Convas

Guidelines for Gamifying Learning Management Systems

Master's thesis in Interaction Design and Technologies

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Cover: Examples of gamified elements in the Convas LMS

Guidelines for Gamifying Learning Management Systems
Gamification in higher education
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Abstract

Gamification is an increasingly popular topic, being implemented in a wide variety of sectors with the intent to increase user engagement and motivation. One sector in which gamification shows great promise is the sector of education and learning, as the motivational effects of gamification can be of great use when engaging students in various educations. While the need for educated people is ever increasing, student attendance has been shown to be on the recline [10]. This thesis aims to explore the use of gamification in higher education to increase student motivation and engagement in order to tackle this problem.

The topic of gamification in higher education was explored through the design and implementation of a gamified experience in a Learning Management System targeted at students in higher education. The gamified experience was constructed with the help of GWEN, a gamification service developed by Insert Coin. Through thorough user testing and an iterative design process, insights gained from the design was used to produce a set of guidelines which depicts recommended gamification elements to incorporate in a digital learning platform in order to create an experience which makes for an as positive impact on students motivation and engagement as possible.

The project resulted in both a prototype of a learning management system called Convas, which incorporates various gamification elements, as well as a set of guidelines aimed to help future designers with designing similar systems.

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1
Introduction

It is news to no one that humans love playing games. In fact, in 2017 the video game industry generated roughly 116 billion dollars, the largest revenue of any major entertainment industry that year [1], and according to a study by the Entertainment Software Association, 60% of Americans play video games daily [2]. From this, it is not hard to draw the conclusion that video games have an incredible ability to motivate people to play. The game elements which makes games such great motivators have in modern time been utilized in non game contexts with the intent to increase motivation and engagement. More recently, these methods have been collected under a single name, gamification, which Sebastian Deterding *et al.* defines as "the use of game design elements in non-game contexts" [3].

Even though the topic has been researched since the 1980s, one of the first articles being *Heuristics for designing enjoyable user interfaces: Lessons from computer games* by Thomas W. Malone in 1982 [4], and the term gamification being (self-proclaimingly) coined by Nick Pelling in 2002 [5], the term did not gain traction until 2010, when, for example, Jane McGonical held her TED Talk *Gaming can make a better world* [6]. In the years since, gamification has grown considerably and has been widely used in various sectors in order to increase productivity and motivation of their users.

One sector which gamification has seen particular success within is the sector of e-learning, meaning learning through an electronic medium, often being the internet. The very successful e-learning platform *Khan Academy* offers a wide range of free gamified courses, and is sporting 18 million monthly users [7]. *Duolingo*, a popular gamified language learning service, flaunted 300 million total users in 2018 [8]. In educational contexts, keeping students interested and engaged in the learning process is vital, which is exactly what gamification aims to heighten.

1.1   Problem description

The demand for people graduated from higher educations is ever increasing, and Sweden alone is predicted to have a lack of 30 000 people with an education related to technology by 2030 [9]. This makes it more important than ever that people educate themselves. However, in Sweden a seemingly strange phenomena has been noticed where students attendance is decreasing, despite students claiming that they believe education to be more important than before [10]. Some

implementations of gamification elements in e-learning platforms have shown to have a positive impact on students engagement in the course material, an example being a study conducted by Paul Denny on the impact of badges on student engagement with a multi choice question platform, where the incorporation of badges resulted in a 22% increase of answered questions [11]. Other studies however, have shown that implementing gamification elements does not result in a prominent difference in student engagement. A study conducted by Afifa Amriani *et al.*, investigating the effect of some common gamification elements in the learning platform *Moodle*, concludes that the elements had no significant effect on the engagement of students [12]. The differing results could be because of differences in the implementations, testing process or the targeted audience. This leads us to believe that, in order to get a clearer picture of how to best implement gamification in an educational context, further research on the matter is needed.

1.2 Research question

This thesis poses the following question:

What factors should be considered when implementing gamification patterns into a digital learning platform with the intent of increasing student retention rates in higher education?

1.3 Aim

In order to develop a possible solution to the previously mentioned problem of student attendance, Vinnova has granted Insert Coin, a company working with gamification, support in order to develop a gamified experience inside the Canvas learning platform, initially for a few courses starting in April 2019 [13]. The aim of this thesis was to cooperate with Insert Coin to design and implement said gamified experience, validating it through thorough user testing, as well as iterating the process in order to create an as effective design as possible. In combination with previous research in the field, insights gained from the design of the gamified experience was to result in a set of guidelines, outlining a set of game design elements especially good for gamification on a learning platform, and explaining how they can be implemented in various ways and explain why they are especially useful. These proposed guidelines could lead to easier implementation of good gamification in educational contexts. With system developers and designers having an easier time developing these kind of systems they would become more accessible to schools and their teachers, which hopefully would lead to more students completing their studies.

1.4   Delimitations

As previously mentioned, the implementation of the gamified experience would take place in the Learning Management System Canvas, developed by Instructure Inc. As this is a well established LMS, used by schools world wide, it was unlikely that we would have full access to integrate the gamification elements freely. As such, we were going to have to work around the potential limitations of implementing a design in a system which we did not have full modification privileges.

The focus of the result would be to make a good gamified experience for students, and students only, in order to increase their motivation and engagement. This would means that the implementation would only focus on the experience of the students themselves, only including user interfaces and features which would be used by students. As such, no focus would be put on the experience of other potential users of such a platform, such as teachers or service administrators. However, some user scenarios of teachers would be put into consideration, as the use of the platform from a teacher perspective has an indirect influence on the students experience, as the teachers are responsible for designing the course material which the students will be interacting with.

2
Background

Playing video games is one of the most common spare time activities among children today with an estimate of 97% of children playing video games [14]. According to a study from 2012, 95% of teachers use educational games in their classroom [15]. Despite this a lot of commonly used Learning Management Systems does not utilize gamification, at least not to its full capacity.

2.1 Related research and previous work

Gamification being a subject still in its infancy does not mean there is no previous research to study. According to a study by Hamari, Koivisto and Sarsa [16] there are many examples of gamified systems in a wide variety of contexts, most of which has had a positive outcome. The study evaluates a set of gamification projects where the majority of them are of educational nature. The study does not go into detail about the difference between what context the gamification is used in and what affordances are being used. Nothing is mentioned about how implementing gamification for an educational context might differ from implementing it for a different service or vice versa. Adam Palmquist [10] states that when implementing gamification in a educational context it is very important to have a narrative for the entire experience and that the content of the gamification is heavily tied to the content of the course. This seems to accord with the study of Hamari J. *et al.* [16] as most of the evaluated projects that have a story/theme are of a educational context.

While there are quite a few examples of gamified products, until recently there has not been a lot of commonly known sets of guidelines useful for implementing gamification. Daniel Andrews [17] and Benedikt Morschheuser *et al.* [18] both write about gamification systems and how one can go about developing such a system. There are many similarities between their suggestions, one being that they emphasise the importance of knowing the context and the users/stakeholders of the project very well before going further into development. Morschheuser *et al.* puts a lot of emphasis in that the process should be an iterative design process while Andrews has more of a waterfall approach but with a lot of emphasis on involving the stakeholders during development.

Christo Dichev *et al.* [19] compares Gamification and Gameful design (a similar concept) and the usefulness of the two in an educational context. Their report

also explains the importance of a gameful experience in school and what game design elements are commonly used in gamified learning experiences.

2.2 Learning Management Systems

Learning Management Systems, or LMS, are software for administrating, documenting, distributing, reporting, tracking and delivering of educational courses, training programs, or similar. This section contains summaries of some of the most popular LMSes.

2.2.1 Canvas

Canvas is an extensive Learning Management System developed by Instructure [20]. Used by over 3000 universities, Canvas is one of the largest LMS's world wide [21, 22], especially popular in Scandinavia [23]. Canvas was released 2011 and is available both as open-source software and as a System-as-a-Service (SaaS) for a price. Canvas offers a lot of features commonly found in LMS software as well as a lot of features meant to simplify education for teachers, such as a speed grading tool.

Inherently Canvas does not have gamification elements integrated. Some features can be tweaked in order to provide a somewhat gamified experience, such as to *Use the quiz engine to create "Choose Your Own Adventure" scenarios and to allow students to experience rewards and setbacks* [24]. To achieve a more solid gamified experience however, one has to make use of Canvas extensions. Doing so runs the risk of those extensions becoming incompatible as they might not be continually updated along with Canvas.

Among the many Universities using Canvas, Chalmers University of Technology in Gothenburg is one of them. During 2018 Chalmers started to transfer from Ping-pong, a LMS developed by a Swedish company in Stockholm [25], to Canvas by introducing a few pilot courses which used the new system. The plan is to completely replace Ping-pong with Canvas by September 2019 [26], the reason being that ping-pong is not up to par and lacks a lot of the newer features that most LMS software has today.

2.2.2 Moodle

Moodle is an open source LMS initially developed by Martin Dougiamas and first released in 2002. It is mainly used for blended learning, distance education and flipped classroom [27]. According to an analysis by Edutechnica, Moodle is the third most used LMS by universities in the USA, after being surpassed by Canvas in 2017 [22]. In 2016 Moodle was the most used LMS in Europe by far [28]. The Moodle LMS software contains most of the common features found in LMS such as quizzes, assignment-submission, discussion boards, and peer assessments.

The system also incorporates a few basic gamification features such as progress-bars and badges.

2.2.3 Blackboard

Another popular LMS software is Blackboard. Blackboard is among the most popular LMSs in Europe [28] and has been the leading LMS is the USA for more than 6 years [29]. Developed by Blackboard Inc. it is one of the older LMS softwares being released 1997. A major update to the system was released in 2015, improving the user experience [30]. The system incorporates an extensive set of features commonly found in LMS software. However, other than achievements and badges, no gamification features are included.

2.3 E-learning

E-learning is the practise of receiving education through technology, be it an online course or a video series. This section describes some of the most well known e-learning services.

2.3.1 Khan Academy

Khan Academy is an online tool created to help students with their education. Founded by Salmar Khan in 2008 the site today has been translated to 36 languages and has about 18 million people visiting the site each month [7]. While there are different subjects available for learning, the biggest part of the available content is related to mathematics. Khan Academy teaches mathematics through a gamified experience where the user is tasked with solving math problems in order to receive points and badges. To learn how to solve these problems there are a large set of videos explaining the different concepts needed.

To make the learning as easy and efficient as possible each subject is divided into smaller parts. Each of these parts can be practiced until proficient. At the end of each subject is a test which contains questions about all the parts contained within that section. Completing the test allows the user to master these parts and eventually the entire subject, yielding additional points and badges.

2.3.2 Duolingo

Duolingo is an online language learning platform, currently offering courses in 32 different languages. In 2018, the platform had roughly 300 million users [8]. The different courses are built up of tests, containing questions related to a specific topic such as greetings or food. More advanced tests require the user to complete easier tests before they can attempt the harder ones. The platform makes abundant use of positive feedback, mostly through the duolingo avatar, the owl Duo. When the user is doing well, it praises the user and when the user is doing poorly, it puts focus on the fact that the user is learning through its mistakes. It

also makes use of badges, experience points and a virtual shop to provide the user with further goals.

2.4 Insert Coin

Insert Coin AB, a company located in Gothenburg, Sweden, is specializing on Gamification. The company was founded 2012 and mainly develop and maintain a SaaS called Gamify the World ENgine, or GWEN, which sole purpose is to offer great gamificaiton without requiring a lot of unnecessary overhead. To Gamify the World. That is GWENs purpose and the mission of Insert Coin.

2.4.1 GWEN

GWEN is a service developed by Insert Coin used to streamline implementation of common gamification patterns in external systems. GWEN aims to be an agnostic tool fit for most use cases and solves this by offering what are called modules. These modules are some of the most common gamification elements such as levels, achievements, missions and challenges. The modules are completely independent of each other, meaning that no user of GWEN needs to have the same set of modules as someone else. A user in this case is the customer who uses GWEN in his/her system, not the person who will utilize the actual system in the end. Depending on the set of modules and on which behaviour the user wants to encourage, GWEN adapts, making every instance a balanced and well designed gamification experience.

The type of gamification that GWEN provides is one where the process is infinite, that is, the system will keep encouraging the desired behaviours indefinitely. While there are a lot of clear goals, such as missions, which are small sets of objectives that yields a reward when completed, GWEN does not provide an end goal. There is no final state for the user to reach.

Figure 2.1: The gamification company Insert Coin is gamifying the world

3

Theory

Gamification and learning are two subjects heavily connected to different theories within the psychology field. This chapter contains summaries of the basic underlying psychology theories of gamification. To get a fuller understanding of gamification this chapter also describes common components of gamification. It also entails some basic interface design concepts which could be relevant for a project such as this.

3.1 Motivation theories

When gamifying an interactive artifact, the main purpose is to increase motivation and engagement in the users of the artifact through the use of design patterns commonly found in games. Knowing this, it is not difficult to make the connection that the basis of gamification research lies in theories surrounding human motivation and behavior. Two theories of motivation commonly discussed when it comes to motivation within game design and gamification are the Self Determination Theory (SDT) [31] and the Flow theory [32].

