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Investigating gamification's effect on student motivation when authoring questions

MARCUS NORDSTEDT

OSKAR EDVARDSSON

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Supervisor: Richard Glassey
Examiner: Pawel Herman
School of Electrical Engineering and Computer Science
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Abstract

Gamification is the use of game design elements in non-game contexts, and it has recently received a fast growing interest in both academia and industry. Several studies have shown that gamification can increase motivation in various contexts, such as health and education. Within education it has been shown that including question-authoring as part of a course can have positive effects on students' performance. This study combines these two areas and investigates gamification's effect on student motivation when authoring questions. To do this a web-based question-authoring system with support for both gamification and non-gamification was developed. The system was then tested by students (n=11) with the participants divided into two groups: a group using the gamified version and a group using the non-gamified version. After using the system for a week the participants were surveyed about their experience. The results of the study indicate that gamification can increase students' motivation when writing questions. But due to the rather low participation in the study no concrete conclusions can be drawn.

Sammanfattning

Spelifiering är användandet av speldesign-element inom icke-spel kontexter och har under den senaste tiden fått ett växande intresse från både den akademiska världen och industrin. Flertalet studier har visat att spelifiering kan öka motivation inom flera olika områden, såsom hälsa och utbildning. Inom utbildning har studier visat att frågeskrivande som del av kurser kan ha en positiv effekt på studenters studieresultat. Denna studie kombinerar dessa två områden och undersöker huruvida spelifiering har en påverkan på studenters motivation vid frågeskrivning. För att undersöka detta har ett webbaserat frågeskrivnings-system med stöd för både spelifiering och icke-spelifiering utvecklats. Systemet testades sedan på två grupper av studenter (n=11): en som använde den spelifierade versionen av systemet och en som använde den icke-spelifierade versionen. Efter att ha använt systemet i en vecka ombedes deltagarna att svara på en enkät kring deras upplevelse. Resultaten tyder på att spelifiering kan öka studenters motivation vid frågeskrivning, men på grund av det låga deltagarantalet kan inga större slutsatser dras.

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Chapter 1

Introduction

In the last decade Gamification, defined as “the use of design elements characteristic for games in non-game contexts” [1], has received a fast growing interest in both academia and industry [2]. Gamification has proven effective at increasing motivation in several different types of contexts including commerce, health and education [3]. Within education question-based learning, a form of learning that lets students master concepts by answering questions, has already successfully been gamified in the form of online quizzes [4]. Usually the teacher would prepare these questions, but it could also be beneficial if students wrote questions themselves. A study at University of North Carolina has shown that including question authoring as a part of a course can have positive effects on students’ performance in the course [5].

Since gamification has been shown effective at increasing student motivation when answering questions, it would be interesting to see if that effect could be replicated in the domain of students writing questions. Therefore the aim of this project is to investigate whether gamifying the question-writing process has an impact on students’ motivation with regard to authoring questions.

1.1 Research question

For this project we are going to investigate if gamifying the question-writing process can increase student motivation. The research question that we will try and answer is the following:

- “Can students’ motivation of authoring questions be increased by gamifying the question-writing process?”

1.2 Hypothesis

Our initial hypothesis is that gamifying the process of question-writing will in general increase students' motivation when it comes to authoring questions. It might however have an inverse effect on some individuals depending on the types of gamification that is used, for example a leaderboard feature has proven to sometimes demotivate students if a higher position feels unattainable [6].

1.3 Approach

In order to answer the research question a gamified web-based question-authoring system will be developed. This system will then be used by two user groups: one with gamification enabled and a control group with the gamification elements disabled. After using the system for a week the users will be asked to answer a survey about their experience with the system.

1.4 Scope

Due to the time constraint of this project the question-authoring system will be relatively basic. The system will only include functionality to submit, not answer, questions and will only support multiple choice questions. The game design elements that will be implemented in the system are points, leaderboards and badges.

Chapter 2

Background

This chapter will introduce gamification and its reported effects. Moving on there will be an explanation of game design elements as well as student-generated content. Lastly some related work will be presented.

2.1 Gamification

Gamification is defined as “the use of design elements characteristic for games in non-game contexts” [1]. As the definition suggests it is the practice of implementing game design elements in non-game contexts, in the hopes of achieving positive effects regarding for instance engagement, motivation or knowledge retention.

A literary review with the aim to investigate if gamification works examined several studies on gamification. The review reported that a majority of the studies did find that gamification has positive effects and benefits [3]. The subset of studies that investigated gamification in an educational/learning context all found that gamification had mostly positive effects. These include increased motivation and engagement in the learning tasks as well as the enjoyment of them [7]. The competitiveness within a gamified system also showed to be mostly motivating, except for some students who found it to be discouraging [8]. Badges were observed to be beneficial for increasing motivation and engagement [9] as well as enjoyment [10]. Leaderboards were shown to be good for improving user participation [11].

However the review also highlights that some studies reported negative aspects of gamification. One study observed that increased competition in some

cases resulted in students approaching tasks with trial and error, rather than carefully and meticulously thinking through the problem. Which is not as beneficial to learning [9]. Another study brought up that the nature of gamified systems limits task evaluation to automatic assessment as immediate feedback is necessary for gamification to be as motivating as possible [8].

2.2 Game design elements

Game design elements are the basic building blocks of a gamified application [6] and different design elements have shown to have varying effects. Below follows a description of three of the most common ones [3]:

2.2.1 Points

Points are a basic element in a myriad of games and gamified applications that serve to numerically represent a player's progress. They are usually awarded to players for completing a specific activity or task. Many different kinds of points are often used, such as experience points, redeemable points, reputation points etc and they serve different purposes within the game or gamified environment. The general purpose of points however is to provide the player with feedback, rewarding specific player behavior in a measurable way. Points have proven effective as a motivator within gamified environments [6].

2.2.2 Leaderboards

Leaderboards rank players based on their relative success, commonly their points. Leaderboards can therefore determine which player performs best at a certain activity. As such they pose as a competitive comparison between players based on their performance. This competitive aspect has shown to motivate players, but the effect is not always positive. If players feel a higher position is unattainable, leaderboards can in some cases be demotivating [6].

2.2.3 Badges

Badges are a visual representation of achievements that can be collected within a gamified environment. They can be earned for various accomplishments and symbolize the player's merits. One of the purposes of badges is to, just like points, provide the player with feedback and visualize how the player has performed. Badges can also serve as goals and motivate the player into attempt-

ing certain tasks or activities and after attaining a badge it can also serve as a status-symbol [6].

