GAMIFICATION FOR SELF-DIRECTED LEARNING IN HIGHER EDUCATION

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Abstract

This paper reports on how gamification was used to promote Self-Directed Learning (SDL) in a course at a Swedish university. SDL is a strategy to lifelong learning, and essential in today's fast-changing society. However, it is challenging to achieve in higher education due to an emphasis on extrinsic motivation, and a tradition of placing the teacher in control. Gamification has been used in educational contexts to motivate and engage students, and this paper seeks to answer how gamification can support SDL in higher education. Based on six years’ experience of teaching a gamified course, the paper summarises four lessons learned: frequent and immediate feedback can support all three dimensions of SDL; balance of game elements is specifically important for engaging students in critical thinking activities; choice can support self-management; and reward structures can both support and undermine motivation.

Keywords: Self-Directed Learning, Gamification, Teaching, Higher education.

1 INTRODUCTION

Higher education is moving towards a more learner-centred approach as a response to our changing society, which requires an ability to think critically, adapt, and learn continuously through life [1]. Self-Directed Learning (SDL) is a strategy to achieving lifelong learning, and self-directed learners continue to learn after the formal education has ended [2]; this is essential in most professions today [3]. SDL has been linked to critical thinking and high quality learning; students who are self-directed learners take responsibility and control of their own learning processes, and are intrinsically motivated to learn [4]. Students who have insight into their own learning needs, have control over their learning strategies and objectives, and have access to the support and resources necessary, are more likely to perform well [5], and may also have an enhanced self-confidence in their own learning abilities [6].

The concept of SDL derives from adult natural learning, and can be challenging to achieve in formal educational contexts [2]. Higher education emphasises extrinsic motivational structures, such as grades, and traditionally places the teacher and not the student in control of what is to be learned and what learning strategies are to be used [7]. In this respect, the traditions of the higher educational system contradict SDL. Yet, SDL is key to achieving lifelong learning [2].

It is becoming increasingly popular to use gamification in education. Gamification is the use of game elements in non-game contexts [8]. In higher education, gamification is primarily used as a strategy to motivate and engage students to participate actively in their own education [9]. It has also been shown to stimulate creative thinking and enjoyment [10, 11].

Nevertheless, while gamification has been widely explored within an educational context, there is still a need for research on how game elements and mechanics can best be implemented in higher education in order to best support learning [12]. Further, the use of gamification in higher education is not without complexities. Gamification can for example lead to more work for both teachers and students [9] if not balanced right. Gamification tends to be implemented as a way to motivate students to participate in learning activities [13], and is rarely implemented from a specific perspective on learning. While motivation is an important aspect in learning, it is also important to consider the nature of the learning activities the students are motivated to participate in. This paper focuses on SDL as one perspective on learning and seeks to explore the possibility for using gamification as a strategy to support SDL. Therefore, this paper intends to answer the question: How can gamification support Self-Directed Learning in higher education?

The paper reports on experiences from six years of teaching a gamified course to first-year undergraduate students, and from the lessons learned summarises four ways in which gamification can support SDL. By describing the experiences from teaching the course, and the course concept, the paper also provides practical advice for educators on how to gamify higher education for SDL.
2 SELF-DIRECTED LEARNING

During the last decades, learner-centred approaches have become increasingly popular, as the focus has shifted from rote learning to lifelong, meaningful learning. An important concept in higher education is Self-Directed Learning (SDL), and describes both a learning and teaching strategy that is active and reflective [14], when the student initiates, plans and reflects on their learning [15]. It is a learner-centred concept of learning, with a focus on psychology complementary to sociology and pedagogy [5]. The concept emphasises the responsibility of the student to drive and understand their own learning process, with the facilitation of teachers who act as guides in achieving critical reflection [14]. The concept was described by Garrison [14] as having three dimensions, which have since been widely accepted: self-management (control), self-monitoring (responsibility) and motivation.

Self-management refers to the perceived level of control that the student has; students should be given control of their learning process by for example choosing approach, pacing, and by being able to ask questions and receive feedback as needed. In higher education, full control cannot be given to the student, and this is instead collaboratively managed between student and teacher. The balance between the level of control, support and freedom is important for achieving SDL. Nevertheless, a higher level of control also implies a higher level of responsibility; the students have a higher level of responsibility for their learning process and making the learning meaningful.

