so-

called “non-response bias”. Literature findings suggested that the non-response bias and abandonment rate rise as the survey length increases. Responders will not spend much time answering questions, with some not beginning if they are aware of a long survey duration (Mora, 2011, Non-response & Abandonment section). This could explain why many students did not participate. Additionally, why the 20 participants did not finish the study. When students participated they first had to fill out two questionnaires before taking part in the practice test. Students were informed of this both via email and before beginning the study, which means they were made aware of the length of the study, this meaning students who were not prepared to invest time and effort would have directly lost interest or motivation.

Secondly, the results seemed to show that the player types Achiever, Socialiser and Player were more engaged by the possibility of using a leaderboard in the practice test than the other player types. This assumption was based on research findings into player type’s preferences (Tondello et al, 2016). It was also based on the investigation into leaderboards effects of using competition and challenges to motivate students to participate and try their best (Landers et al., 2017). Further research should be conducted to investigate how students' perception may change after having the leaderboard be published. As Lopez and Tucker (2019) found that research that identifies and incorporates player types to improve motivation and performance, have mainly done so without actually exposing the individuals to the game element, as may have been done in this study, with the leaderboard not being published until nearer the end of the study, because of delayed participation. Therefore, not giving students the chance to first experience the gamified element and then report on their engagement towards it. This could influence the outcome of students' opinion on the engagement towards using a leaderboard as that it could increase or decrease based on students actually being exposed to it.

Thirdly, it was assumed that students with high levels of self-efficacy would find the aspect of a leaderboard more engaging than students with low levels of self-efficacy. The results of the current study showed that students with high self-efficacy did not find a leaderboard more engaging than students with low self-efficacy, the opposite of what was expected. This assumption was supported by literature that states that both self-efficacy and leaderboards separately are motivating factors in students' performance (Fotaris et al., 2016; Schunk, 1991). It was assumed that students with high self-efficacy would feel engaged by the gamified element of a leaderboard, as those with high self-efficacy generally have more motivation and increased interest in progressing in learning (Schunk, 2003). However, this was not the case. This result may be due to students not feeling actively engaged by the leaderboard. Literature has found that gamification can have a motivating as well as a demotivating factor, depending on how it is implemented (Huang & Hew, 2015).

Lastly, it was hypothesized that students' self-efficacy beliefs match their outcome in the practice quiz. The current study results from students' self-efficacy levels and their practice test outcome score showed that students with low self-efficacy scored higher on the practice test than students with high self-efficacy. These results are the opposite of the assumption that students

with high self-efficacy would match their outcome score on the practice test. This may be explained by students overestimating or underestimating their skills. Having a certain amount of trust in their capabilities is good for students as Bandura (1986 as cited in Pajares & Miller, 1994) argued, however an overestimation leads to overconfidence and underestimation leads to a lack of confidence. Overconfidence gives students the false belief they are prepared. A lack of confidence, leads to a lack of persistence and effort, that is necessary for difficult tasks (Pajares & Miller, 1994). This was further investigated by Schunk (1991) stating that if students do not have the required abilities then high self-efficacy will not yield competent performances. This is connected to the statement by Pajares & Miller (1994) that students to some extent overestimate their capabilities. If students are overestimating their self-efficacy their performance will not provide the results they are expecting.

Another explanation for this result may be the so-called "satisfacing" effect; this is when individuals answer questions without investing much thought. Such an occurrence happens when a survey for example is too long and individuals' mental capacities are exhausted (Mora, 2011, Data Quality section). This may have occurred within the study, as the program on which the study was created (i.e. Qualtrics), indicated an issue with the length. It may have happened that by the time students participated in the practice test, after filling out all questionnaires, they were no longer able to invest all their mental capacity that was needed.

Limitations

Some player types were better represented than others. However, all player types were somewhat underrepresented when investigating the amount of students that took part in this study. The reason for some player types being more present than others, may be due to the so-called selection-bias. When participants choose to participate in this study, they may be subjected to selection bias. Students who choose to participate in the study of their own free-will could share a similar trait that sets them apart from students who do not participate right away (Wolbring & Treischl, 2016). It is therefore unclear whether students who participated are the same as those who did not participate in the study, as students who participated may share characteristics (i.e. motivations) that make them different from others. This impacted this research, in that it is unclear what type of students participated in this study and whether these characteristics could have affected the randomization of this study.

Another limitation is that of individual biases. During the study, students were asked to say to what extent they feel like they would be engaged by a leaderboard, as well as whether the leaderboard would engage students in retrying the practice test in order to improve their scoring. However, their opinion was asked without first being exposed to the leaderboard. Research found that individuals are infrequently mindful towards their own preferences and behaviors when they have not tried out the stimulus (i.e. gamified element) (Codish &Ravid, 2014; Laffan et al., 2016; Orji et al., 2017).

The final limitation that may have influenced the results of this study is the aspect of incorporating "meaningful gamification". Huang and Hew (2015) suggested that for gamified elements to work they must first be tailored to three concepts; these include autonomy,

relatedness and competence. For one the importance of autonomy is mentioned, students must be able to set their own goals in learning. Secondly, students must have the opportunity to connect with their fellows and have social comparison. Finally, the task, which is asked of students, must give them the sense that it is worth it and that they are able to master the task (Huang & Hew, 2015). This study only incorporated the element of relatedness with a leaderboard and to some extent competence with the investigation into self-efficacy. However, autonomy was not regarded, which could have made students feel like the gamification of the practice test was not meaningful, therefore leading to little engagement towards it.