2.3 Student-generated content

Student-generated content (SGC) is content produced by students with the intention of being shared with other peers. This makes students prosumers, since they both produce their own content and consume knowledge from their peers' content [12]. SGC has been proven to have a number of benefits for students including encouraging them to have a deeper engagement with their learning since they are aware that their produced content will be viewed by other students [13].

Even though SGC comes with several benefits for students, there are still some potential problems with it. It has been shown that in some cases a majority of the content has been created by a small portion of the group. Resulting in the majority of the group gaining little to no benefit from SGC, however some students who simply consumed others' content did show some learning improvements. As SGC nowadays is mostly conducted online, it can also cause issues for students in lower socioeconomic positions as their access to computers and the internet can be limited and thus these students run the risk of being excluded from SGC moments [12].

2.3.1 Student-generated questions

Student-generated questions (SGQs), a specific type of SGC, where students are tasked with authoring and answering questions, has been reported effective at both enhancing knowledge retention as well as motivating students to study [14]. A study conducted by the University of Edinburgh [15] showed that the use of PeerWise, an educational system for authoring and answering multiple choice questions, in a course can have a significant improvement on students' examination performance. This improvement was consistent across all five tested course modules spanning three scientific disciplines across three different institutions, suggesting that SGQs can be beneficial for student learning regardless of course, institution, instructor or student. The study also found evidence suggesting that SGQs can be especially beneficial for students in the lower and intermediate part of classes [15].

2.4 Related work

Systems that use gamification as a way to motivate students with question-answering, and/or question-authoring, have been developed and studied before. Below follows a summary of two such systems and what has been found about their effects.

2.4.1 Quick Quiz

In a study conducted at the Royal Melbourne Institute of Technology a system named Quick Quiz was developed [4]. Quick Quiz is a gamified quiz-system, in which students can take quizzes consisting of multiple choice questions. The objective in Quick Quiz is to answer a set of questions within a certain time limit and depending on the speed and correctness of the answer the student is awarded points. After completing a quiz the student is shown an overview of their performance on that quiz, showing if their answer was correct and how many points they received. There is also a leaderboard where the students can see their performance compared to the others who have taken that quiz [4].

After the system had been developed the study continued with letting students in three IT-based courses use Quick Quiz for four weeks. After the four weeks had passed the students were asked to fill out a survey. 76 students participated in the study and completed the survey. The results of the study showed that 78% of the students experienced enough engagement to complete quizzes. Furthermore 46% of the students experienced happiness while taking quizzes and 59% believed that Quick Quick increased their performance in the course [4].

2.4.2 PeerWise

PeerWise is a web-based system where students can write their own questions, as well as answer and rate other students' questions. PeerWise uses a point system where each student has an answer score. This score increases every time a question is answered correctly and decreases when a question is answered incorrectly. PeerWise also makes use of badges, which are awarded to students for completing certain activities (e.g. "For contributing your first question to PeerWise"). Furthermore PeerWise also offers a leaderboard feature, with different leaderboards based on a number of different indicators [16].

A literary review of the effects of PeerWise examined a total of eight empirical studies [17]. Several of these studies found that the use of PeerWise results in better academic performance. Majority of the studies also indicated that PeerWise increased the students' level of interest in the subject as it was a fun and enjoyable learning tool. Students also expressed that comparing their performance with their peers and the earning of badges were motivational [17]. The results of a study made by Cork Institute of Technology did not show any correlation between students' PeerWise usage and examination performance. It did however observe some considerable positive effects in student motivation as well as reflective learning and self-understanding [18].

Chapter 3

The question-authoring system

This chapter will handle the question-authoring system that we built. It will start with some justifications for why we had to build this system. It will then continue with how the system was developed and how game design elements were integrated in the system. Lastly there will be a description on the layout of the system.

3.1 Justifications for building the system

Our reasoning behind building our own question-authoring system instead of using pre-existing systems is that we wanted a fully controlled environment where gamification is the only variable. No system available offered this functionality meaning we would have had to use different systems for the two groups which could introduce other variables such as different user interfaces.

3.2 Development of the system

The system was developed in Python using the Django framework. For hosting of the system the web hosting service Heroku was used. The frontend of the system was written in HTML and CSS. The source code can be found on GitHub.¹

¹<https://github.com/oskaredv/kex2021>

3.3 Game design elements

The system utilizes three game design elements: points, badges and a leaderboard. Points are earned through submitting questions and earning badges. Each question submitted earns the user 100 points. If the users submit questions several days in a row they will gain a streak. While having an active streak the points gained from submitting a question increases with 10 points per day. Badges can be earned by submitting a certain number of questions or by maintaining a streak for a certain number of days, see table 3.1 for the specific badges and the points gained for earning them. The leaderboard ranks the top 10 users of the system based on their amount of points.

Badge	Points for earning it
First question	100
Five questions	300
Ten questions	500
Two day streak	200
Three day streak	400
Four day streak	600

Table 3.1: All obtainable badges and the points received for earning them.

3.4 Layout of the system

The system consists of three main pages: the “Write a question” page, the profile page and the leaderboard page. Furthermore the system has a homepage containing the instructions for the study as well as an about page with some more details about the system and the study. On the homepage the user also has the possibility to log in or create an account. When an account is created the user is assigned a group based on their user ID. Users with an even ID are assigned to the gamification group and the ones with odd IDs are assigned to the control group.

Home page

After logging in the user arrives at the home page again, see figure 3.1 for a picture. Here they are presented with the instructions for the study as well as a button that takes them to the “Write a question” page. For users in the gamification group there is also a bullet point list with short explanations of how the points, badges and streaks work which can be seen in figure 3.2.

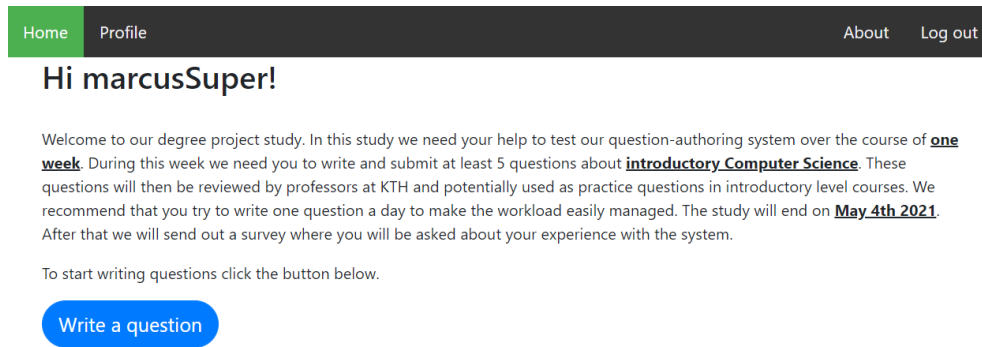


Figure 3.1: Control group homepage.