Self-monitoring refers to the cognitive processes relating to learning strategies and reflection. The responsibility granted by a high level of control over one's learning process also creates a need to be aware of the state of that process. In order to be able to self-monitor, students are reliant on external and internal feedback; teachers and the educational system provide external feedback, while the students themselves provide the internal feedback. This requires the ability to reflect and think critically, and is something that students may have to practice. Teachers can support students in this by providing a reason for why certain tasks are assigned, helping in the search for additional information, and through discussion and practice.

Motivation refers to the drive to both enter into and continue a learning process. Students are more likely to be motivated to enter into a learning process if they experience the learning goals as achievable and relevant to their needs. The other two dimensions also affect the dimension of motivation, as anticipated control is important in determining motivation. If a student is provided with control and choice they can be more motivated to begin and maintain the learning process; yet in higher education, which is focused on extrinsic motivation in the form of grades, the challenge is for students to internalise the motivation in order to maintain the initial motivation.

The SDL approach has grown from an adult learning context with a focus on informal learning in natural settings [16]. The term SDL is sometimes confused, or used interchangeably with the term Self-Regulated Learning (SRL). SDL is a macro-level concept stemming from adult learning, and describes a process in which the student drives their own learning, and takes responsibility and control over the process itself. SRL, on the other hand, is a micro-level concept stemming from cognitive psychology, and describes a process where the student is active in setting learning goals, while maintaining control over cognition, behaviour and motivation in a balance with the external environment [1]. Some consider SDL as a broader concept that encompasses SRL [17]. The concepts mainly differ in theoretical background and application [1].

SDL has been picked up in several education fields, such as the education of healthcare professionals [see e.g. 18], engineers [see e.g. 2], and second language learners [see e.g. 19]. Further, it is particularly prominent in literature on distance education [4, 16, 20]. SDL is at the basis of approaches such as blended learning and flipped classroom [2], which aim to increase self-direction. In fields that are rapidly changing, due to for example technological developments, SDL is particularly important to achieve [21].

In summary, according to SDL, in order to achieve lifelong learning and academic achievement, students have to feel in control of, and take responsibility for their learning process, and have to be motivated to begin and continue their learning.

3 GAMIFICATION OF EDUCATION

A widely used definition of gamification is that of Deterding, Dixon [8]: "the use of game design elements in non-game contexts" (p. 10). The purpose of using gamification is primarily to motivate and engage users [8]. During the last decade, gamification has reached immense popularity in a variety of
fields, one of which is education. Gamification has been used in higher education in order to increase for example student learning [see e.g. 9, 22], engagement [see e.g. 23], creativity [see e.g. 24], and academic results [see e.g. 25, 26].

Gamification is an approach to motivate and engage students; by applying game mechanics such as increasing the difficulty as the player’s skill increases, it is possible to engage students in an on-going process that constantly drives them to learn and iterate in order to increase their skill [12]. This progression can also increase student engagement [27]. Yet, there is a difference between using a gamified approach to teaching, and using actual games in teaching; in the foremost, game elements and principles are integrated in typical teaching activities and structures [12].

Deterding, Dixon [8] describes game elements along five levels: (1) game interface design patterns such as badges and leader boards; (2) game design patterns and mechanics, such as time pressure and turn taking; (3) game design principles and heuristics, such as enduring play and clear goals; (4) game models, such as challenges and fantasy; and (5) game design methods, such as playtesting and playcentric design. Examples of frequently used game elements in education include: time pressure, reward structures such as badges or points, frequent and immediate feedback, progression or levels, storytelling, and competition or cooperation [13, 28, 29].

Nevertheless, gamification of education is not always straightforward; balance between the game elements is essential [11]; one risk for example consists of undermining the intrinsic motivation of the student by applying extrinsic motivational structures in ineffective ways [28]. Increased complexity can also discourage students if assignments are not balanced well [12]. Game elements should be used with caution, as some can have an adverse affect; leader boards have for example been shown to demotivate some [30].