3.1.1 Self determination theory

SDT is a theory developed by Richard M. Ryan and Edward L. Deci [33] regarding human motivation and psychological well being. It splits motivation into two categories, intrinsic and extrinsic motivation. Intrinsic motivation can be described as motivation based on personal interest and enjoyment in an activity. Some examples of intrinsic motivation could be reading a good book because you find it interesting, or spending time with friends because it is fun. Extrinsic motivation is based on the result of taking part in an activity, rather than the activity itself. An example being going to work because your employer pays you to do it. Deci and Ryan states that a vast amount of research has shown that people being intrinsically motivated to partake in an activity, rather than extrinsically motivated, increases their psychological well being as well as their performance. [33]

The theory also describes three human needs which control a person's psychological well being, these being autonomy, competence and relatedness. Autonomy expresses a person's need to have control over their actions and choices, competence defines their need to feel like their actions are actively contributing to their desired outcome of the activity, while relatedness represents their need for

interaction and forming relations with other people [33]. Activities which satisfies these needs have a positive effect on motivation [34]. By keeping these three needs in mind, it is possible to design activities which stimulate them, increases self determination and in turn increases intrinsic motivation.
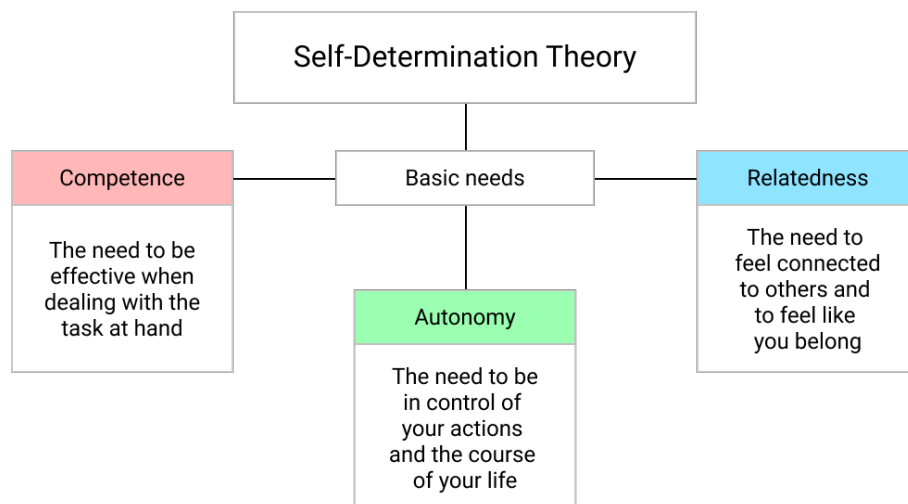
Figure 3.1: The three basic needs according to the Self-Determination Theory.

3.1.2   Flow

The theory of the 'flow state' is developed by Mihaly Csikszentmihalyi [35], which describes the state of mind where one is completely absorbed in the current task at hand. The state is characterized by complete focus, a sense of full control of the situation and a loss of self-consciousness and temporal awareness. It also fills the person with a sense that the activity is intrinsically rewarding, which both allows the person's skills to grow and also motivates the user to return to the activity. The main criteria for a person to achieve the flow state are clearly stated goals, continuous feedback of progress and a difficulty level fitted to the person's skills. These criteria are commonly met when implementing standard gamification patterns, more specifically, clear goals exist in the form of missions, levels and badges, feedback in the form of points, and scaling difficulty in the form of mission difficulty balancing. The conditions for the flow state are visualised in figure 3.2.

3.2   Gamification

While concepts which can be described as gamification has existed for a very long time, popular examples being membership cards to gather points at your local supermarket or getting every 10th coffee for free at your favorite cafe, gamification as an acknowledged concept has not existed for very long. The recent excitement surrounding gamification lead to many companies seeing it as a feature that is
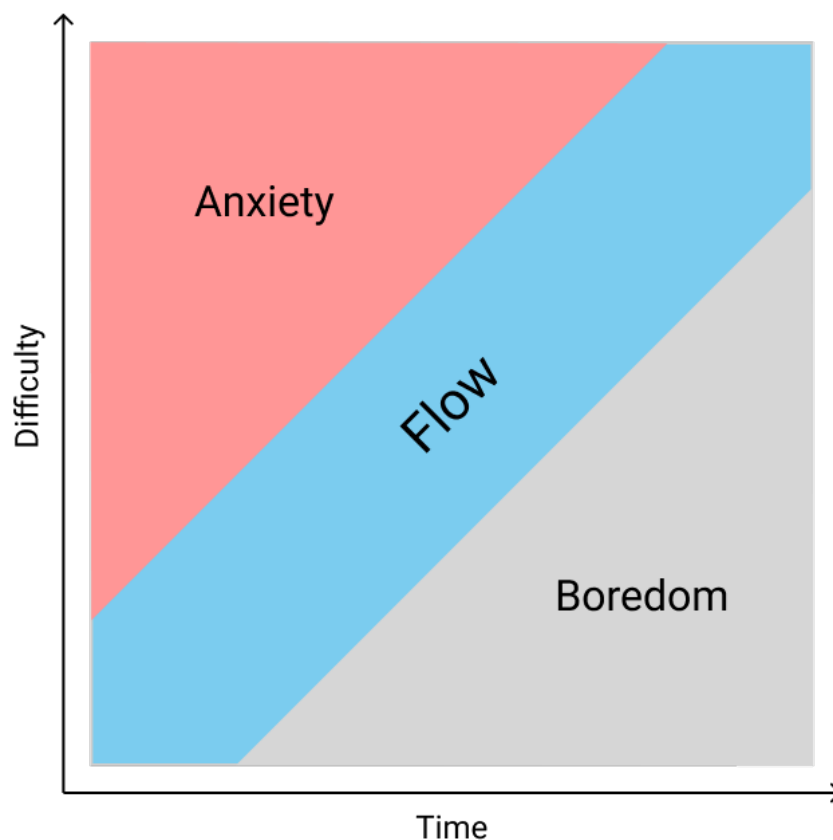
Figure 3.2: Increasing difficulty over time allows for flow.

simply added to whatever system you want just to magically see your user participation increase. While there might be some cases where this approach had a positive result, the most successful cases of gamification happens when the gamified experience is planned and designed from the ground up with heavy user involvement [17]. For this thesis the definition of gamification used is as in *From game design elements to gamefulness: defining "gamification"*, where Deterding *et al.* [3] defines gamification as:

> *"[...] the use of game design elements in non-game contexts."*

Gamification is not a way of making a game out of a non entertaining task, but rather a way of utilizing some of the elements that makes games so engaging and easy to come back to, and apply these elements to otherwise mundane but productive tasks, in order to motivate users to keep doing that task. It is important however, that gamification does not overshadow intrinsic motivation with extrinsic, but rather combine the two for increased performance [19]. In essence, this means that while the gamified experience should be fun and engaging, the users should not base his/her actions on getting as many points, achievements etc. as possible, as this rarely works in the long run. This is especially important in a

learning context as the will to actually learn is very important in education.

There are a lot of different game design elements. Knowing which ones to use when implementing gamification is not trivial. The following section summarizes some commonly used elements and their strengths.

3.2.1 Gamification elements

There are several commonly used elements when designing a gamified experience, which for different reasons provide incentive for the user to interact with a system. Most are general elements which can be utilized in most situations, while others are more fit for an educational context. Many of the mentioned elements can be tied to either the Self Determination Theory (see 3.1.1), being used to increase one or several of the basic needs which increase intrinsic motivation, or to the Flow Theory (see 3.1.2), being utilized to allow users to enter the flow state.

3.2.1.1 Narrative

A common game design element is the use of a narrative, or a story line, which lets the player experience a story with themselves playing the main character. Unlike other types of media such as movies or books, the narratives in games are interactive and hence not necessarily entirely linear. However, in most cases they still follow a common thread with the beginning, major plot points and ending being predefined. This element is often a way to make sure that the player follows the intended line of progression and does not skip to the end too early (Figure 3.3). Through defining this narrative beforehand, the designers of the game can also more easily balance the difficulty curve of the game to better fit the flow model.

As Palmquist describes, this design element can be translated to fit a gamified educational experience, as courses often have a chronological course plan. The different activities can be designed to relate to a larger context and be incentivised in a sensible chronological order [10]. An important consideration when designing a narrative in a gamification context is not making it too linear. Through implementing a number of choices the user can make which has impact on the narrative, one can increase the autonomy, and in turn self determination, in the user, which results in a positive impact on motivation.

3.2.1.2 Social relations

Another commonly found dynamic is the aim to build social relations. While there are single-player games where no interaction with other people is required during gameplay, playing with others usually enhances the experience. The same goes for gamification. By introducing a social aspect of the gamification it is possible to increase the need for relatedness according to the SDT. Palmquist also argues that performing tasks in a group can not only serve as a motivating factor, but can also result in an improved ability to learn [10]. It can be implemented through cooperative activities, because the opportunity to share one's knowledge can be a

Figure 3.3: In Crash Bandicoot the player has to complete each level in order to get to the next level and progress the storyline [36].

motivating factor, or through competitive activities, as the ambition to win is often a strong incentive.

3.2.1.3   Positive emotions

Positive emotions is an evident motivational factor. If an activity evokes positive emotions in the user, that user will want to keep experiencing those emotions through continuous participation in the activity. Gamification aims to bring forth emotions, such as self esteem and pride, through the means of positive feedback, putting focus on the success of the user while putting less attention to its short-comings [10]. Approaches include praising the user when they succeed, and also shifting attention to the fact that failure also is a form of progress, should they fail. Remarking the successes of the user also satisfies the need for competence, according to the SDT.

3.2.1.4   Instant feedback

The concept of *feedback loops* is commonly used in game design [37]. Feedback loops can either be positive or negative. In the context of gamification a positive feedback loop is usually one where, when the user does an action, especially when that action is considered good, the user get feedback which in turn gives the user motivation to keep doing these actions. Instant feedback is also one of the main criteria for a user to enter the flow state. What good gamification does well compared to real life scenarios, such as in education or in working environments, is providing this feedback immediately after the action has been performed. An action is followed by a reaction. In real life scenarios this is often not the case as the feedback can be delayed days or even weeks after an action has been per-

formed.

Instant feedback is often given in the form of notifications, i.e. when reaching the next level (example figure 3.4), or animations, i.e. a progress bar being filled as the player receives experience or numbers ticking up quickly as the player gains points. For extra effect a sound can be played as the feedback is received, making it easier to notice.

Figure 3.4: A message is displayed in the center of the screen, coupled with a big flash of light, when a player reaches the next level in Diablo 3 [38]

3.2.1.5 Goals and progress

One of the most important aspects of gamification is the use of continuous feedback of the users progress and a transparent goal setting. By constantly reminding users of their progress through various visual elements, it shows the users that their effort is paying off, and that their skills are improving, satisfying the need for competence [19]. This practise is closely related to the goal-setting theory, which argues that peoples motivation to complete a task is related to how the goal to complete that task is set. Among other things, the theory states that providing a person with goals which are well defined and specific rather than general and vague improves the persons performance when working towards that goal, as well as the importance of providing feedback to the person as it helps the person know how well they are doing and how they need to adjust their actions to do better. [39]

3.2.1.6 Incentives and rewards

The use of incentives and rewards is a fundamental element in gamification. Providing users with rewards for engaging in the different activities can serve as both an external motivator and as feedback of their progress. The rewards can be lasting, such as points, badges, achievements or currency, or they can be non-lasting, such as praise and positive feedback. The user is commonly rewarded for three separate behaviours, which include engagement, completion and performance. Rewards for engagement are awarded for simply taking part in a task, rewards for completion are awarded when a user has completed a task, and a reward for performance is awarded depending on how well a task has been performed. It is important to balance how often users receive rewards, as it has a big impact on how well the rewards work as a motivational factor. If they are awarded too seldom they run the risk of having no impact, while if they are awarded to frequently they might become uninteresting, or the users may become dependent on the rewards to complete the tasks. [10]

Lesson Complete! +10 XP

You are 40 XP away from your daily goal
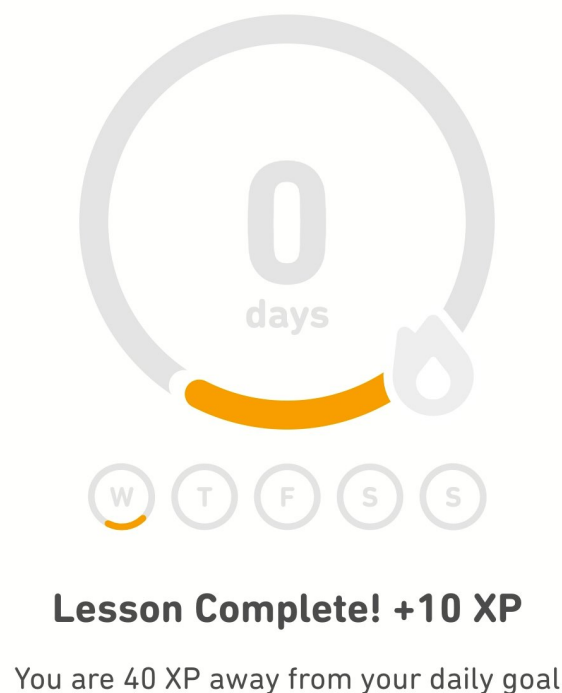
Figure 3.5: Completing lessons in Duolingo rewards you with XP.