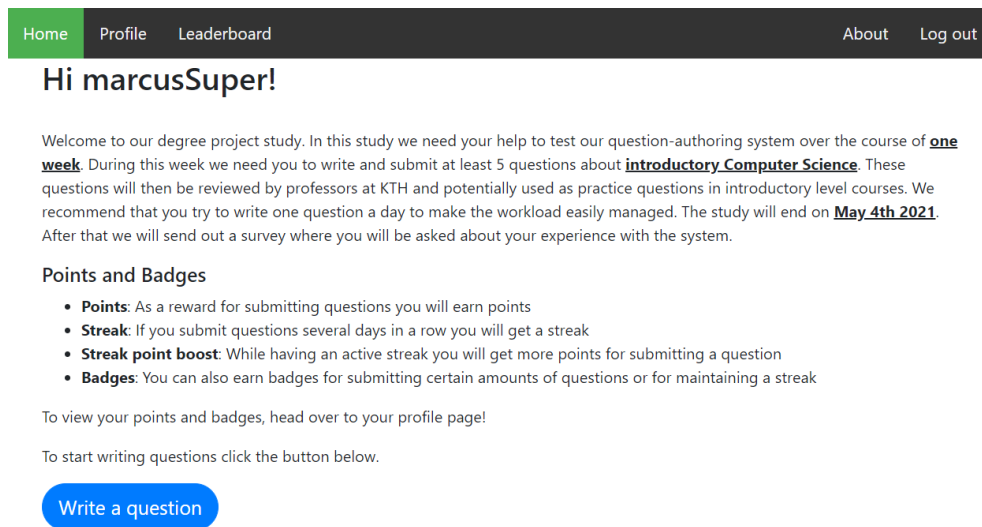


Figure 3.2: Gamification group homepage.

Write a question page

The “Write a question” page, seen in figure 3.3, is a rather simple webform where the user is asked to write a multiple choice question with four answer alternatives. The user can then mark answers as correct by checking the boxes corresponding to those answers.

Home Profile Leaderboard About Log out

Write a question:

Questions can have several answers, check the boxes for each correct choice.

Question text*

Write your question here

Choice a*

Choice a correct

Choice b*

Choice b correct

Choice c*

Choice c correct

Choice d*

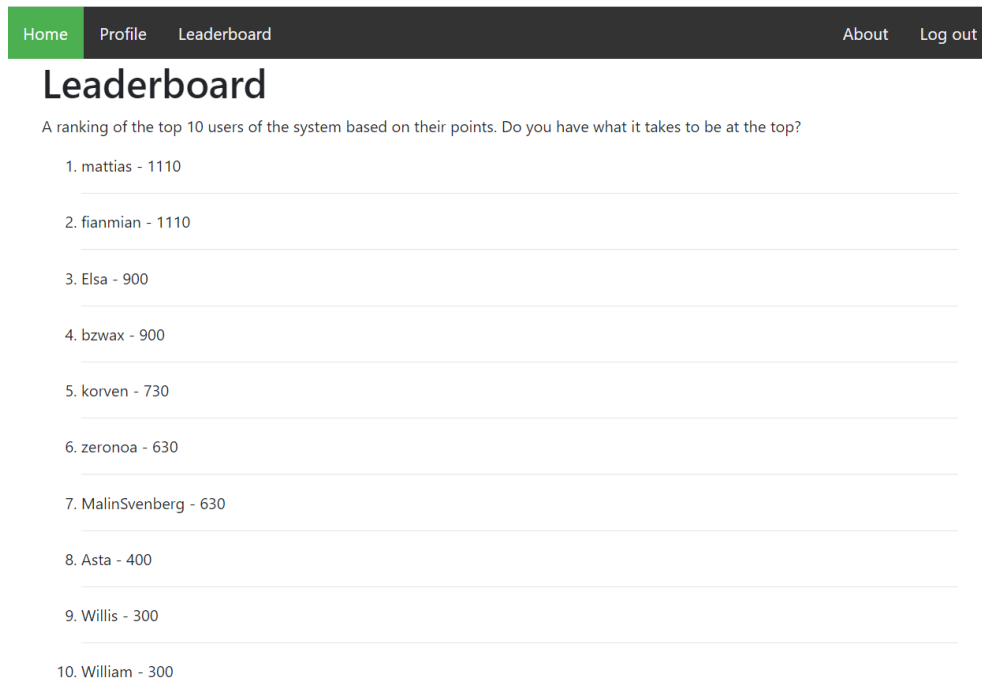
Choice d correct

Submit Question

Figure 3.3: The write a question page.

Leaderboard page

The leaderboard page presents a list of the top ten users with the most points, as seen in figure 3.4. Users in the gamification group are the only ones with access to the leaderboard page. The control group does not have a leaderboard button in their top bar.



Leaderboard	
A ranking of the top 10 users of the system based on their points. Do you have what it takes to be at the top?	
1. mattias	- 1110
2. fianmian	- 1110
3. Elsa	- 900
4. bzwax	- 900
5. korven	- 730
6. zeronoa	- 630
7. MalinSvenberg	- 630
8. Asta	- 400
9. Willis	- 300
10. William	- 300

Figure 3.4: The leaderboard page.

Profile page

Finally there is the profile page. Here the user can see some basic personal statistics. The gamification group can see the number of questions they have written, their points as well as their badge collection, see figure 3.6. The control group on the other hand can only see their number of written questions which is illustrated in figure 3.5.

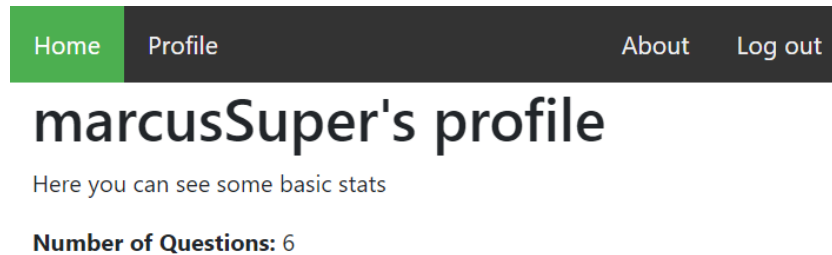


Figure 3.5: Control group profile page.