There are several examples of gamification being used in higher education. Iosup and Epema [25] report on their experiences with gamifying two computer science courses and found that students performed above average, and participation was high. Furthermore, they found that students who did not express an interest in the gamified elements still spend more time than typical on planning their advancement in the course, and that top students attended activities that did not impact the course grade, showing that intrinsic motivation still remained.

To be motivated is a prerequisite for achieving SDL [5], and as an approach to motivate and engage, gamification should in theory be suitable for supporting that dimension of SDL. However, the application of gamification is precarious, and how gamification can support the three dimensions of SDL remains to be studied.

4 METHODOLOGY

This paper reports on the experiences from the past six years of teaching a gamified course for first-year interaction design undergraduate students. The course aims to teach prototyping techniques, as well as introduce design critique as a way to further design work. The course was developed in 2013, and has since been taught once a year to a total of 253 students.

4.1 Game Elements in the Course

The course implements a number of game elements: points, levels, choice, boss, collaboration, player status, and feedback.

4.1.1 Points

The students are presented with a number of assignments during the course that they have to complete in order to collect points. The point system in the course is made up of two different types of points, which can be collected by performing different types of objectives: Reflective Experience Points (RefXP) and Generative Experience Points (GenXP). Students collect RefXP by performing assignments that are reflective or critical in nature, such as seminars, quizzes, and design critique. Performing assignments that are practical in nature, such as sketching, building prototypes, and performing programming assignments, collect GenXP. The students have to collect a specific amount of both types of points in order to receive a passing, or higher grade.
4.1.2 Levels

Points are collected in order to gain a higher level. Each level is given a skill (for example n00b, intermediate, master) and students require enough of both GenXP and RefXP in order to level up. Some levels correspond to course grades; for example, when reaching level 6 (proficient), the student also reaches enough points to gain a passing grade.

4.1.3 Choice

At the beginning of the course, the students are presented with a game manual that lists all assignments for the course – in the latest version of the course there were 20 assignments. Some assignments are obligatory, while others are voluntary. The students have to perform a number of the voluntary assignments in order to achieve a passing grade, but they can choose which assignments they prefer to do, and can calculate how many points (if given the maximum point) these assignments will give them and what grade that will result in. In this way, the students can choose to skip some assignments if they are not interested and choose to settle for a lower grade.

4.1.4 Boss

Some assignments are obligatory, and are called bosses. These assignments are somewhat more difficult or present a milestone in the course. Examples of bosses include creating a prototype of a mobile application, planning and holding a lecture, and taking a quiz. In order to receive a passing grade or higher, the students have to beat all the bosses; that is, even if a student has collected enough points for a passing grade, they cannot receive that grade if they have not beaten all the bosses. This is to ensure that all students have the required knowledge for the course.

4.1.5 Collaboration

While a majority of the assignments are single player assignments, some assignments are performed in teams, or multi-player. For these assignments the students team up and collaborate in solving the assignment. One of these assignments is for example to plan, organise and perform a lecture. There is no competition between the teams, instead the students are for example asked to support the other teams by attending their lectures, ask questions and participate actively.

4.1.6 Player Status

At the beginning of the course, the students are asked to choose an avatar from among 20 different choices, and a username. The avatar can then be found on a player status page that summarises the students' collected points, completed and remaining assignments, and other course information. Each student has a private profile page. The profile page has evolved during the years that the course has run. During 2013 and 2014 the students could follow their points on a public spread sheet that was administered by the teachers, where the students' names were anonymised. Since 2015 the students
have been able to access their profile page online, and fig. 1 shows a screenshot from the latest profile page.

4.1.7 Feedback

Feedback is provided in several ways. First, since each assignment is given a maximum point value, the amount of points the students are given serves as a way to give feedback on their performance. Second, the teacher gives students who excel or do poorly at an assignment additional feedback. Third, the students can follow their total progress on their profile page, where they can also see how far they are from levelling up, how many points they were given for each assignment, and whether or not they have finished all the bosses. Since the students follow their own progress, the feedback is provided as soon as possible after the assignment has been handed in. While the formal rule is that the teacher has fifteen working days after the deadline to provide feedback, feedback is typically provided within two or three days on this course.