3.2.1.7 Avatars

An avatar can be described as a personified graphical representation of an agent inside a digital system. An avatar can both be a representation of the user itself, or it can be a representation of the system, providing the user with instructions and feedback[40]. Figure 3.6 shows examples of avatars used for user representation in the gamified learning platform Khan Academy.

According to Emad Henin and Sandra Abadir, an avatar representing the user plays a large role for the users engagement with the system, as it provides them with a more intimate relationship with the system in the form of a bond between the player and the visual manifestation, while also boosting their self esteem [41]. User avatars can often be personalized through customization options which lets the user decide its appearance through changing elements such as body features, clothes and accessories. It is not uncommon for customization features to be unlockable through i.e. completing a feat or through a purchase with system currency. A study conducted by Takayuki Furukawa *et al.* showed that a majority of students expressed that unlocking avatar customization made them to some extent more motivated to study [42]. Using an avatar as an instructor is common in e-learning contexts, where the avatar provides the user with someone to relate to in the same way they would relate to an actual teacher in a traditional educational context. The avatar also makes the system more interactive, as the avatar can provide the user with instructions, tips and feedback [43].
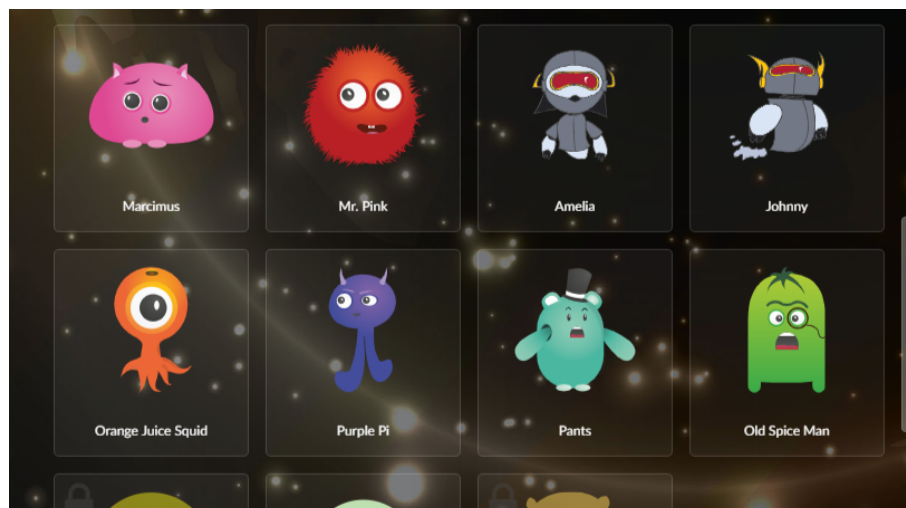
Figure 3.6: Avatars available for use in Khan Academy

3.2.1.8   Level and experience

Commonly found in games, a level is a numerical value representing a player characters progress, which increases when certain goals have been achieved. This goal is often on the form of attaining a certain amount of experience points which are gained through various means. Reaching a higher level often results in the player being rewarded, sometimes with improved attributes and abilities of the character, or with some sort of unlockable reward [44].

This gameplay design pattern is often used in gamified systems, but since gamified systems often miss the aspects of character progression found in games which incorporate levels, the levels need to feel significant through other means. Duggan and Shoup argue that levels serve two important roles in gamified sys-

Figure 3.7: A list of achievements available for the game Seasons after Fall through the Steam platform

tems. Firstly, gaining a level provides the user with satisfaction, motivating them to pursue the next level. Secondly, the user's level represent their expertise, which becomes a symbol of status for players of a lower level [45].

3.2.1.9 Achievements

Another common gameplay design pattern which is easily translatable to gamified systems is achievements (or badges). Staffan Björk defines achievements on his gameplay design pattern wiki as *Goals whose fulfillment is stored outside the scope of individual game sessions.* He continues to explain that achievements are rewards for completing specific goals, such as progressing a certain amount, taking part in optional gameplay, or completing a task a certain amount of times [46].

The concept of achievements is by no means new. A good example of the concept being used to motivate people can be found as early as the 1910s when the badge system was introduced to the scout movement. Achievements in gamified systems are often represented through a visual "badge" (figure 3.7), Judd Antin and Elizabeth F. Churchill explains that the functionality of achievements include providing the user with further goals. Much like gaining a level, completing an achievement is satisfying for the user. They continue to explain that achievement also serve as status symbols as they communicate the users past successes in the form of their achieved goals [47].

3.2.1.10 Currency and shop

A gamification pattern sometimes used in business related gamified systems is that of the in-game currency and an accompanying shop. It allows employees to gain in game currency inside the gamified system and spend it on benefits outside of the system, such as discounts on company product or an option to make

their schedule more flexible [48]. It is also commonly used in various eCommerce services, where users earn points when purchasing items, which can then be used to get discounts or other benefits. This pattern fits an educational platform well, as an educational context is in many ways much like a business related context. Students could earn currency through completing tasks the learning platform and then spend it on various benefits related to their education.
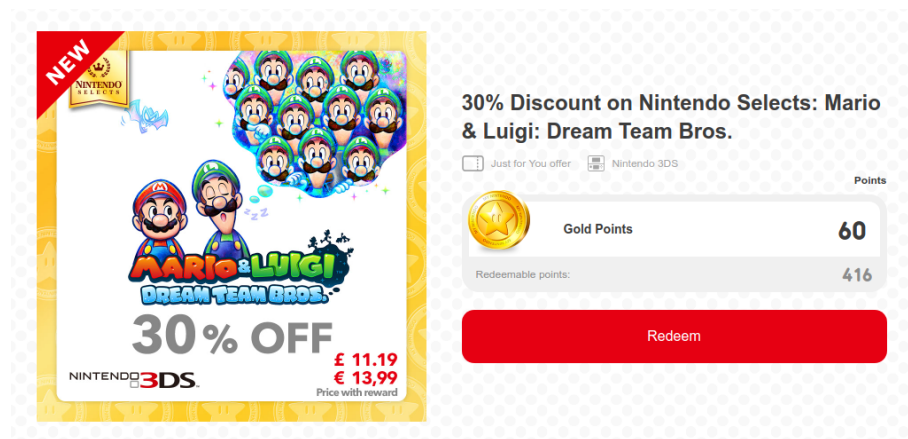
Figure 3.8: The Nintendo Shop offers discounts in exchange for virtual currency. That currency is earned through having made previous purchases within the shop

3.2.1.11 Progress indicators

The progress indicator is a common design pattern both in games and in non-game contexts. It is a visual representation of progress towards a goal, and it can take many forms. The most basic and common form of a progress indicator is the progress bar, a bar which fills with color gradually as the user gets closer to the goal. In a gamified system it could represent the amount of experience needed to reach the next level. In a gamified learning platform it could also display how much of the course material the student has taken part in.
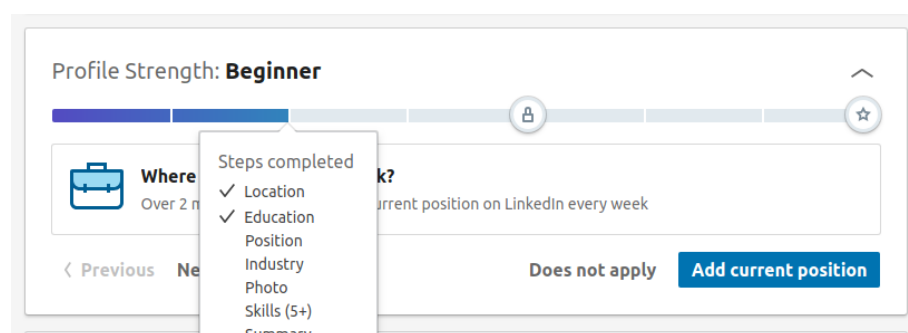
Figure 3.9: The progress indicator on a LinkedIn profile representing how complete the users profile is with information.

3.2.1.12 Competition

As previously mentioned, one way to implement social interactions in a gamified system is through competitive elements, where the users can compete against each other. While it is a commonly implemented element, studies has yielded various results regarding its effects on the contestants' motivation. A study conducted by Juan C. Burguillo on students competing against each other in a course in programming pointed to competitive elements having a positive impact on the students' motivation, while another study conducted by Deci *et al.* on testers solving puzzles suggested that testers under the impression of competing against others were less motivated than the testers who were simply instructed to do their best [49] [50].

As follows with a competitive environment, implementing competition could also lead to students only acting in their own self interest, rather than offering to help their peers, which is an undesirable and unhealthy culture for educational contexts. Karl Kapp argues that a successful implementation of competition in an educational context needs to be designed in a way that emphasizes that winning or losing does not matter, but that it is rather the process which is in focus. He also argues that it is preferable to divide students into smaller groups which compete against each other to keep the number of individual contestants to a minimum, and the length of the competitions should be enough to allow students to be able to catch up if their initial performance is poor [51].

3.2.1.13 Skill trees

A skill tree is a gameplay design pattern commonly found in games with RPG elements (example in figure 3.10). It can be described as a set of skills and abilities which the player can learn by gaining talent points through various means of gameplay. Skills are represented in the skill tree as nodes in a tree structure, and learning skills often require you to first learn the skills in all parent nodes. It is a powerful tool for adding depth and replayability to games [52].

The skill tree can be easily translated to a gamified learning context, as different courses can be represented as skills in a skill tree, each requiring knowledge in a previous, less advanced course. It is a good tool for displaying a students progress through their education and helps the student understand how the different courses or subjects relate, and what their requirements are. Displaying the many choices between courses also helps stimulate the need for autonomy according to the SDT. [10]

3.2.2 Gameful design

Gameful design is a topic very similar to gamification. So similar that the end user of a product developed with gamification or gameful design in mind might not be able to tell the difference. Gamification aims to utilize game design elements in order to reach a goal, be it increase motivation, productivity or retention. Gameful

Figure 3.10: In Titan Quest players get skill points when leveling up which can be spent in order to gain new skills and increase in power [54].

design focuses on creating a gameful experience for the users. Both methods produce similar results and often overlaps but the difference can still be quite important to know about [53]. Christo Dichev *et al.* writes about gameful design as a method where, instead of using extrinsic motivators, game elements are used to improve the experience and make the users feel good for expressing their creativity rather than feeling good about getting points. The biggest difference in how it is utilized is that Gameful design aims to have the developer(s) think like a game designer rather than simply using game design elements.[19]

> *"No amount of points can keep someone (especially students) engaged in a bad game." - Dichev et al. 2014*

3.3   E-Learning

E-learning refers to the concept of receiving education through digital means, for example online courses. E-learning utilize a wide variety of tools, including texts, videos and quizzes, while also making use of social learning through for example discussion boards, chat rooms and editable wikis. E-learning is generally split up into synchronous and asynchronous courses. Synchronous courses allow students to digitally attend scheduled real time sessions with an actual teacher, while in asynchronous courses, the student sets their own pace, as the course material is accessible at anytime, at the expense of not having any real time teaching ses-

sions. [55] Jorge G. Ruiz *et al.* cites several studies in their report *The Impact of E-Learning in Medical Education* that E-learning have shown to be more useful, cost effective and result in better user satisfaction than traditional learning contexts. [56]

3.4 Graphical Interface Design

As with almost any interactive system on a computer, smartphone, tablet etc., a graphical user interface (GUI) has to be designed. While interfaces can have very different appearances depending on the context, there are guidelines thoroughly refined over the years for what to consider when designing interfaces.

3.4.1 Designing for flow

As previously described in section 3.1.2, flow is a state where a person is completely absorbed by a task and almost completely unaware of his/her surroundings. This is of course something to strive for when it comes to designing software for productivity. Alan Cooper *et al.* states that in order to best support flow, software has to become transparent, meaning that the software should almost become invisible when the user is in a state of flow. It should feel like an extension of one's arm [57]. To achieve this one needs to remove as much as possible of what is in the way of users doing what they want, and doing it how they want to do it, with the system. Obstacles such as these are called excise.

3.4.2 Excise

Excise is when a user has to perform more actions than necessary to reach a goal, or when the user is performing a task and is suddenly interrupted by something unrelated to what the user was doing. Excise is bad and should be avoided as much as possible. Excise can be divided into four kinds: navigational, skeumorphic, modal, and stylistic.