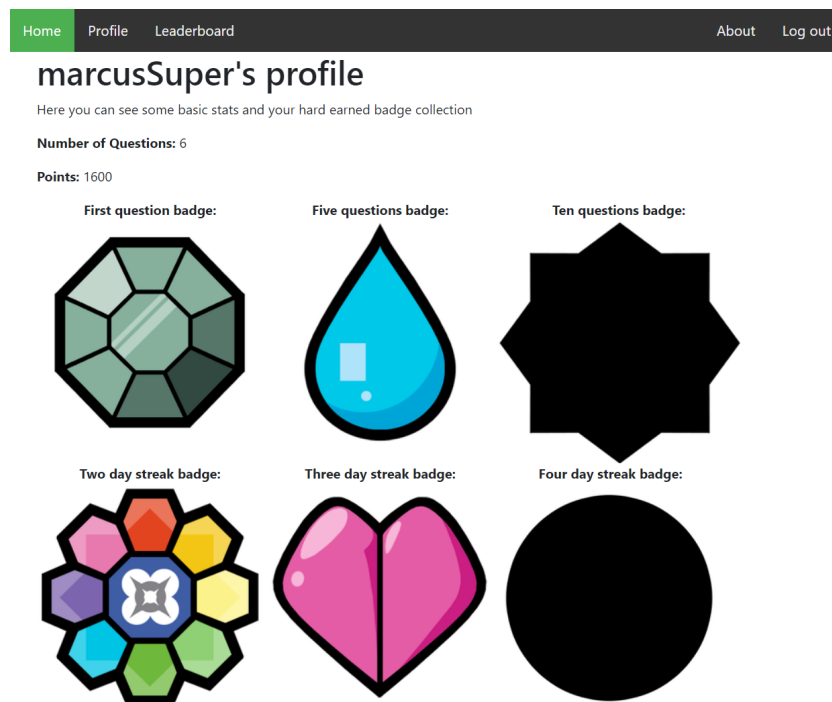


Figure 3.6: Gamification group profile page. The black badges represent badges yet to be earned by the user.

Chapter 4

Methods

This chapter will talk about the chosen method for the study. It will begin by explaining the procedure of the method and then move on to some justifications for the chosen method.

4.1 Procedure

Before the study started a miniature pilot study was conducted. The reason behind this was so that we could ensure that the instructions for the study were clear and that the system was free of issues [19]. The feedback received was generally positive so we decided to proceed without any major changes to the system or the survey.

Users were gathered via several online forums, such as facebook and discord, for computer science students at KTH. The users were divided into two equally sized groups by the system: one with gamification features (gamification group) and one with gamification disabled (control group). The users were asked to submit at least 5 questions over the course of a week with a recommendation to submit one question per day to make the workload easily managed. After the week had passed separate surveys were sent out to each of the two groups (See appendix A). These surveys included a few personal questions about the user as well as questions and statements regarding the user's experience. The statements used the well established Likert scale, where answers range from 1 (strongly disagree) to 5 (strongly agree). Users are then asked to pick the answer on the scale which best corresponds to their opinion.

4.2 Justifications

We chose to use two completely separate groups to use the two different versions of the system as we want as accurate results as possible. If we were to let the participants use both versions of the system it could introduce some bias as the participants likely would compare the two versions of the system. The reason for having the participants use the system for a week, as well as instructing them to submit at least 5 questions, was to investigate the effects of gamification in a scenario similar to a course setting.

4.3 Limitations

Based on this method, there are some possible limitations. The study will take place remotely without direct supervision from us, which means we cannot control our participants in any way. We are therefore heavily relying on the participants to do exactly what we are asking of them to get any usable results. With the study taking place over a week this could become even more of a problem.

There is also a risk that novelty could skew the results. Question-authoring is not a wide-spread practice within education which means that there is a rather high probability that part of our participants will not have used a question-authoring system prior to this study. Therefore the experience of using the system could be quite novel which could introduce some bias into the results.

Chapter 5

Results

The results chapter will start with the participants' demographics and then continue with comparisons of the participants' enjoyment and motivation based on group affiliation and number of questions submitted. It will also include comparisons of how different game design elements motivated the participants.

5.1 Demographics

A total of 15 participants signed up to be part of the study. Of those 15 there were 11 participants (6 in the gamification group and 5 in the control group) who submitted questions and answered the survey. As seen in figure 5.2 18% of the participants did not study at university, and the other 82% who did study at university were mainly students from year three and four. The participants were evenly divided between each gender, which can be seen in figure 5.1. Both of the groups had a relatively similar demographic. None of the participants had used a similar question-authoring system before.

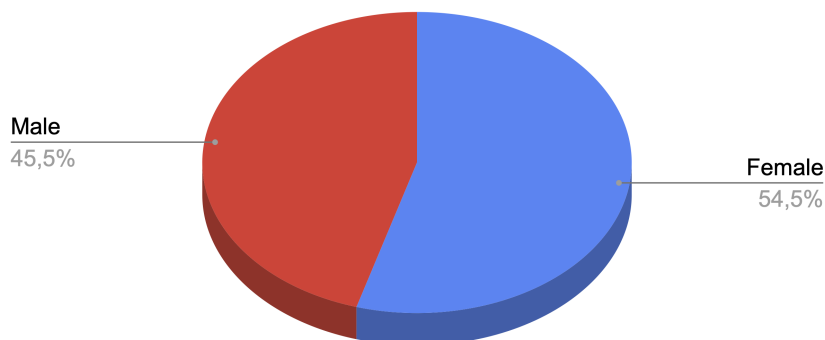


Figure 5.1: The gender distribution of the participants

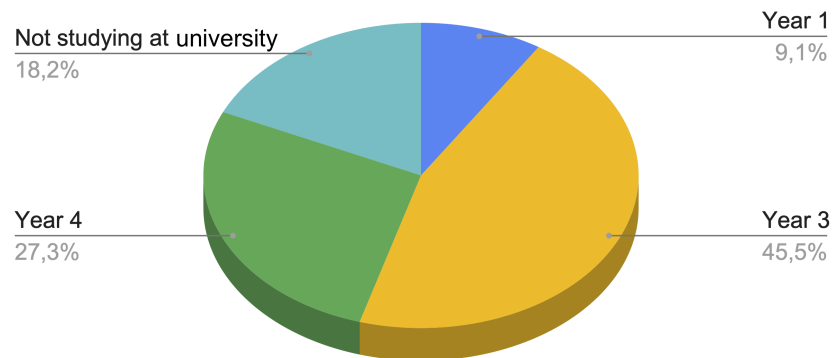


Figure 5.2: The participants' distribution between years of study

5.2 Enjoyment

When asked whether they agreed with the statement “I enjoyed using the system” the two groups answered relatively similarly. As seen in figure 5.3 more participants from the control group agreed with the statement than the ones from the gamification group. Apart from one disagreeing person, the participants of both groups were either neutral or agreeing with the statement.