4.2 Evaluating the Course

The course has been taught for six years, once a year since 2013. The course runs for eight weeks during the first year of a three-year undergraduate program in interaction design. The students’ experiences have been evaluated in several ways. After the course, the university distributes a standard evaluation form. To complement this, since 2015 we also perform an oral evaluation at the end of the course. During 2016 and 2017, oral evaluations were also performed halfway through the course. Further, a voluntary assignment in the course is to write a reflective text. Unfortunately, many students have chosen not to perform this assignment, as it has had no effect on their grade. Lastly, since 2016, after the course introduction, all students were asked to write a short statement summarising their expectations on the course. Table 1 summarises the number of students taking the course, and how many participated in each evaluating activity.

<table>
<thead>
<tr>
<th>Year</th>
<th>Students</th>
<th>Expectations</th>
<th>Mid-evaluation</th>
<th>Oral evaluation</th>
<th>University evaluation</th>
<th>Written reflection</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>29</td>
<td>N/A</td>
<td>No</td>
<td>No</td>
<td>11</td>
<td>15</td>
</tr>
<tr>
<td>2014</td>
<td>45</td>
<td>N/A</td>
<td>No</td>
<td>No</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>2015</td>
<td>32</td>
<td>N/A</td>
<td>No</td>
<td>Yes</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>2016</td>
<td>45</td>
<td>45</td>
<td>Yes</td>
<td>Yes</td>
<td>30</td>
<td>3</td>
</tr>
<tr>
<td>2017</td>
<td>51</td>
<td>51</td>
<td>Yes</td>
<td>Yes</td>
<td>14</td>
<td>2</td>
</tr>
<tr>
<td>2018</td>
<td>48</td>
<td>48</td>
<td>No</td>
<td>Yes</td>
<td>20</td>
<td>3</td>
</tr>
</tbody>
</table>

5 RESULTS

The experience from the six years of teaching the gamified course will here be structured based on the three dimensions of SDL from Garrison [14].

5.1 Self-Management or Feeling in Control

The students during all six years expressed that the game elements gave them a clear overview of what they had to do, and what they had done. During 2013 and 2014, when the results were published using a spread sheet, the students expressed that the points were not updated often enough (approximately once a week). Since implementing the profile page, students will see their points as soon as their assignments have been graded, and this problem has been solved.

Several students mention in the course evaluations that they experience it as positive to be able to choose assignments. For example, one student in 2016 wrote in their evaluation that:

"It was really nice to see from the beginning what you have to do, and then be able to plan a bit on your own how much time you want to put into certain things. You can also see what is the most important and the least important."
Several students further mention that they appreciate the possibility to plan and predict their grades, and set their own level of ambition.

As an incentive to work on the quality of some of the assignments, the more difficult assignments can be rewarded with extra points for quality. What constitutes high quality has been difficult to communicate, and the feedback from the students has expressed a wish to clarify this. While attempts have been made to clarify what high quality means in general in the course game manual that is given to the students at the beginning of the course, some students still express that they find the requirements unclear.

Further, some students indicated that the gamification concept was too complex and that, at least in the beginning, they had some difficulty understanding all the variables of the game elements. To this was in 2015 added the complexity of two different course webpages, as the profile page was external to the learning management system that the university uses for all its courses. The students thus have to use two different systems for the course. As a teacher on the course, it has been important to be structured and clear in the communication of the game elements to the students. Any confusion has always been possible to clarify early in the course.

In summary, the gamification of the course appears to support the students' feeling in control. The students are able to choose what assignments they want to do, prioritise, monitor their progress and plan their grade in advance. While this also adds to the complexity of the course, clear structure and communication can support the students in understanding the course concept.

5.2 Self-Monitoring or Feeling a Sense of Responsibility

Feedback is important for the ability to self-monitor, and several students mention that the quick feedback was rewarding. Since the students are able to continually monitor their points and thus their course result, they are able to plan a course of action suitable to their current situation. Since the profile page was introduced in 2015, the students continuously express appreciation of being able to see their course status. One student in the course evaluation from 2013 expresses that the point system moved the focus from grades to a focus on points, and that this removed some of the pressure, and allowed them to establish their own level of ambition.