- **Navigational excise** - The excise of when the user has to do unnecessary or difficult navigation. Almost any navigation the user has to do is excise. Well designed navigation reduces the amount of navigation required to perform a task to a minimum. In software navigational excise occurs when navigating...
    - ...across multiple windows, views or pages.
    - ...across multiple panes or frames within a window, view or page.
    - ...across tools, commands or menus.
    - ...within information displayed in a pane or frame (scrolling, panning, zooming etc.)
  [57]

- **Skeumorphic excise** - Excise carried over by the fact that something is designed to be familiar or similar to existing products, also known as skeumorphism. While skeumorphism can be useful at times, it can cause excise by being unnecessarily cumbersome in a software context. Many times software could do something in a much more efficient manner than the physical product it is trying to replace.

- **Modal excise** - Excise occurring when unnecessary "mode-switching" occurs, i.e. when an error message window appears on the screen, hindering you from doing further work until you've pressed "OK" or something similar. This is unavoidable at times but can often be reduced by for example using modeless feedback such as notifications or by not asking users for permission unless completely necessary.

- **Stylistic excise** - Excise when the user has to do too much visual decoding to understand an interface, that is, when there are too much visual clutter, making it difficult to find the information that's useful to the user. This can be mitigated simply by designing an interface with the minimum amount of information needed displayed at each point in time.

4

Methodology

This chapter summarizes different commonly used methods within the field of design. These methods are included in an attempt to make sure that the result of this thesis is produced using established practices. The methods are split into research related methods and interaction design processes and methods as research and interaction design are the main practices of this thesis.

4.1   Research

This section describes different research methods commonly used for design related research.

4.1.1   Research Through Design

Research through design describes the research method commonly used by designers in the HCI field, in which designers produce a design meant to provide a solution to a problem. The answer to the research questions is derived from the design itself, with the design being viewed as a realization of the knowledge and experience the designer gained when researching the problem. The answer to the research questions often comes in the form of a set of recommended approaches, or guidelines for dealing with similar problems. [60].
The main benefits of Research Through Design is that it is a useful method for addressing so called *wicked problems*, something which conventional science and engineering methods does not do very well. It also provides useful ways for Interaction designers and the HCI community to spread knowledge and make contributions which utilizes real skill and focuses on attempting to make the right thing. [61]

4.1.2   Design Science Research

"Design science is a creative, and often iterative, problem-solving process that builds and evaluates purposeful artifacts" [58]. Despite being a research methodology that has proven to be valuable for design science, Design Science Research (DSR) was slow at becoming well used within the community. Ken Peffers *et al.* stated that this was because of the lack of a commonly accepted framework for the practice [59]. This changed, however, as Alan Hevner *et al.* published what

has since grown into being a well used set of guidelines for DSR [58]. The guidelines are as follows:

1. **Design as an Artifact** - Design-science research must produce a viable artifact in the form of a construct, a model, a method, or an instantiation.

2. **Problem Relevance** - The objective of design-science research is to develop technology-based solutions to important and relevant business problems.

3. **Design Evaluation** - The utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods.

4. **Research Contributions** - Effective design-science research must provide clear and verifiable contributions in the areas of the design artifact, design foundations, and/or design methodologies.

5. **Research Rigor** - Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact.

6. **Design as a Search Process** - The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment.

7. **Communication of Research** - Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences.

4.1.3   Producing Guidelines

In order for a design to produce something of research value the design most likely needs to be abstracted in some form. Research through design often tries to solve wicked problems. As described by Richard Buchanan, wicked problems are inherently indeterminate in the way that they have no definitive constraints and that there is no single solution to them. He continues to explain that the research problems designers often face are of the wicked variety because, unlike traditional scientific research areas, the matter of design is subjective in the sense that it is up to designers themselves to decide what is good or bad design [62]. William Gaver writes the following:

> *"The goal of conceptual work and research through design is not to develop theories that are never wrong, it is to create theories that are sometimes right."* [60]

He concludes his paper by stating that the HCI community should be careful producing norms that everyone has to follow, but rather create frameworks or guidelines that could have the possibility of creating a better design if put to use in the right context. While there is no way to find the perfect solution to design, creating guidelines can be useful to others whose problem has similarities to the problem which the guidelines were constituted for solving.

4.2 Interaction Design processes

In order to be able to develop useful guidelines, thorough research had to be done on commonly utilized design processes. Knowing and utilizing these processes during the research process is a vital part of creating guidelines which will be useful in other scenarios.

4.2.1 Iterative Design

There are a multitude of different approaches when it comes to working with development and design. Designing interfaces is naturally a quite iterative process. Planning every little detail in advance in order to create the best design possible in one attempt is rarely a good idea [63]. Over the years methods making use of iterative design has been developed in order to efficiently create well developed designs. Figure 4.1 is an example of an iterative design process.

An iterative design process is a potentially endless process where a design goes through a set of stages. Each loop through these stages is an iteration, which aim to leave the design better than before the iteration. While this could go on forever, as most designs could be improved indefinitely, it is usually constrained by limited time and/or resources, which means that a design eventually reaches a point where its considered finished or "good enough".

4.2.2 User-centered design

When developing a product using User-Centered design (UCD) the focus lies on the needs of the users by placing them at the center of each design decision. However, it is not the user that creates the product, and it is not about directly asking users what they want, rather it is defining their behaviours and creating a design based on that [64]. In practice this means not only performing interviews and getting to know the needs that the users know or think that they know, but also researching the actual context. Chadia Abras *et al.* writes about the history of UCD and about different methods useful for user involvement, such as usability testing and participatory design [65].
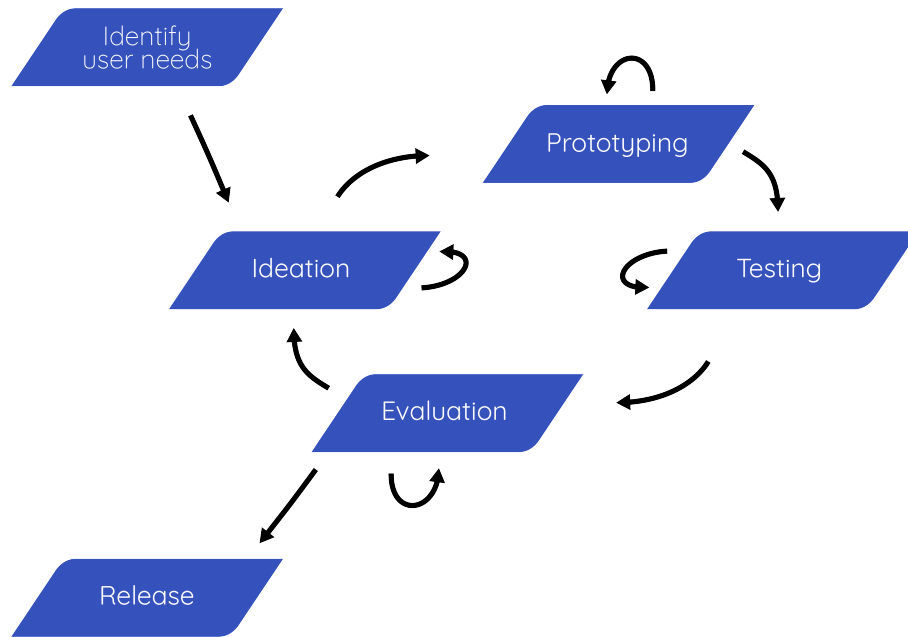
Figure 4.1: A flowchart representing the iterative design process.

4.3 Interaction Design Methods

Just like knowing the processes used in interaction design is important for making good guidelines, so is knowing about the different methods. This section goes into detail on commonly used interaction design methods.

4.3.1 Ideation

In order to fully develop a concept and/or product that fulfill a given set of requirements, solutions to these requirements are needed. Ideation methods are methods which aim to support the creativity process and thereby create a larger set of possible solutions, some examples being bodystorming [67], brainwriting [68], SCAMPER, skewing, sketching or mind mapping.

4.3.1.1 Brainstorming

A very common and popular ideation method is that of brainstorming. The aim of a brainstorming session is to produce a large number of ideas while keeping encouraging free thinking and discouraging criticism. Allowing designers to ideate in such an environment allows them to produce a large variety of ideas, consisting of both their own ideas and additions to others' ideas. To keep ideas on topic it is important to clearly state the question or problem which needs to be answered before the session. [69]

4.3.1.2 Skewing

Skewing is the method of taking an already existing design and changing one or more of its properties in order to produce or get inspiration for new ideas. Firstly, a design is analyzed and its properties listed according to a suitable predetermined framework describing the interactions with the system. One or more of the listed properties is then changed, or skewed, which produces a new concept. Many different new ideas can be produced by changing which property is being skewed. [70]

4.3.1.3 Sketching

Sketching allows designers to express their ideas through a simple sketch. A sketch of an idea often provides a better explanation of an idea than words would, and having a concrete image to look at often helps with sparking further ideas and with finding flaws in the idea ahead of time. The sketches should be simple, focusing solely on relaying the core of the idea in order to not waste time on details. [71]

4.3.2 Prototyping

In order to test the validity of the design concept, designers produce prototypes. A prototype is a physical rendition of the concept produced from ideation, used to test how well the design works in practise. Different methods of prototyping is used depending on the desired level of detail of the prototype, referred to as the fidelity of the prototype. Low fidelity prototypes are of less detail, but also requires less time and effort to produce, which makes them suitable for testing more general design elements early on in the design process. High fidelity prototypes are of higher detail, and represents a more accurate rendition of the final product, but takes longer to produce, which makes them more suited for testing out more minor details after the general design is already decided. [67]

4.3.2.1 Paper prototyping

When designing graphical interfaces, paper prototyping is a very common method for producing and evaluating a low fidelity prototype. Every possible interface element is drawn on a piece of paper and the interface is represented by putting the different elements together to form a screen. Interactions with the design is then represented by switching out the different elements on interactions. This is a quick and inexpensive method for early testing of a design. [67]

4.3.2.2 Wireframing

When designing an interface there are many factors that come into play. Completing an interface can often take up a lot of time. Wireframing aims to remove a lot of unnecessary work by only managing the basic elements of a UI, placing content and functionality before any design has been made. Managing wireframes is a lot easier than moving elements around in a more complete interface and is a

lot quicker to create. Wireframing is also a great tool for conveying ideas about how an interface should be laid out to other people [72].

4.3.3 Testing

In order to narrow down the set of possible solutions to the given requirements as well as making sure the current progress approaches a solution to some or all of the given requirements testing is required. The following methods are some ways of acquiring test data, which can be useful for the evaluation stage.

4.3.3.1 A/B testing

A/B testing is a evaluation method which tests two separate designs that share the same goal, and compares the results, determining which design did the job better. The two designs are released to two different groups of randomly selected users and then their interactions with the designs are recorded in order to statistically determine which design is more fitting. This is a good method if you just want to compare which of two designs work better in practise, but it gives no information as to why the design works better, unlike other evaluation methods such as the cognitive walkthrough. [67]

4.3.3.2 Cognitive Walkthrough

Cognitive walkthrough is a method which tests the usability of a design through analyzing each action the user can take. Each action is analyzed through asking the four questions: Will users want to produce whatever effect the action has? Will the user see the control (button, menu, label etc) for the action? Once the user finds the control, will they recognize that it will produce the effect that they want? After the action is taken, will users understand the feedback they get, so they can confidently continue to the next action?
Through asking these questions, designers can determine which actions help the user progress towards their goal, and which actions hinder them. Its most common use is to evaluate the experience of a user with no prior experience with the system. [67]

4.3.3.3 Think-Aloud Protocol

As with many concepts used in User Experience (UX) design, Think-Aloud Protocol is borrowed from cognitive psychology. The method is performed by having a user perform a task or set of tasks while "thinking out loud" or verbalizing everything that crosses his/her mind while performing the tasks [73]. This method is very advantageous as the user gets to perform the task with little to no affect on his/her thought process except for slowing down the process slightly. The elicitor gets to see every little detail of the interaction, such as the body language of the user, which gets lost when for example having the user write about his/her experience instead. Recording the process also allows for very qualitative elicitation.

4.3.4 Evaluation

Evaluating the results of previously used methods helps in the process of researching and discovering what requirements the final product must fulfill. The process includes users as good requirements does not come exclusively from the customer or developer. Finding requirements could be seen as a constant process. In an iterative design process evaluation is an important step in each iteration as the requirements of a design often changes during development [66]. Evaluation is the phase that makes sure that the iterations are actually improving the result and not the opposite. The evaluation phase can also result in additional possible solutions which could be useful in following iterations. The following methods are useful for this purpose.

4.3.4.1 Interviews

While the interview-method is applicable to almost any stage of a design process it is very useful for direct collection of user experiences, thoughts, ideas and so on. Interviews can be performed in many different ways. Structured interviews poses a predefined set of questions and does not go off script while unstructured interviews depend on the interviewer coming up with questions as the interview progress. Semi-structured interview consist of a set of predefined questions but does not hinder the interviewer from asking other questions as he/she sees fit. They all have their different advantages.