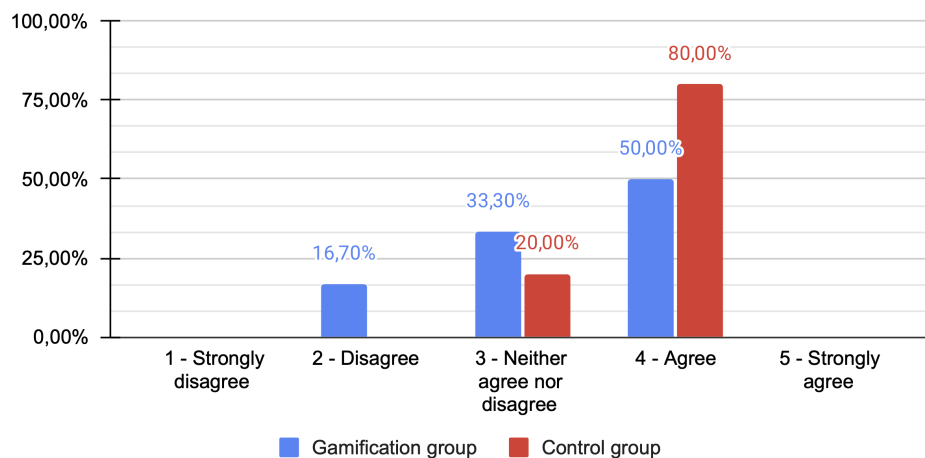


Figure 5.3: The answers from the two groups with regard to the statement “I enjoyed using the system”.

When looking at the enjoyment of the participants based on how many questions they submitted, the participants who submitted more questions seemed to enjoy using the system a bit more. Although the difference is marginal, it is still noticeable as you can see in figure 5.4.

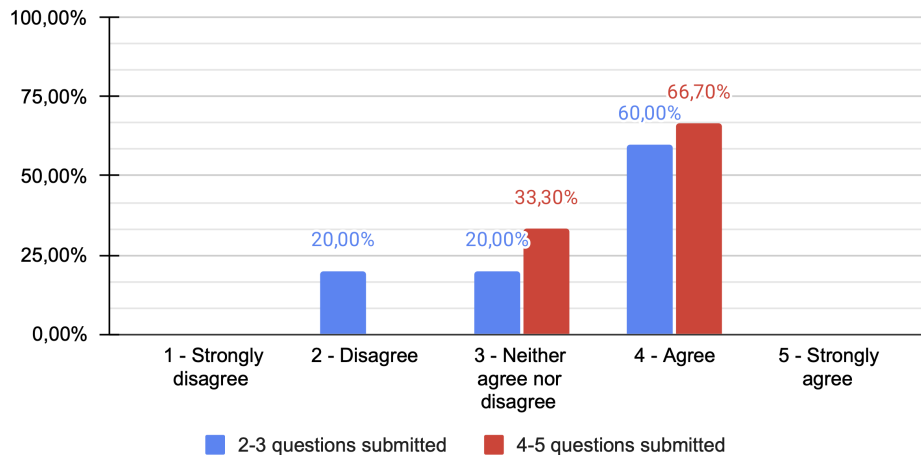


Figure 5.4: The answers to the statement "I enjoyed using the system" with groups based on the number of written questions.

5.3 Motivation

When asked whether they agreed with the statement "I felt motivated to submit questions while using the system" the two groups answered quite differently. As seen in figure 5.5 the gamification group was generally more motivated with 66.7% either agreeing or strongly agreeing with the statement, while only 20% of the control group agreed. The remaining 80% of the control groups' answers show these participants did not feel motivated to submit questions with 40% neither agreeing or disagreeing, 20% disagreeing and 20% strongly disagreeing.

Independent of group affiliation there appears to be no correlation between the participants' motivation to submit questions and the number of questions they actually submitted, as seen in figure 5.6.

The survey also asked the participants to motivate their answer to the statement "I felt motivated to submit questions while using the system", which can be seen in table 5.1 for the gamification group and in table 5.2 for the control group. Most of the gamification group participants who gave a high answer on the statement mention that they found the leaderboard to be fun and motivating. One participant wrote that they like gamification in general and that earning badges was fun. A participant who answered 2 "disagree" to the statement wrote that they thought the system was fun but that they lost interest quickly. Half of the control group participants who motivated their answer brought up

that it was difficult to remember to submit questions and that they would have liked some sort of notification to remind them. One control group participant said that they found the site quite boring. Another control group participant, who gave a high answer, wrote that they “just thought it was fun”.

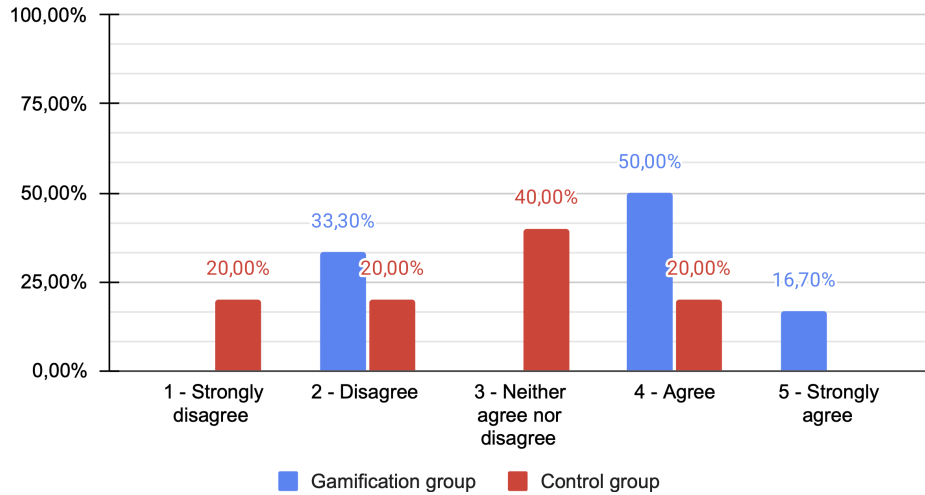


Figure 5.5: The answers from the two groups with regard to the statement “I felt motivated to submit questions while using the system”.