Nevertheless, providing fast feedback places some requirements on the teachers. It is important to grade assignments immediately after the deadline, and as there are approximately 20 assignments for the course with around 30-50 students, this is not always possible. Since the points given for the assignment can function as feedback, we have taken the strategy of only providing additional written feedback for students who have performed particularly poorly or well. This will provide an opportunity for these students to improve for the next assignment, or raise their self-confidence.

A recurring comment in the course evaluations is that the course has a high tempo and that there is sometimes too much to do. This is related to an, in the beginning, somewhat unclear understanding of the requirements of the assignments. The experience from the course is that the students who express uncertainties experience less stress once they perform some assignments and begin to understand the concept and level of quality of the work required.

In summary, the ability to continuously monitor the amount of points, and plan a course of action based on this, has been highly appreciated by students. While it requires some work on the part of the teachers, the students have also appreciated the quick feedback.

5.3 Motivation

The students show a high level of motivation at the beginning of the course. The short reflections on their expectations on the course that the students were asked to write after the course introduction, starting in 2016, used expressions such as "exciting", "fun and interesting", "high quality enjoyment", "learning in a fun way".

Several students express that the motivation lasts throughout the course. In the course evaluations, students in all years write that the gamification made them want to study harder than normal, wanted to level up quickly, and that the point system made it more fun. Playfulness and fun are words that recur in the evaluations of all six years, and in several written reflections.

However, between 2013 and 2015 attendance at the lectures by the other students did not give any points, and we experienced that attendance was lower than at lectures in other courses. Subsequently, from 2016 students receive a small number of points for attendance as well. The
amount of points is very low considering the total number of points, but attendance at lectures in 2016 and 2017 has been between 80-100%.

Furthermore, the 2016 evaluations indicated that the students wanted to be able to level up faster. From 2017, additional levels were added; this did not affect how many points were necessary to achieve a passing grade, but it was easier to increase in level. Even though the levels did not always earn a grade, the students since 2017 express that the levelling system worked well.

In 2017, however, several students mention a wish to be able to use their points for more than just levelling up. They suggest creating the possibility to buy things for your avatar, or gain some other advantage.

The point system has had to be revised somewhat during the years; in 2014, it was possible to gain the highest grade without writing the final reflection. This was adjusted in 2015, yet then many students chose to take a lower grade instead of writing this reflection. In 2016, several students mention that the point system was unbalanced as a majority of the points were given for assignments that were at the end of the course. Many of the bosses were also placed at the end of the course. The students were then unable to see much progress in the beginning, and then felt overloaded at the end of the course.

Finally, the course results show that students are motivated to finish the course. The number of students passing the course on the first try is higher than typical, and the number of higher grades also tends to be above average. However, during the six years, no student has levelled up to the highest level, as it does not provide a higher grade.

In summary, the students express motivation initially, and show continuous motivation to perform the course activities. A majority of the students are positive to the course concept and appreciate the playfulness. However, balance in the game elements is important and it has required continuous adjustments.

5.4 Reflections on the Course

Some reflections from having taught the course for six years includes that while more time than typical is required for grading the different assignments, less time is required for preparation, as the students drive the content of the course. Nevertheless, the concept could be taken further, and future developments include for example using a reward structure to reinforce certain assignments that may be more difficult, using for example badges or the ability to level up the avatar, and using a skill tree to communicate to the students what the assignments in the course can be used for in other contexts.

A small number of students have expressed that they would have preferred a regular course structure; one student in 2014 wrote in their course evaluation that they struggled to understand the course concept, and another student in 2017 wrote that they would have liked a more formal course structure. Besides this negative feedback, the majority of the students have expressed positive experiences from the course. It is also the experience of the teachers that it is not only a fun course to teach, but also that more students than typical express appreciation of the course.

6 DISCUSSION

This section will discuss how gamifying the course described in this paper has supported the three dimensions of SDL. First, self-management was supported by the use of choice and the transparency of the player status page. Choice is an essential component of achieving self-management [14]. In this case, the students were able to choose some of their assignments, depending on their level of ambition, and were able to make this choice strategically through the overview of their current points. Choice is also a key element in gamification, and engagement increases if the choice feels authentic in the learning situation [12].