The type of questions can also vary. Most commonly the interview aims to gather qualitative data, asking questions which does not have a small set of possible answers. However, while interviews can be used to gather quantitative data there are other methods which are better suited for this purpose, such as questionnaires for example. [67]

4.3.4.2 Content Analysis

A content analysis is a method used to analyze qualitative data gained from interviews, or other methods which generate qualitative data. Designers systematically go through the gathered data, identifying common themes and categorizes the different answers accordingly. It helps designers identify the areas users find most important [67] and often results in findings which wouldn't have been found otherwise.

4.3.4.3 Affinity Diagram

A method closely related to the content analysis is affinity diagramming. Designers go through the gathered data and writes down each single observation on a post-it note. When all data has been analyzed, the post-it notes are put on a large enough surface which allows the designers to move them around and separate them from each other. The observations are then analyzed and categorized by moving them into different areas, one for each category. This provides the designers with common themes in user data, helping with prioritization. [67]

4.4 Front-end development

One of the most common places where Interaction Design is applicable is within web development, specifically front-end development. Gamification is often found in web applications or sites, and learning management systems are often implemented as a web application, mainly because of its accessibility. The following section summarizes a few front-end development frameworks, at the time of writing commonly used within the field.

4.4.1 Angular

Angular is an open-source front-end web application platform which was released in its current form during 2016 [74] after being completely re-implemented. While Angular is a fairly well used framework its popularity went down during 2018 [75]. Angulars main focus is building applications, rather than user interfaces, and is therefore considered more difficult to learn when compared to other similar front-end frameworks [76].

4.4.2 React.js

React.js (or React) is a JavaScript framework used for building user interfaces and single-page applications. It is, at the time of writing, the most popular front-end JavaScript framework, mainly because of its ease of use and elegant API [77, 76]. React is developed by Facebook along with a community of developers and companies and was initially released in 2013 [78].

4.4.3 Vue.js

Vue.js (or Vue) is a JavaScript framework used for building user interfaces and single-page applications. It is the newest framework compared with React and Angular and therefore has not yet become as popular as the other frameworks. Nonetheless, it is growing in popularity because of its ease of learning for developers [79, 76]. It is developed by Evan You, a former Google employee who wanted to do create a more lightweight library with the features from Angular that he liked [80]

5

Process

This chapter will be focusing on the different phases of the working process in a chronological order, with each section detailing our decisions made and methods used in each phase. After the initial planning and research phase an iterative process was started. Each iteration has its own section and contains a summary of findings made during the iteration, changes made to the platform and addition/changes made to the draft of guidelines.

5.1 Forming the research question

The thesis project was developed in cooperation with Insert Coin AB. During the initial contact with Insert Coin, a meeting was set up with Johan Gustafsson, the CTO of the company. During this meeting, two main research topics was discussed, both related to using gamification to increase motivation and engagement in users, using GWEN. The first topic regarded an implementation of GWEN into the instance of the learning management system Canvas currently used by Chalmers University of Technology, analysing student retention rates and engagement and comparing results from before GWEN was implemented.

The second topic regarded the implementation of a game and testing two versions of the game on users, one version with GWEN implemented and one without, in order to see how well the GWEN engine works when implemented in a game context. We were recommended to contact Adam Palmquist, gamification designer at Insert Coin and gamification researcher at the University of Skövde, for further research idea discussions.

When making contact with Adam, mainly the first topic was discussed and we decided to pursue writing a master's thesis regarding this topic. After a number of meetings with Adam, Johan and other staff at Insert Coin, discussing the details and scope of this research topic, we came up with the following research question:

What factors should be considered when implementing gamification patterns into a digital learning platform with the intent of increasing student retention rates in higher education?

5.2 Planning

This section details the planned working process of this project as well as the time plan summarizing what was planned to be done during each week. It also includes a description of what actions will be taken in order to stick to the plan, as well as what will be done if the project falls behind schedule.

5.2.1 Planned working process

Before any substantial project work could be done, we planned to do preparatory research regarding gamification as a tool in education, as well as spend time learning the systems which will be utilized in the implementation. These systems include first and foremost GWEN, but also different learning management systems in order to gain an understanding of how they commonly operate.

After enough preparatory work we planned to start the development of the GWEN implementation into Canvas. This development would then happen in cooperation with Insert Coin, with the goal to deploy at the end of March to be used in a course at Chalmers over a period of two months. During this time, the plan was to analyse any results the design had on student engagement and retention rate, while also doing testing, evaluation and continued development of our own, separate version of the platform. Our platform would then be compared to the Canvas implementation on regular intervals in order for us to exchange feedback with Insert Coins' development team. These results in combination with feedback from students and others engaged in the four courses will then be used by the group to write a set of guidelines useful for implementing gamification into learning platforms.

5.2.2 Time plan

This section shows the initial timeplan created for this project.
The project starts monday the 21st of January 2019 and is aimed to be complete around the 9th of June the same year. Throughout the process the group will develop a set of guidelines which will be refined regularly. A final report will also be worked on during the entire project. The following is a brief planning:

- **21/1 - 17/2 (Week 1 to 4)**
  - Planning the project in more detail
  - Research gamification and existing social systems, and perform user studies
  - Learn about existing systems, frameworks and practices used by the company but also in other similar instances.
- **18/2 - 14/4 (Week 5 to 12) - First iteration**
  - Design and implement the system
  - Perform additional user studies
- **15/4 - 28/4 (Week 13-14) - Second iteration**

  - Evaluate and redesign the system
  - Perform additional user studies
  - Develop an initial set of guidelines
- **29/4 - 12/5 (Week 15-16) - Third iteration**
  - Evaluate, improve and finalize the design
  - Improve the set of guidelines
- **13/5 - 9/6 (Week 17-20)**
  - Write report
  - Finalize the guidelines
  - Prepare presentation and opposition
  - Listen to other presentations

The main part of the project is divided into iterations. The first iteration is significantly longer as that will be when a lot of setup work has to be done in order to be able to produce results. However, the quicker the setup-phase is finished the more time there will be for refinement.

5.3 Pre-studies & preparatory work

In order to specify which topics was of relevance, the following steps were taken:
- Discussions with people working with gamification
- Discussions with people knowledgeable about the psychological elements going into gamification
- Discussions with people working in education
- Reading articles about gamification from well established researchers within the field

After having narrowed down the topics relevant for the research the main sources of information was Google Scholar [81] and ACM Digital Library [82] with free access to a lot of resources through the Chalmers student privileges. The studies was divided into methods of gamification, psychological theories, educational topics and UX design topics, with the most focus put on researching gamification methods. Psychological topics such as psychological frameworks were studied as they are the underlying theories and motivations for gamification and are necessary to know about when designing good gamification. Knowing the different learning methods utilized in schools was also an important topic as it would be necessary to compare gamification as an educational tool to other methods of teaching in order to properly validate the effectiveness of gamification.

During this phase it was discovered that it would be a lot more difficult to achieve the intended integration of GWEN (see 2.4.1) into Canvas. This lead to a decision where, instead of working along side Insert Coin on implementing this integration we would immediately start making our own LMS implementation where we would have full control over how the software interacted with GWEN. While this perhaps led to less discoveries on the effect that the gamified Canvas version had on the students taking the course, we believed that making our own platform

would lead to a better gamified experience and thereby a better support for creating guidelines for gamified LMS software. This had a big impact on how the continued work on this project would turn out. A lot of the effort would be put on implementing this other LMS and integrating GWEN into it rather than doing research on an existing system. This decision was made on the premise that the most focus would be put on the implementation of the gamified experience, while the layer of LMS features would be down prioritized, only being implemented to work on a surface level if possible.

5.4 Iteration 1

The goal of the first iteration was to gather enough information to make well informed design decisions for the first prototype of the platform. Furthermore the goal was to learn enough of what was required to implement these designs. During the starting phase of this iteration a lot of discussions were held with people from Insert Coin in order to get an understanding of the technical requirements, as well as for us to get a feel for what direction we wanted to take the platform and the Gamification experience. We also came in contact with the program responsible and teacher for the *Automation and Mechatronics engineering* program, who gave us some valuable insights when it came to the whole concept of gamified education from a teachers perspective, as well as some approaches they found to be useful when designing courses to motivate and engage students.

The first iteration was the longest one by far as there was a lot for us to learn during the entire process and also as we had to get a hold of a lot of people in order to make the best of our design and research.

5.4.1 Questionnaire

In order to further narrow down the requirements of the gamified LMS we created a questionnaire. We chose questionnaires as the form of elicitation as this would more easily be distributed to many and result in a lot of both quantitative and qualitative data. The questionnaire in its entirety can be seen in appendix A and the results in appendix B. The way we shaped the questionnaire was with two goals in mind. To generate qualitative data which could either support previous theories we had read about, such as the fact that students learn best from doing practical exercises, or to find new discoveries; and to generate qualitative data such as ideas for features to include in the platform. The questions in the questionnaire was divided into the following categories: Studies, LMS and gamification.

The questionnaire was made available for university students, most of which were studying Interaction Design and Technologies. In total the questionnaire yielded 54 results in a week.

5.4.2 Observations and interviews

During the early part of the iteration a lot of opportunities appeared for us to attend meetings at the Insert Coin office space. The meetings were mostly about different parts of the gamification of Canvas project, during which we made different observations on what behaviours they strove to drive the users towards, what kind of activities teachers favored and why, and also what technical difficulties there were and why. Some of the meetings ended in a small interview between us and the people we thought would have the most relevant information. The interviews were semi-structured (see 4.3.4.1) which kept the door open for new ideas and discoveries.

5.4.3 Affinity Diagram

Having gathered a lot of data, both quantitative and qualitative, from the questionnaires (see 5.4.1), we needed a way of analysing and consolidating it into actual requirements. As both of us had experience with Affinity Diagram (see 4.3.4.3), as well as preferred it over a lot of other methods, we chose this as our way forward. As seen in figure 5.1 the sorting of the different insights resulted in a number of different categories which in turn were used to construct a set of requirements for the platform. In summary the affinity diagram resulted in a lot of observations of what people were sceptical about when hearing about gamification. Many of these came to be things we tried to avoid during the entire design process in order to not live up to these poor preconceptions. The observations were divided into the following categories:

Distractions	Extra steps	Convenience	Addictive properties
Competition	Seriousness	Relevance	Features
Extrinsic motivation	Feedback	Organization	Intrusiveness

These categories were then used when making the requirements for the platform.
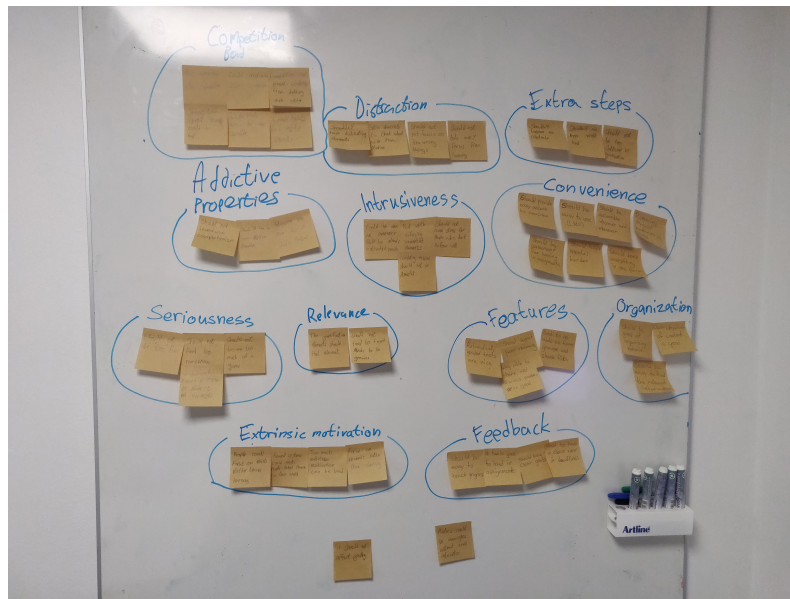
Figure 5.1: Affinity diagram of questionnaire answers

5.4.4 Designing the LMS

Using the requirements, we created basic mockups of the LMS interface. The layout of the interface was based on the look of the interface of Canvas, since the initial plan was to make an implementation integrated into Canvas, and also to reduce time spent on the layout design, allowing us to focus more on designing the gamification and content. We decided to change some elements to be more, in our opinion, intuitive, such as merging views or pages which were closely related. Other elements which does not have any impact of the gamification aspects of the system were also simplified or excluded, such as email functionality or student cloud storage. The mockups were created using Figma [83], which is a collaborative interface design tool. The entirety of the created mockups can be seen in appendix C.