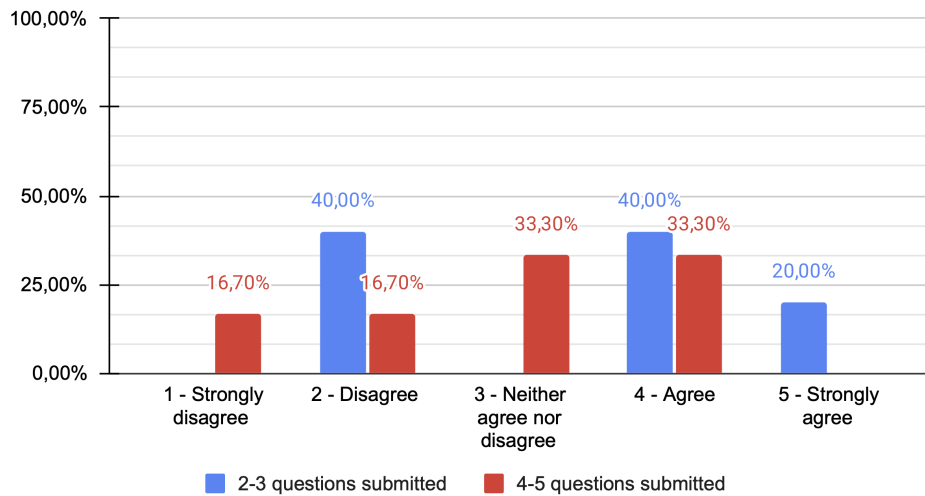


Figure 5.6: The answers to the statement "I felt motivated to submit questions while using the system" with groups based on the number of written questions.

Gamification group	
Answer from figure 5.5	Motivation
5	I was motivated by the streak function and climbing the leaderboard
2	It was fun at first but lost interest quick
4	I like gamification and it felt fun to get badges for questions!
4	The leaderboard was motivating and made it fun

Table 5.1: Answers from the gamification group to the voluntary question "Please motivate your answer to the previous question. Was there a certain reason why you answered that way?" with the corresponding answer to the statement from figure 5.5

Control group	
Answer from figure 5.5	Motivation
2	The site was pretty boring. It wasn't ugly, but it didn't look that nice either (sorry :p).
3	I almost forgot to submit the questions. It would have been good to have some kind of notification that reminds you to submit a question each day.
1	I usually forgot to make questions and made them in bulk. Would have been nice with a reminder every day. (although i could, of course, have set one myself as well) It was difficult to come up with questions. As a third year student it's hard to remember what basic computer science stuff is and what you learned your first year.
4	No, I just thought it was fun

Table 5.2: Answers from the control group to the voluntary question "Please motivate your answer to the previous question. Was there a certain reason why you answered that way?" with the corresponding answer to the statement from figure 5.5

5.4 Questions submitted

The number of questions submitted by participants in the two groups differ quite a bit, as seen in figure 5.7. The control group submitted generally more questions with 60% reaching the 5 question requirement compared to the single participant (16.7%) from the gamification group.

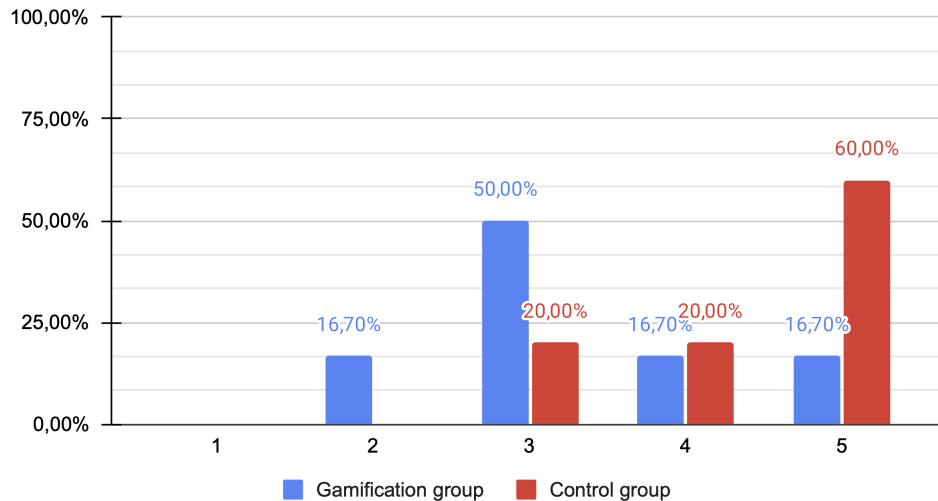


Figure 5.7: The number of questions submitted by participants in the two groups.

With regard to how regularly the participants submitted questions there is no major difference between the two groups, as seen in figure 5.8 50% of the gamification group submitted one question per day and 40% of the control group submitted one or more questions per day.

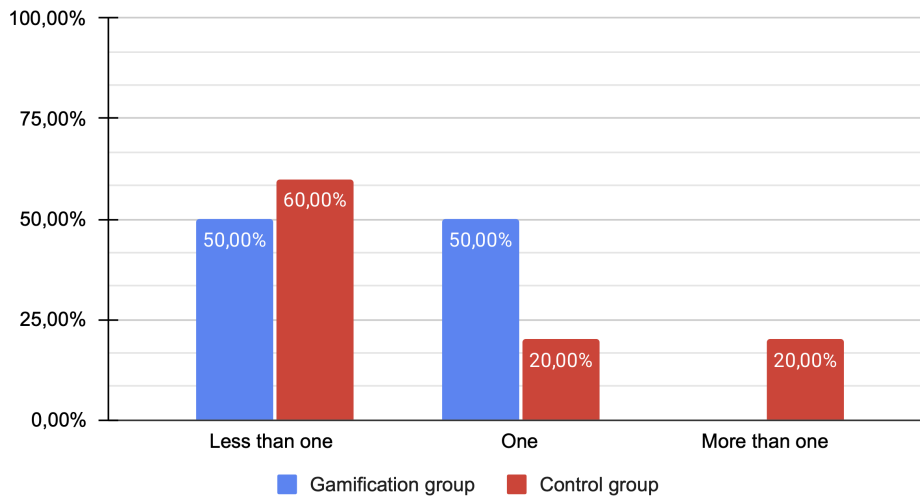


Figure 5.8: The average number of questions submitted per day by participants in the two groups.