Second, self-monitoring was supported by the transparency of the reward structure and frequent external feedback; in this case, the point system and associated profile page allowed the students to maintain an overview of their current standing in the course. Further, in order to be able to self-monitor, the student is dependent on both internal and external feedback [14]. The point system, combined with frequent feedback from the teachers on the finished assignments, functioned as this external feedback. Combined, this transparency and frequency of feedback allowed the students the possibility to have control and take responsibility of their learning. Frequent and immediate feedback is a game element important for maintaining engagement and increasing player skill [28]; as such, it is
an element often used in gamification of education [13]. In this case, providing frequent feedback did increase the demands on the teachers, but it was also one of the most appreciated elements by the students.

In order for students to improve critical thinking skills, the teacher has to guide the student in exercises and with feedback [14]. Using gamification, it is possible to engage students throughout the learning process in activities supporting critical thinking and problem solving [12]. In this case, the assignments important for critical thinking or other necessary skills were made obligatory as bosses in the game, and yet more students than typical met the required knowledge goals. It was thus possible to guide students in their efforts and the direction that their learning takes, through careful balancing of the game elements.

Third, the reward structure, levels, choice, bosses, and the overall novelty of the concept supported motivation. The challenge in SDL in higher education is to internalise extrinsic motivation [14], and in this case the overall strong grades of the students, and their continued motivation to participate in course activities show that this was at least partly successful. Nevertheless, while the levelling system appeared to motivate students initially, it did not motivate them to reach the highest level. Furthermore, the reward system showed indications of having negated the students’ intrinsic motivation, as only a few students attended the activities that were not rewarded with points. A similar phenomenon was observed by Hill and Brunvan [12], where students who had reached the highest grade did not complete the final assignments. This points to a need to further explore how gamification can place more emphasis on intrinsic motivation in education; since the educational system is highly focused on extrinsic rewards in the form of grades, it has proved particularly challenging.

Finally, as Garrison [14] argues, the three dimensions are invariably linked and dependent on each other. In this case the challenge was how to balance the game elements in order to achieve all three dimensions, yet still maintain the structure of formal education where knowledge goals and grades are predominant. The balance of a functioning gamification concept, which does not add additional complexity, yet is motivating and provides the students with a sense of choice and control was not achieved the first year the course was given; it has been a lesson during several years of iterating the concept and adapting to the feedback from the students.

Based on the lessons learned from teaching the course, and this discussion, we can summarise four ways in which gamification can support SDL in higher education:

- Frequent and immediate feedback can be used to support all three dimensions of SDL, and as such is one of the most important game elements to implement when gamifying higher education.

- Gamification can be used to support self-monitoring, as it can engage and motivate students to participate in activities for enhancing critical thinking. Balance in the game elements is important not only to engage students, but more specifically to engage them in participating in critical thinking activities. Game elements can be used to direct students to activities that they otherwise may have elected not to perform.

- Choice can be used to support self-management, but is the most difficult to design into a course structure where students are supposed to meet specific knowledge goals in order to earn certain grades. This may lead to more work for the teachers, as it may be necessary to have multiple assignments for each knowledge goal.

- Appropriate reward structures can be used to motivate, but reward structures that give extrinsic rewards risk reducing the students’ intrinsic motivation. In formal education, which is graded, it is more challenging to increase intrinsic motivation, as extrinsic motivational structures, such as grades, are predominant. Frequent feedback can be favourable for intrinsic motivation.

7 CONCLUSION

This paper intended to answer the question: How can gamification support Self-Directed Learning in higher education? From the lessons learned from six years’ experience of teaching a gamified course, we formulate four ways in which gamification can support SDL: feedback can support all three dimensions of SDL and is thus one of the essential game elements in higher education; game elements can be used to direct students towards critical thinking activities, and thus support self-monitoring; choice can be used to support self-management, but is the most difficult to design into a course structure; and intrinsic motivation is difficult to support in higher education where focus is on
extrinsic motivation in the form of grades, but can be supported by using appropriate reward structures and frequent feedback.

This paper shows how gamification potentially can shift the focus in higher education from extrinsic motivation, and support the students' experienced control in order to achieve SDL. As higher education is becoming increasingly learner-centred, and we see a society where professional roles change more than ever, there is a search for strategies to reinforce lifelong learning. This paper shows that gamification can be one such strategy, and can hopefully be inspirational for educators who wish to explore the possibilities of gamification in higher education.

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