5.4.4.1 Course modules

In order to better present the course material in a coherent narrative we decided to present courses in the form of course modules, similar to modules in Canvas. A course module is focused around a specific fraction of a course, which could be a specific time period in the course schedule, or a more specific subject taught in the course. The course modules contains sets of objectives, which consists of different types of course materials. An objective could be to read an article, to take a quiz or to hand in one of the course assignments. The full course is made up of several course modules, which in turn are made up of objectives. The reasoning behind this design is to present students with what they are expected to do in the course and how much of it they have already done, because a large part of gamification is presenting users with clear goals, as well as clearly showing the users progress towards these goals (see 3.2.1.5). Through splitting up the

material in small parts, it is also very simple to provide the students with constant feedback as well as rewards (see 3.2.1.6) for completing the objectives.
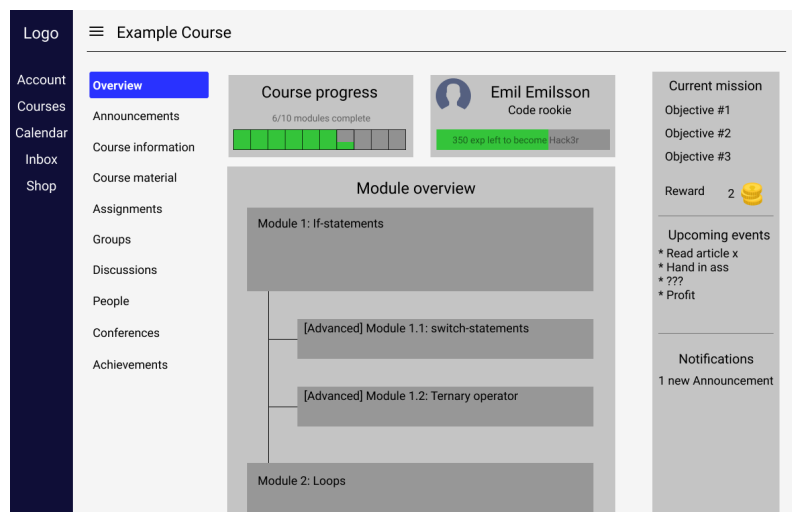
Figure 5.2: Initial mock-up of course modules.

5.4.4.2 Discussion boards

One of the three pillars of the SDT (see 3.1.1) is the need for relatedness. We try to satisfy this need through incentivising social behaviour through discussion boards. Discussion boards are either in the form of internet forum threads, where a user can open a board to ask a question or discuss a topic, or they can be related to a specific course material, where the users can post comments related to the material in question. Discussion boards do not only fulfill the need for relatedness, but may also potentially increase learning. When asked about effective learning methods in the questionnaire, 35 out of 64 answered that they learn effectively through teaching others, which can be done through answering questions on discussion boards.

5.4.5 Gamifying the LMS

Gamification, as previously mentioned, is the use of game design elements in non-game contexts. There are a lot of different game design elements and/or patterns and most likely not all of them fits an educational context. A lot of time went into discussing what elements would be included in the platform, both from a technical point of view but mainly from a conceptual viewpoint.

5.4.5.1 Narrative/Storyline

One specific game design element which many has said to be useful in educational contexts are narrative/storylines (see 3.2.1.1). However, as this could compromise the autonomy of the user we were hesitant towards disabling content until a certain criteria is met, be it time passing or certain content being completed, and eventually decided against it. Still, enabling or even encouraging that

courses in our platform are built up with a narrative in mind was very important to us. Making sure that what is learnt early on in a course feels relevant throughout we felt was a great way of maintaining motivation. To solve this, without enforcing a specific path through the course material, we implemented Course modules.

5.4.5.2 Level and experience

In order to get a further understanding of their progress, the user also has a level. The level is unique to the associated course, and starting at level one, the user gains experience from completing course objectives or gaining achievements, which in turn raises their level after a certain amount of experience has been earned. The level is displayed as a number with a circular progress bar showing the amount of xp left until the next level. Each level has an accompanying title, which is related to the course in some way. For example a course in programming could have titles ranging from 'hello world' to 'lead developer'. Leveling up awards the user with a new title, as well as a number of coins which can be spent in the shop. Since engaging in the course increases the level, the level is a rough representation of how much the user has learned. The experience gain rates are balanced to make the user reach the highest level and title after taking part in most of the course material, to make the title a closer representation of how much they have learned.

5.4.5.3 Notifications and animations

Whenever the user earns experience, levels up or completes an achievement, they are met with an animated notification. This is to further provide them with instantaneous feedback of their progress. The xp gain notification is small and subtle, only consisting of a small line of text appearing when you gain experience, as well as the level progress bar increasing. The notification for achievements and level ups is larger and more prominent, appearing as a box containing text in the corner of the screen.

5.4.5.4 Achievements

Achievements (see 3.2.1.9) are visual 'trophies' which the user can earn through completing more distinguished tasks. Convas has achievements such as completing all objectives of a specific module or reading all articles available in a course. Achievements are meant to take longer to complete than objectives, and therefore grant greater rewards than objectives does, such as more experience and coins. Each course has a set of achievements available for the user to unlock.

Achievements are in some sense quite similar to levels as they both indicate knowledge gained. While levels somewhat indicates how much knowledge a user has gained, it does not allow the user to get an overview of the specific knowledge he/she has obtained in the way that an achievement can.
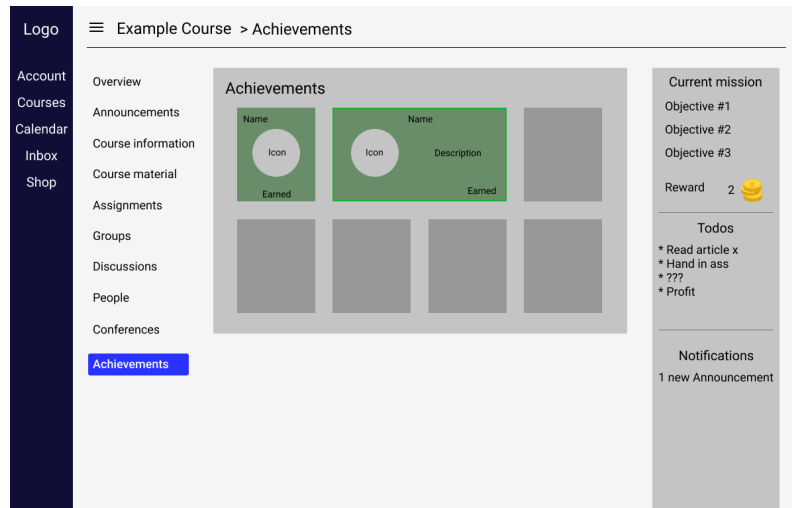
Figure 5.3: Initial mock-up of the achievements view.

5.4.5.5 Shop

The shop is where the user can spend all the coins they have earned through taking part in different activities in the system. Coins can be exchanged for, for instance, course services such as tutoring sessions or extended deadlines, or real life goods such as merchandise or coupons. One issue at this point was the fact that there were no ways of gaining more than a certain amount of coins as the only way of getting coins were from gaining levels and from completing achievements. Since the achievements as well as amount of exp available was finite the amount of coins were finite as well. This would result in one of two things: Users having to pick between what items to buy for the amount of coins available, or the items being cheap enough for users to be able to buy at least one of each available item.
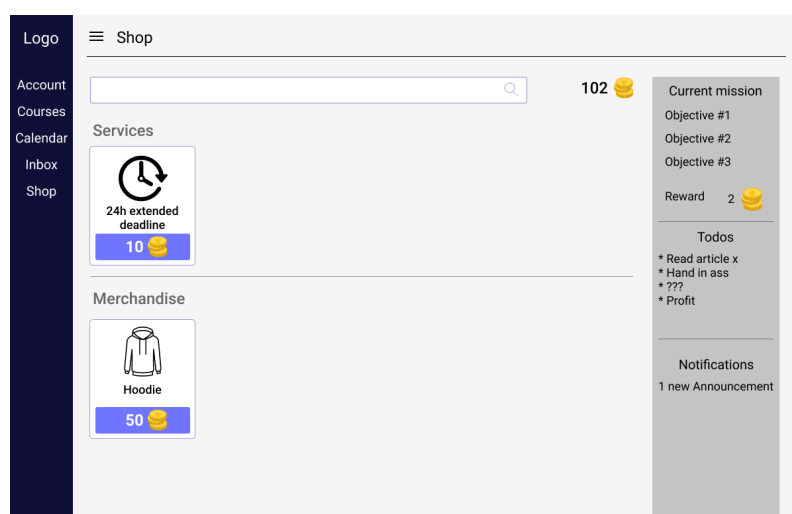
Figure 5.4: Initial mock-up of the Shop.

5.4.5.6 Exclusion of competitive elements

One of the most common patterns found in gamified systems is competitive elements such as leaderboards. While competition can work as a good motivator, the question regarding competition as a motivator on the questionnaire provided us with mixed results, with almost as many people answering that they are not motivated by competition as people answering that they are. These results in combination with the potential risk of forming an unhealthy culture of students being reluctant to help each other lead to the inclusion of competitive elements being deprioritized for this iteration.

5.4.6 Implementation

With the requirements made and mockups to reference, our next step was to get into the technical details. With a fairly low amount of previous web development experience within the group the decision was made to find a well used, well documented framework for building front end web applications. While there are a vast amount of different options when it comes to frameworks, libraries and software available for front-end web development, we ended up looking into React, Angular and Vue, three of the most used frameworks within the industry at the time of writing (see 4.4). While they are all excellent frameworks well capable of doing what we wanted to, we ended up choosing React for the following reasons:

- We percieved React to be an easy to learn framework and to be easy to get started with.
- React utilises so called class-based components which was an advantage for us being comfortable with Object Oriented Programming.
- React is the most used framework in the industry by a large margin.
- React is used by Insert Coin which made it easy for us to ask technical questions that would come up.

Furthermore we chose to use Git as our distributed version control system as this was considered the most popular source control management system by far at the time of writing [84] and as this was what we both were used to using.
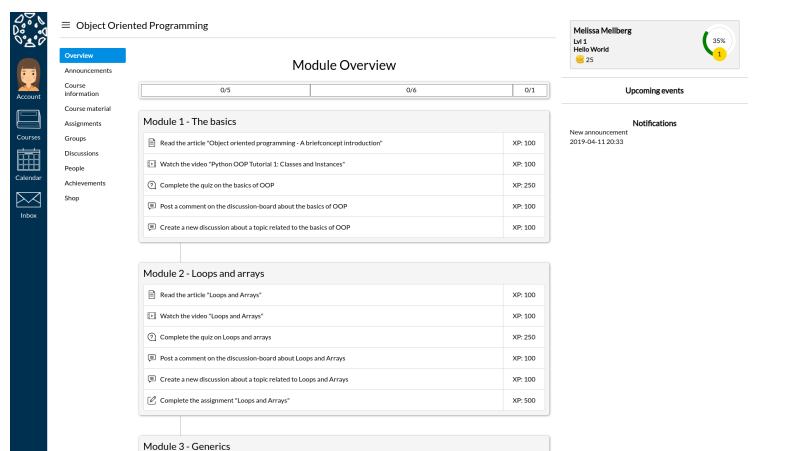
Figure 5.5: The Convas course module view after the first iteration.

5.4.7 Feedback

A big discussion point during the platform development was the feedback that users would receive. With immediate feedback being one of the major benefits of having gamification (see 3.2.1.4) this was a topic of great importance. The main focus of the feedback was to make sure that it was received immediately, or at least as quickly as possible after something productive had been done. This was very important as the positive feedback is what would hopefully give the user positive emotions and the motivation to keep going, at least more than there not being any immediate feedback. The feedback that ended up being implemented was of graphical nature. Initially it consisted of notifications appearing when something had been achieved, small or major, as well as a progress bar being filled animatedly as experience was received.

Figure 5.6: A simple notification displayed when the user levels up.

5.4.8 Repeatable tasks

Gamified systems often rely on tasks being repeatable when balancing experience rates and rewards. In this way, there is no need for an ending of the experience and the user can keep using the system indefinitely. When it comes to educational contexts however, it is hard to define repeatable tasks as the course material is finite, meaning that the user will eventually, for example, be tasked with reading an article they have already read, or with reading more articles even though he/she has already read all that is available. In order to tackle this, the system is designed in a way that the user is only incentivised to complete tasks they have not completed before. This leads to the amount of rewards a user can earn in a course to be finite, but since the intent of a course is for the user to learn the material and then move forward, there is no reason to have an unlimited amount of rewards for the user.

5.4.9 Lasting progress between courses

Our initial vision of the platform featured levels, coins and achievements bound to each individual course. This was because we wanted user progress to be tied to the specific course they made progress in, making it more clear that the level is representative of the effort spent in that specific course.

After some discussion we realized that this might not be the best approach, as it would effectively eliminate all progress and reset the user to square one whenever the student finishes their courses and enrolls in new ones. We came up

with a potential solution to this, which included having an overarching level spanning over the entire education, while reworking the course specific levels to something which effectively would allow the user to view course specific progress in the same way, but would be separate from the overarching level. This way the user can always feel like they are progressing towards something, while also combating the problem with finite course material, as the user can continue to make progress on their overarching level over any amount of courses.