Recommendations

With the limitation of selection bias, recommendations would be to minimize the selection bias in future research to obtain research without errors of this type. To minimize the risk of selection bias, it would be necessary to randomly assign participants to a control group to see how they would interact with a practice test. Additionally, a group assigned to the study should then be investigated in regards to their engagement towards either leaderboards specifically or another form of a gamified element, with a comparison of both groups then being investigated.

An additional recommendation for future research, based on the second limitation, is to give students the opportunity to try out the gamified element before stating their amount of engagement. It is better to let students try the gamified element (for example a leaderboard) and then let them create an opinion based on their experience, then have them speculate about how it might affect their motivation (Codish & Ravid, 2014; Laffan et al., 2016; Orji et al., 2017). For this reason, future research should implement the leaderboard after the practice test and then have students state to what extent (out of their own experience) the gamified element of a leaderboard engaged them in the context of a practice test.

Based on the findings from literature as well as from this study, future research should investigate the three components of the concept of "meaningful gamification" (Huang & Hew, 2015). The chosen gamification in future studies should include all three concepts. This includes making the task meaningful to students in allowing individual goals and activity setting, whilst also allowing for social interaction and comparison and giving students a sense of ability when it comes to the difficulty level. If this research study were to be similarly repeated, it would be necessary to not only incorporate one concept, but all three concepts to ensure students' motivation for example towards a leaderboard in a practice test.

Within this explorative study results indicated that player types possibly differentiate in their engagement towards the use of leaderboards in a practice test within this study. Self-efficacy may affect students' receptiveness to the use of leaderboards and in some way self-efficacy may predict students' test performance. However, these findings were not given in the current version of this study. If researchers were to implement the recommendations mentioned in regards to future research, then it could be possible to receive the expected outcomes to increase student engagement in practice tests.

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Appendix

Appendix A. Hexad player type questionnaire

User Types		Items	5-items subscale correlation (r)	4-items subscale correlation (r)
Philanthropist	P1	It makes me happy if I am able to help others.	0.786	0.780
	P2	I like helping others to orient themselves in new situations.	0.779	0.775
	P3	I like sharing my knowledge.	0.733	0.783
	P4	The wellbeing of others is important to me.	0.771	0.763
	~~P5~~	~~I feel good taking on the role of a mentor.~~	0.667	removed
Socialiser	S1	Interacting with others is important to me.	0.730	0.734
	S2	I like being part of a team.	0.624	0.617
	S3	It is important to me to feel like I am part of a community.	0.670	0.676
	S4	I enjoy group activities.	0.688	0.662
	~~S5~~	~~It is more fun to be with others than by myself.~~	0.569	removed
Free Spirit	F1	It is important to me to follow my own path.	0.529	0.480
	F2	I often let my curiosity guide me.	0.491	0.546
	F3	I like to try new things.	0.507	0.525
	F4	Being independent is important to me.	0.538	0.496
	~~F5~~	~~I prefer setting my own goals.~~	0.373	removed
Achiever	A1	I like defeating obstacles.	0.603	0.574
	A2	It is important to me to always carry out my tasks completely.	0.483	0.485
	A3	It is difficult for me to let go of a problem before I have found a solution.	0.553	0.569
	A4	I like mastering difficult tasks.	0.612	0.604
	~~A5~~	~~I am very ambitious.~~	0.454	removed
Disruptor	D1	I like to provoke.	0.579	0.588
	D2	I like to question the status quo.	0.451	0.398
	D3	I see myself as a rebel.	0.569	0.569
	D4	I dislike following rules.	0.523	0.577
	~~D5~~	~~I like to take changing things into my own hands.~~	0.323	removed
Player	R1	I like competitions where a prize can be won.	0.445	0.459
	R2	Rewards are a great way to motivate me.	0.561	0.622
	R3	Return of investment is important to me.	0.359	0.313
	R4	If the reward is sufficient I will put in the effort.	0.580	0.568
	~~R5~~	~~I look out for my own interests.~~	0.305	removed

How to use the scale:

1. Ask users to rate how well each item describes them in a 7-point Likert scale.
   a. Use only the 24 items numbered from 1-4 in each subscale.
   b. Items must be presented without identifying the corresponding type and, if possibly, in random order.
2. Separately add the scores of the items corresponding to each subscale.

Appendix B. Self-efficacy questionnaire

1. I believe I will receive an excellent rating for my practice quiz results.
2. I am certain I can understand the most difficult material presented in the practice quiz.
3. I am confident I can understand the basic concepts of the questions posed.
4. I am confident I can understand the most complex material presented by the instructor in the practice quiz.
5. I am confident I can do an excellent job on the practice quiz and the exam.
6. I am certain I can master the questions asked in the practice quiz
7. Considering the difficulty of this course, the teacher, and my skills, I think I will do well in the practice quiz.

Appendix C. Value of a leaderboard

1. “I find the aspect of a leaderboard engaging”.
2. “The aspect of the leaderboard makes me want to retry the practice quiz, to improve my ranking”.