5.5 Game design elements

The different game design elements implemented in the system showed a varying degree of success with regards to motivation, as seen in figure 5.9. All game design elements did contribute to motivate the participants to some degree with at least 50% of users agreeing or strongly agreeing with the statement “game design element X motivated me to submit more questions” for each of the game design elements. However it is very clear that the badges were most successful in motivating the participants. The leaderboard was quite successful but 33% of participants neither agreed or disagreed with the statement and one person (16.7%) strongly disagreed. The points feature had very differing effects with 50% agreeing with the statement that the points motivated them but with the remaining 50% disagreeing or strongly disagreeing.

The streak badges were quite successful at motivating participants to submit questions several days in a row, as seen in figure 5.10, with 66.7% agreeing or strongly agreeing and 33.3% strongly disagreeing. The streak point boost was not as successful with 66.7% of participants neither agreeing or disagreeing and 33.3% strongly disagreeing.

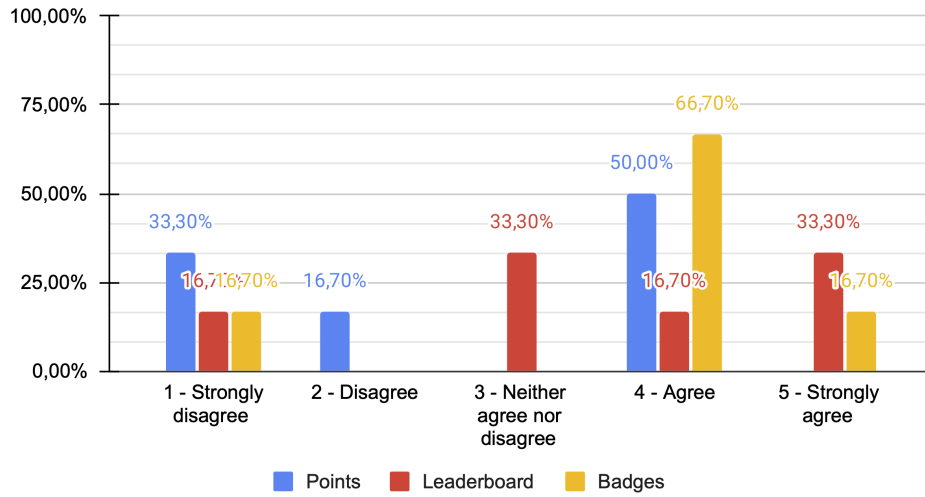


Figure 5.9: Game design element X motivated me to submit more questions. With X being either points, the leaderboard or badges.

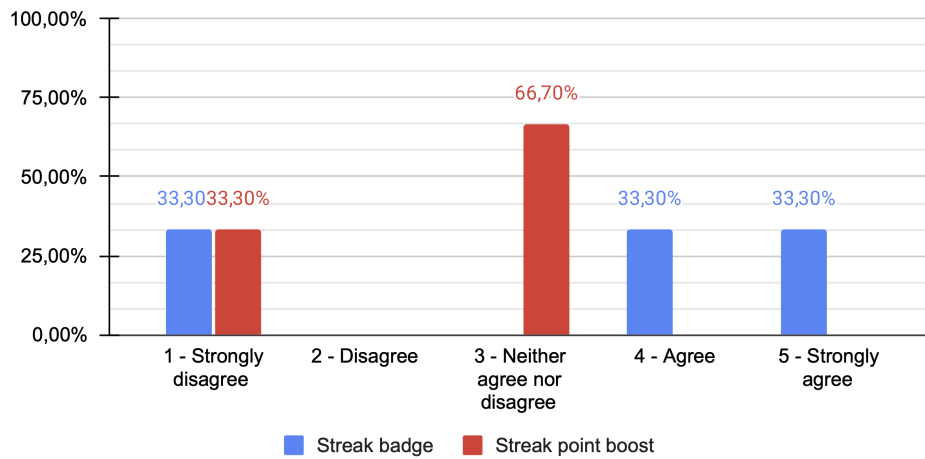


Figure 5.10: Game design element X motivated me to submit questions several days in a row. With X being either streak badges or the streak point boost.

Chapter 6

Discussion

The data that we gathered appears to offer an answer to our research question, “Can students’ motivation of authoring questions be increased by gamifying the question-writing process?”, as the gamification group experienced substantially higher motivation than the control group. This corresponds with the findings of previous studies using PeerWise [17] [18].

We have found that the level of motivation did not however have a noticeable effect on the amount of questions submitted. But it is difficult to know whether this is because of our low number of participants and their specific experience or if there is no correlation between motivation and number of submitted questions.

The results show that the enjoyment of using the question-authoring system was quite similar, and quite high, in both groups. We expected the enjoyment for participants in the gamification group to be quite high, as previous research has shown that PeerWise with its gamification was fun and enjoyable [17]. But we did not expect the control group to show as high of a level of enjoyment. We believe that this is probably due to the novelty of using the system as no users had used a similar system before. It could however be the case that gamification does not increase the level of enjoyment. The system was novel for all participants, in both groups, so it could be expected that the results for the two groups would be affected by this in an equal manner. If gamification increases enjoyment we would therefore expect that the gamification group still would experience a higher level of enjoyment. But since this is not the case it might suggest that gamification does not affect enjoyment or that the effect of novelty overrides the effect of gamification. However this contradicts pre-

vious research [7] [10] and due to the low participation in the study we cannot say anything conclusive about gamifications effect on enjoyment. However we noticed that the participants who submitted more questions also enjoyed the system slightly more, as seen in figure 5.4. This might suggest that higher enjoyment leads to higher engagement.

Looking at points, badges and leaderboards our results show a varying effect on motivation between the different game design elements. They were all relatively successful at motivating the participants, with badges being the most effective with an overwhelming majority feeling motivated by them. However the opinion on the motivational effect of points and the leaderboard was much more divided. With regards to points half the participants were positive and half were negative. With regard to the leaderboard half the participants were positive, a third were neutral and a sixth were negative. If we interpret negative answers (1 strongly disagree, 2 disagree) as the participants feeling demotivated we can see that, as previous studies have shown, leaderboards are quite effective but can be demotivating for some users [6]. Surprisingly points were demotivating for even more participants. Worth noting however is that the participants might not have interpreted “strongly disagree” and “disagree” as demotivating like we have. However no matter how one interprets the strongly disagree and disagree, badges and leaderboards showed to be more motivating than points.