We decided that this change was too major to tackle in the first iteration, so we made plans to discuss the topic with users during the first user testing session, as well as making preliminary plans to implement this change in a future iteration.
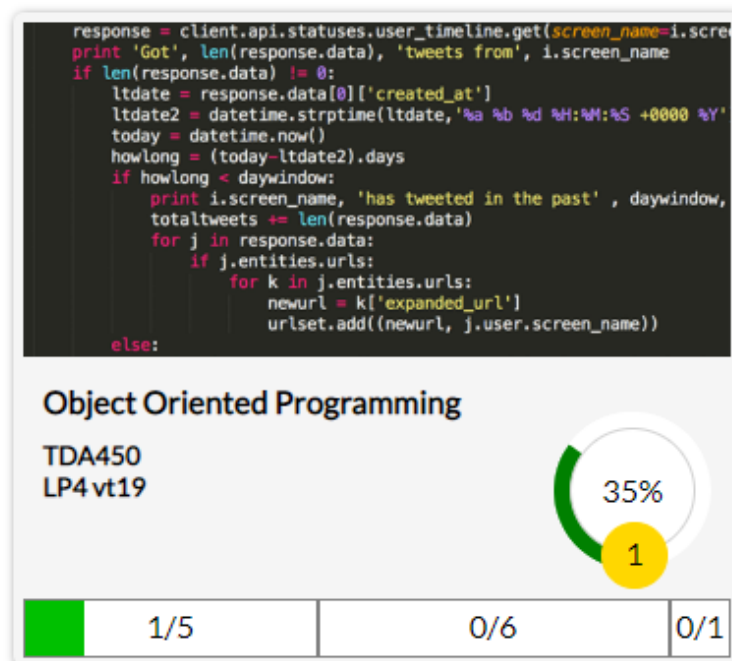
Figure 5.7: In the initial version, levels were entirely tied to specific courses.

5.4.10   User testing

In order to test the platform in the state it was in so far we decided to use the Think-aloud protocol method in combination with a semi-structured interview with the test subjects. The purpose of the Think-aloud protocol was not to research the usability level of the platform but rather to record the reactions of the tester in regards to the gamification. For the testers who also studied the course in Canvas which had GWEN implemented we also wanted to get their impressions about the different implementations. The audio from the user testing sessions was recorded, and the recordings were later listened to in case we missed to note anything during the actual sessions.

With the limited time for the entire project another goal was to receive as much information as possible about the long term usage effect of such a system. The

interviews were therefore structured in a way which would possibly generate such data. Asking questions such as "What do you think about having an overarching progress indicator, such as a level which increases during your entire education?" resulted in the interviewees thinking about how they would feel using such a system for a longer period.

Each of the meetings with testers went through the following stages:
- An introduction to gamification, our research and to the platform itself
- Some questions about preconceptions about games and gamification
- Think-aloud protocol (see 4.3.3.3) where the tester was tasked with completing the first module (see 5.4.4.1) of a course.
- Some questions about their experience testing the platform and about how the gamification felt.

The sound of the entire process was recorded in order to be able to further analyse both the testing and the interview afterwards. In total, eleven user testing session were held with a total of seven different testers. Before any sound was recorded, we informed testers that they would remain anonymous and that any feedback or insights stemming from the user test would be used to improve the prototype.

During the first iteration, the test was performed with a total of four users, all being students at Chalmers but studying various programs. The following section will depict observations and insights from the user tests, partly gained from the user interacting with the platform, and partly from the answers to the interview held afterwards. The testers previous experiences with games in general varied as well. Two testers described themselves as very experienced with games, while one of the testers described their experience as minimal. The same can be said about the testers experience with, and attitude towards, gamification as some testers displayed a very positive attitude towards the concept, while others were clearly sceptical.

Several valuable observations were made while the testers interacted with the platform. All the testers found the clear display of goals in the form of objectives to be useful. Some of the testers found the navigation to be confusing, primarily how to navigate back to the course module after completing an objective. Some testers was unsure how to actually complete objectives, not realizing that they are completed automatically. All users also had a hard time noticing the animations displayed when getting xp. When completing the course module, the testers found the "achievement unlocked" notification to be positive.

While not all observations were directly related to the gamification aspects, they all contributed to the overall experience of the platform. The main takeaway from these observations was that, while some things were clear and gave a positive experience, some things needed to be more obvious for the user to notice and actually feel the instant gratification.

Following the testing an interview was held. The following section will explain each question and go into detail about what observations were made from the answers.

5.4.10.1 Interview questions

What was your first impression? Do you think gamification is a good thing in educational contexts?

We asked this question to get an overall view of their impression, and also to see if it coincided with their previously stated attitude towards it.
Most testers found it to be a positive experience but was not entirely sure if the concept would be fitting for a higher education context. Receiving experience, achievements, and levels felt good for the testers but some were concerned about the fact that it made the experience feel less serious.

Some of the behaviours we're trying to push are related to social interaction, such as participating in discussion forums. What do you think about this?

This question was asked mainly to confirm our idea of social behaviour being an important part of a learning experience, and perhaps to receive some new perspectives of how it could be realized.
Testers found pushing these behaviours to be positive but was not entirely sure of the best approach.

Do you see any other ways of pushing social interactions? Perhaps even real life interactions?

One suggestion that came up was to separate discussions from course material entirely so that if a discussion strayed from the topic at hand it would be easy to create a new discussion. Another idea was to have some sort of voting or liking system in order to encourage responses which actually contributes to the discussion, rather than having users who posts responses just to get experience points.

How do you think this would affect your motivation? In the beginning? After 2 months, 2 years etc.?

We asked this question to get a feel for the perception people have on gamification, not only in a short term, but what effect it would have for the long term.
Most users thought it would have a positive effect, at least initially. Some were not sure about the long term effect and some thought it would have an outright negative effect. This group, however, was of the vast minority.

What do you think about the levels being tied to each course? Do you think something lasting between courses is missing? Why/why not?

As previously mentioned, we had some internal discussion as to whether it is a good design choice to only tie progression to specific courses. We felt that this would make the experience lack some meaningful progression between courses, and that the progression tied to courses would be less meaningful as it would reset the user to square one whenever they move on to the next course. This

question was asked to confirm our thoughts on the matter.

All testers would have preferred that there is some sort of lasting progression between courses, at least between courses which are related to each other. Some users argued that an overarching progression could be tied to your progression at Chalmers, showing for example all courses, which courses you have completed and also showing your total higher education credits earned. All testers also found the levels and progression tied to specific courses to be a good thing, so a combination of the two would seem to be the best approach.

What would you think about adding a leaderboard (or some other competitive element)?

Up to this point, we have been very sceptical to adding competitive elements to the platform, due to a number of reasons discussed earlier in the thesis. This question was asked to gain more qualitative opinions from users, as opposed to the quantitative data gathered from the questionnaire.

Users were generally sceptical to competitive elements, however for differing reasons. One user thought competitive elements would be a great motivator, even to the point that it could become stressful and therefore have a negative impact on mental health. Another user thought it would breed competition even outside of the system, like competing who would get the best grades. Most users figures that competitive elements would benefit users who are close to the top of the leaderboard, while hurting those who are closer to the bottom. One user also suggested competitive elements in the form of smaller, opt in competitions. This way users would not be forced into competition if they do not want to, and those who like competition can still take part in it. This approach may be worth looking into at a later point.

What do you think about the level of seriousness of the platform now that you've tested it?

The reason we asked this question is because there is a general attitude towards gamification, where people see it as non-serious because of its roots in games, which are generally meant for leisure and entertainment. We observed some concerns about implementing gamification in higher education because of this perceived level of seriousness, and we wanted to know the users general opinion of the level of seriousness after testing the platform.

None of the testers found the platform to be too non-serious. Some of them commented that the inclusion of a shop may have a big impact on the perceived level of seriousness depending on the users personality.

At the moment there is a shop in the platform. What do you think about the items available? Anything else you would like to see?

Lastly, we wanted to get the testers first impressions of having a currency system and an accompanying shop, as well as to get some feedback on the items avail-

able for purchase, The testers impression of the shop in general varied. Some found it to be a good addition which could provide extra motivation to students, while others argued that it could potentially be too addicting to "grind" coins, comparing it to patterns commonly used in mobile games, where the goal is to keep grinding indefinitely.

5.4.11 First draft of guidelines

Based on the reactions, opinions and feedback received when testing and showcasing the learning management system platform Convas, as well as findings made during development, the following first draft of guidelines was produced:

Avoid competition: While competitive elements can be motivating for some users it might also have the opposite effect for some, making it a bad element to include.

Perceived level of seriousness: A design which can be considered non serious can have a negative effect on some users. Usually this is heavily related to how the platform looks and how the feedback is received, rather than the actual behaviours that the gamification tries to push. Allowing different themes or other customization options could mitigate this issue.

This guideline is based on results from a questionnaire (see 5.4.1) where a concern among potential users was that gamification is not serious enough.

Clear goals: Something which can be quite frustrating as a student sometimes is not knowing what next steps there are to take in order to make progress. Gamification can bring a good solution to this by presenting the available actions or "objectives" to the user, making it much easier to know what there is to do as well as what has already been done. While this guideline is applicable to most gamification scenarios, it's particularly applicable to the context of education.

Relation between course material and gamified experience: In order for the points, levels, achievements etc. to feel relevant the content has to feel relevant. It is very important that the behaviours pushed by the gamification plays a clear part in learning the course material.
For example, while having an objective which tells the user to "read an article" could make users more prone to reading the course material, replacing the text with "read article X" where X is a specific article related to a specific topic within the course the objective feels relevant and motivates the user more that the previous example.
It is equally important to design the course material with the gamified experience in mind. Since a substantial part of gamification is providing users with clear goals and showing progress, it is essential that the course material allows for being split up and categorized into smaller steps, such as in the course modules of the platform.

Feedback, feedback and more feedback: Feedback is the backbone of gamification. Knowing when progress has been made and allowing the user to feel good about is is the biggest part of what pushes the user to continue being productive. Therefore, while it may feel like a small part of the development, putting effort into how progress is presented is very important. Progress-bars, notifications, rewards, levels, ranks and so on are just a few of the ways of giving users feedback. Making sure they are presented in a nice fashion can make a big difference in how the user is affected by the gamification.

Social learning: Relatedness is one of the three needs of the SDT 3.1.1, and it can be satisfied through encouraging students to study together, social learning. Social learning also has the potential to make students not only more motivated, but also learn better 3.2.1.2. When asked about encouraging social learning, most user testers had a positive attitude towards it, and argued that it would have a positive impact on their motivation. This guideline is therefore supported both by theory and by user testing.

5.5 Iteration 2

The goal of the second iteration was to redesign parts of the platform with the user feedback in mind, as well as implementing parts that we either did not have time for or did not prioritize during iteration one. Furthermore, another user testing session was held towards the end of the iteration, with the aim to get feedback on new features as well as on the changes that was made.

5.5.1 Changes and additions

The continued implementation of the platform included adding objectives and functionality for project groups and peer reviewing, an overhaul of the level system and more distinct notification animations.

5.5.1.1 Project groups and peer reviewing

These features allow the users to join and create project groups, for the purpose of managing group assignments, as well as reading and submitting feedback on other users hand ins. Both of these features are encouraged through objectives, since they allow for social interaction and social learning, satisfying the need for relatedness according to the SDT.

5.5.1.2 Course ranks and student level

While making progress and eventually completing a course is a good feeling, it can also be quite irritating to have to start all over again when the next set of courses starts. To solve this, while still keeping the individual progress of each course we

also made the actual level be related to the user, rather than the progress of an individual course. As a result of this the coins gained from objectives, achievements etc. was also moved and is added to a pool outside of a specific course. This overarching level will be something that constantly increases while the user is making progress during their education. This gives the user an easily accessible way of seeing the overall progress of his/her education. Something which might not be very easy to see today unless the user actually makes an effort (be it a small one) in order to measure how much he/she has done so far or how much he/she has left.

Instead of each course having a level for each user it now has a rank which increases to a maximum of 5 for each course. This way the user does not only have an easy way of comparing their progress between courses but can also get a better overview of how much they have left. Another addition was the rank titles. Each rank can have a course related title, making the rank feel less like just another number that increases over time but instead feel more relevant.

5.5.1.3   Notification animations

In iteration one, the notifications received when gaining a level or an achievement were simple and bland. We wanted them to be more recognizable and have more character. To achieve this, we designed a mascot character for the platform and implemented the notification to be displayed as speech bubbles from the character, which appears from the bottom of the screen. This approach makes the notifications more noticeable, and receiving feedback from a little person on the screen could make the feedback more relatable than if you would receive it from a small uninteresting box. This approach however runs the risk of being viewed by users as too playful or unserious, which needs to be explored in testing.

5.5.2   User testing

The purpose of the user testing stage during the second iteration was to gain feedback on the changes made since the last iteration. The testing was done similarly to the first user testing but with some differences to what questions was asked and in what order. The testing was done both with the same testers who participated in the first testing phase and with a set of new testers. With the returning testers we were able to get a feeling of if the changes made were positive or negative. We were also able to get more thorough feedback as the testers were more familiar with the platform, as well as with the concept of gamification. Much like in the first iteration, the audio from these user testing sessions was recorded as well.

With the new testers we were able to get a new set of eyes looking at our platform, additional feedback and more interview data to base or findings on.