The streak badges were quite effective at motivating participants to submit questions several days in a row, but the streak point boost was very unsuccessful. The reason for this does appear to reveal itself when looking at the comments two of the participants left under the “Other thoughts” question in the survey: “I didn’t understand that there was a streak point boost.”, “I didn’t get the streak point boost :(“. So it appears this feature was not properly explained to the participants and therefore it did not motivate them. This emphasizes the importance of the user understanding the game design element for it to have any effect on motivation.

If we interpret “strongly disagree” and “disagree” as demotivating it appears that we can confirm our hypothesis since our results show that gamification does improve students’ motivation when writing questions, but some game design elements can be demotivating to certain people. But our low number of participants does not allow us to confirm it fully.

6.1 Limitations and improvements

It is important to note that the low number of participants in our study does not allow us to draw any concrete conclusions. There were several reasons for the small group of participants. The primary one being the time constraints caused by the development of our own question-authoring system. We could of course have used pre-existing systems to conduct our study in order to save time, but to be able to compare a gamified experience to a non-gamified experience we would have had to use two separate systems. However this could have run the risk of the different user interfaces affecting the results. For this reason we wanted a controlled environment to conduct our study where the only variable was gamification. This led us to develop our own system, which left little time to conduct the actual study. A short recruitment window along with inability of physical recruitment due to the ongoing pandemic resulted in the small number of participants who signed up for the study.

One rather obvious improvement would have been to recruit more participants for the study. We were not able to start recruitment until the system was finished as the participants were supposed to register at the site. What we possibly could have done is to promote the study earlier and for longer, and have people sign up through a form or something similar. Then when the system was finished we could have distributed the link to these people. If this would have actually generated more participants is difficult to know as it was quite a demanding study which people often are not interested in. On a similar note it would have been quite beneficial for the study to take place over an even longer period of time to examine long term effects on motivation, especially after the novelty of using the system reduces.

In our survey we used quite a lot of Likert style statements, which gave us a large amount of good data. But it would have been beneficial to have more explicit and specific answer scales for each, or at least some, questions. For example when analyzing the answers to the statement “I felt motivated to submit questions when using the system” we interpreted “strongly disagree” and “disagree” as the user feeling demotivated. The participants however may not have interpreted these answers in the same way which makes our data slightly ambiguous.

Furthermore we could see a rather clear pattern of participants not understanding the streak point boost feature so a better explanation of this would

have allowed us to see its effects compared to our current results.

6.2 Further work

It would be quite interesting to conduct a similar study, perhaps using the system we have developed, alongside a course. This would easily solve the issues of poor participation and grant a longer timeframe for the study. It would also examine the effects of gamification on question-authoring in an actual learning context. If the system developed here were to be used for further studies it would be wise to implement some sort of notification feature to remind the participants to submit questions.

The system we developed for this study was quite simple with regard to the visual aspect, especially the control group version. One participant who answered 2 “disagree” to the statement “I felt motivated to submit questions while using the system” motivated their answer with “The site was pretty boring. It wasn’t ugly, but it didn’t look that nice either (sorry :p)” which might suggest there could be a correlation between the design of the system and its motivational effects. It could therefore be interesting to compare the effectiveness of gamification using a highly visual system with for example animations and high quality badges, and a visually simple system, possibly with simple colored squares as badges.

Chapter 7

Conclusions

The results of the study indicate that gamifying the question-authoring process does make students more motivated, but that higher motivation does not appear to lead to more submitted questions. But our low number of participants does not allow us to draw any concrete conclusions, so even though our findings do appear to offer an answer to our research question we cannot confidently give it.

Even though our results are uncertain, we still believe that our findings, together with previous research, show that it would be highly beneficial to implement gamification in education. Especially in these tough times of COVID-19 where many students are struggling with motivation, gamifying parts of education could really make a difference.

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Appendix A

The surveys

Below follows the two surveys sent out to the two groups of the study. Figure A.1 is the shared first page of the surveys. Figure A.2 is the control group specific questions and figure A.3 as well as A.4 are the gamification group questions.

Degree project survey

Thank you for testing out our system! Now we have a few questions about your experience with the system. The form is quite short and will only take a couple of minutes. If you have any questions feel free to contact us

* Required

What is your year of study at university? *

1

2

3

4

5

5+

Not studying at universit

What gender do you identify with? *

Male

Female

Non-binary

Have you used a question authoring system like this before? (e.g PeerWise) *

Yes

No

If yes, please specify which one

Your answer _____

Figure A.1: The shared first page of the two surveys

Degree project survey

* Required

Below follows a few questions and statements about your experience with the system. On questions with answers on a 1-5 scale, the numbers stand for:

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Neither agree nor disagree
- 4 - Agree
- 5 - Strongly agree

Please pick the answer that best corresponds to your opinion.

I enjoyed using the system *

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly agree

I felt motivated to submit questions while using the system *

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly agree

Please motivate your answer to the previous question. Was there a certain reason why you answered that way?

Your answer _____

How many questions did you submit? If you don not remember you can check at kex2021.herokuapp.com/profile *

Your answer _____

How many questions did you submit per day on average? *

- One
- More that one
- Less than one
- Do not remember

Other thoughts

Your answer _____

Figure A.2: The control group specific second page

Degree project survey

* Required

Below follows a few questions and statements about your experience with the system. On questions with answers on a 1-5 scale, the numbers stand for:
 1 - Strongly disagree
 2 - Disagree
 3 - Neither agree nor disagree
 4 - Agree
 5 - Strongly agree
 Please pick the answer that best corresponds to your opinion.

I enjoyed using the system *

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly agree

I felt motivated to submit questions while using the system *

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly agree

Please motivate your answer to the previous question. Was there a certain reason why you answered that way?

Your answer

How many questions did you submit? If you do not remember you can check at kex2021.herokuapp.com/profile *

Your answer

How many questions did you submit per day on average? *

One

More than one

Less than one

Do not remember

Figure A.3: The gamification group specific second page (first half)

The points received for submitting questions motivated me to write more questions *						
	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly agree
The leaderboard motivated me to write more questions *						
	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly agree
The possibility of earning badges motivated me to write more questions *						
	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly agree
The possibility of earning streak badges motivated me to write questions several days in a row *						
	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly agree
The streak point boost motivated me to write questions several days in a row. *						
	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly agree
Other thoughts						
Your answer _____						

Figure A.4: The gamification group specific second page (second half)

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