5.5.2.1 Questions for returning testers

How does the platform feel compared to the last testing session and what gamification elements did you notice during the testing?

This question was asked to get an understanding of how the experience compares to the users experience during the first user testing session to see if the changed elements made for an improvement or not.
The general response that we got from this question was that the platform felt better than last time. The most noticeable changes was the ranks instead of levels for the courses, which people felt gave a better overview of their progress in the course, and the new and improved animations which made some information clearer and simplified some navigation.

In this version we have implemented more ways to interact with other students through peer reviews and student groups. Do you think these are good ways to push social behaviours?

Since we have based most of our design around the needs defined in the SDT, we want the users feedback on how well we have managed to satisfy the needs. This question aims to get an understanding of whether the users feel they can adequately interact with their peers, satisfying the need for relatedness.
Similar to the last testing sessions the testers were positive towards pushing social behaviours. Some said that peer-reviewing was something they felt was underutilized in their experience. Groups felt like a fairly standard feature which should be included in order to be able to hand in assignments etc. as a group. However, some suggested that if the platform was to be used more than similar platforms are used today there should perhaps be additional feature related to the groups such as a chatting service so that people can communicate easily using the platform.

How big of an impact do you think that the course content has on the gamification experience? Do you think this concept would work on any kind of course?

According to Adam P. a gamified course should be built with gamification in mind in order to make the experience as good as possible. As we were unsure of how doable this is with any course, especially when it comes to making use of the different features as good as possible, we wanted more thoughts and opinions on whether any kind of school, course or subject would be able to utilise a platform like ours.
Similar to ourselves many of the testers had to think a while about this. While, at first glance, it may feel like some courses fit better than others, most said that they would likely be able to adapt to fit the structure needed to make good gamification. Because of this, many thought that the experience would depend on the course responsible shaping the course to fit the platform which might be a difficult thing to ask teachers etc. to do.

After the previous three questions we told the testers a short summary of what SDT is and explained that a lot of what we've done is based on that theory. This was done with the intent of perhaps engaging the testers in more conversation about how the system does or does not fulfill the criteria of SDT.

What do you think about the splitting of level and course ranks? Do you see any pros and cons with it and is there a better way it could have been done?

This question aims to get feedback on the rework of the level system. Since most users felt they wanted some sort of lasting progress between courses when asked during the first user testing session, we wanted to know if this approach was a working solution.

Having a progress-bar which gives a clear view of how far into a course a student has progressed was something that all testers were positive to. The ranks attached to it was more of a bonus which a few felt was a nice addition and the rest were quite neutral towards.

The overarching level gave a mixed response. Some said that it might be something which feels good to have and to strive towards increasing while some said that it was "just xp" which would not feel rewarding at all unless it was connected to some other reward somehow.

The general concern when it came to the level was that it would just be a number and that it wasn't clearly representing knowledge gained. If it could be connected to how far into your education you'd gotten it would feel a lot better.

We've also got plans for implementing some sort of "karma"-system where people can like comments they think are relevant and/or contributing to the given subject and thereby give the writer rewards. This would hopefully reduce some of the flaws with the current system. What do you think about such a system? Are there any pros or cons with it?

Most of the testers saw current issues with the current system being that the discussions would likely quickly become filled with comments that would not contribute and instead just be posted so that the user gets his/her experience points. The suggested solution of a "karma"-system got mixed feedback. While it would hopefully encourage people to post useful comments in discussions it would also run the risk of making people more biased towards certain answers just because they have obtained more karma than others and appears higher up in the discussion.

5.5.2.2   Questions for new testers

The testers which were new for the second round of testing were all studying on a university level. They were all studying to become engineers, however all of them in different programmes. They had varying levels of experience and knowledge, both in gamification and in playing games.

What are your first impressions? Do you think gamification could be good in a

learning context?

Basic question to start of with in order to get a feel for what the users idea of gamification is and what their stance towards it is.
The testers were generally positive towards the platform, especially praising the clear cut manner it displays the modules display progress. The general attitude towards gamification in a learning context was positive as well.

What gamification-elements did you notice?

It is important that the gamification actually has an impact on the user, otherwise why put so much effort into including it in the system, however it mustn't draw too much attention either. Hopefully the answers to this question give us a feel for how much attention the gamification pulls from the user.
Aside from the positive feedback towards the course modules, the most noticed features were the level and the notifications. Almost no testers paid any attention to achievements or the shop until we specifically told them about them. However, this was likely an effect of the short amount of time the testers had to play around with the system.

Some of the behaviours we tried to encourage by help of the gamification are social interactions such as participation in discussion forums and peer reviewing. Do you see any pros and/or cons with this kind of encouragement?

Once again, this question was asked in order to give confirmation (or deny) our idea of social interaction being an important part of learning.
Testers found our approaches for incentivising social interaction to be generally positive, commenting on the value of giving students more reason to help one another. One tester mentioned the importance of having meaning behind objectives, more specifically the objective for posting in/creating discussions, as the meaning behind posting a comment in a discussion is not clearly conveyed by the system.

Can you come up with other ways of encouraging social interaction? Perhaps even with interactions in real life?

Having a digital systems through which you don't physically see and interact with your peers puts another layer in between the users which increases the difficulty of encouraging social behaviours. More or better ways of pushing social interactions are welcome. We asked this question to perhaps generate new ideas.
We got some suggestions including an instant messaging feature as well as letting industry representatives have access to discussion forums to better the link between education and industry.

At the moment there is a shop in out platform. What do you think about the different items in the shop? Are there other items you thought would be nice to

add? Should some be removed? What do you think about a shop in general as a way to boost motivation?

While the initial idea of a shop sounded like a good idea to incorporate, after the initial testing we were not entirely sure of how the shop were to be implemented in order to give the best results. Was a shop a good thing to have in general? How much should the items be able to affect the studies of a student? Should they have an effect at all or simply be cosmetic? As we were still unsure of the answers we continued to ask these questions to new testers.
The feedback was similar to last time, with some people being somewhat sceptical while others were more positive. The extended deadline reward received the most attention, with most testers being positive towards it. Testers also argued that the customization reward as well as the course specific unlock would be better of unlocked for everyone without the need to purchase it. One user suggested a reward in the form of bonus points on assignments or exams.

5.5.3   Questions for all testers

Do you feel like you can consume the content of the course in any way or order you'd like?

As much of our underlying theory is based on SDT we asked this question in order to get a feel for the autonomy of the platform. Our hopes was to get good feedback about the autonomy of our platform or to get suggestions on what isn't good autonomy and perhaps on how it could be improved.
The general response to this question was that the autonomy of the platform when it comes to consuming course content was good. The responses differed somewhat though as some thought that, even though the system allows for it, it didn't feel like you could consume the content in any order you like as the content was presented in the specific order and divided into modules. Others said that, while it felt like you could do it in any order, you most likely still wanted to do everything close to the presented order as this would hopefully be the best order in which to learn the content, at least according to the course responsible.

How big of an impact do you think that the course content has on the gamification experience? Do you think this concept would work on any kind of course?

According to Palmquist a gamified course should be built with gamification in mind in order to make the experience as good as possible [10]. As we were unsure of how doable this is with any course, especially when it comes to making use of the different features as good as possible, we wanted more thoughts and opinions on whether any kind of school, course or subject would be able to utilise a platform like ours.
After the previous three questions we told the testers a short summary of what SDT is and explained that a lot of what we've done is based on that theory. This

was done with the intent of perhaps engaging the testers in more conversation about how the system does or does not fulfill the criteria of SDT.

How do you think this type of system would affect your motivation to study? In the beginning? After 2 months? 2 years etc.?

It is difficult to get an understanding of the long term effects of using a system without performing a much longer study. This question was an attempt at mitigating this issue by at least getting the users idea of how they would be affected by using the system during a longer period of time. However, the answers to this question is to be taken with a grain of salt as the testers as well as us can only guess what the effects would be.

This question gave very interesting results as the testers gave very different answers. Some very very positive to the concept and were sure that the effects would be positive, both in the short term and in the long term. Some thought that it would be fun for a while but that the effects would wear of after a while. Finally, a small number of testers thought that the system would have little to no effect or even be negatively affected by the gamification elements.

Many connect gamification (not surprisingly) to games and therefore have the perception of gamification not being serious enough for use in a higher education context. What do you think about the level of seriousness in our platform?

During the initial user elicitation, when asked about gamification in educational contexts a concern that came up was that a gamified system might not be taken that seriously. We believed that this might be the case but that it mostly depended on how the gamification elements were presented, the aesthetics of it, rather than what the system is doing, encouraging certain productive behaviours. As people have very different tastes we continued to ask this question to new testers in order to get multiple viewpoint of the aesthetics of our system.

Despite the somewhat cartoony addition of "Emil", the chalmers student giving you feedback each time you've achieved something, the testers were mostly ok with the level of seriousness of the platform. Some reacted on the fact that it didn't feel as much as playing a game as they thought it would.

If this was to be explored to a more extensive degree the testing should have been performed with more users where there should have been different versions of the systems with different aesthetics in order to see the different reactions on the different systems.

Since the last session we've worked on improving the animations. What are your impressions of these? Do you think they have an impact on the experience and if so, are they positive or negative?

While this question was related to the level of seriousness question we still wanted to ask about this to find out whether people liked the instant feedback that was

given, as this is one of the more important parts of gamification.

Since the answers to this question were based a lot on preferences it was difficult to find a pattern between the different testers. However the general consensus was that the animations were better than before and that it had positive impact on the experience. Some expressed concerns that the "Emil" animation might become annoying and start to "feel like Microsofts Clippy" after too many appearances.

We have plans on adding so called sub-modules into the course module system, where sub-modules consist of optional content. The aim is to allow eager students to easily gain a deeper knowledge not required for the course. What do you think about this?

With the intent of further increasing the autonomy of the platform we planed on making sub-modules, non-obligatory objectives containing interesting topics for the students. This questions was asked to get feedback about this idea and perhaps get thoughts on how the feature could be implemented. As the usefulness of this feature would depend a lot on the different types of users we asked this questions to get feedback on if it would actually be used or not, especially if it was just containing information which would not increase your chances of getting a better grade, but rather containing interesting knowledge related to the course. With the vast amount of places to attain knowledge in today's society, having extra modules with information that does not help in getting a higher grade could feel like extra clutter to the platform. The general response of the testers was that sub-modules could be good for placing objectives which could help in getting a higher grade or objectives which gives a more practical example of what could otherwise be theory intense courses. Knowledge which is simply interesting and related to the course but has no effect on the outcome could be nice if it is a course that the student finds particularly interesting but would likely often be something that most would look past.

5.5.4 Second draft of guidelines

With the changed and additions to the platform done, as well as additional feedback from users improvements on the guidelines from the first iteration were made. The following is a summary of the changes and additions made.

Overarching progress Losing progress is never fun. If a platform is used over a longer period, or over multiple courses, make sure there is always something to progress and that there are rewards which lasts. Completing a course just to have to start over is not a good feeling.

Feedback, feedback and more feedback: Feedback is the backbone of gamification. Knowing when progress has been made and allowing the user to feel good about is is the biggest part of what pushes the user to continue being productive. Therefore, while it may feel like a small part of the development, putting effort into how progress is presented is very important. Progress-bars, notifications, rewards, levels, ranks and so on are just a few of the ways of giving users feedback.

Making sure they are presented in a nice fashion can make a big difference in how the user is affected by the gamification.

Rewards only when it's earned Receiving a reward after completing a challenging task feels great. Receiving a reward before completing the task or when doing something very easy can become quite tedious and risks having the opposite effect after a while. Having very frequent rewards for easy tasks is inadvisable. If a user receives a reward before he/she feels like the task was complete it might make the user feel like he/she is cheating, that the system is broken or that there was something that the user didn't understand which made him/her feel dumb. This should be avoided at all cost as it could quickly start reducing the motivation of the user.

Design the system to have content available by default Design the platform so that all the content in a course is available by default. Locking content behind time constraints or behind progress should be an option that requires actions to enable, not the other way around.

This guideline stems from the Self Determination Theory (see 3.1.1)

5.6 Iteration 3

Much like the second iteration, the goal of the third iteration was to further develop and make changes to the platform according to the feedback gained in iteration two. We decided, since the planned changes either were fairly minor or had been satisfactory discussed during previous user testing sessions, that we would not conduct user testing for the changes made during the third iteration. This led to the iteration being considerably shorter than the previous iterations.

5.6.1 Changes and additions

Major changes made to the platform included functionality for module objectives to have several goals, the addition of optional course modules, the implementation of reply threads for discussion comments and the ability to disable certain elements in the system. Some minor changes for increased usability were also made, including renaming the overview section to modules for clarity, linking the peer review objectives to the list of available peer reviews instead of to the assignment view, and enabling the use of hotkeys to post comments in discussions.

5.6.1.1 Subobjectives

Initially, when clicking an objective related to consuming some kind of course material, such as reading an article or watching a video, the user would get rewarded immediately when the page with the material loads. We had suspected that this was a bit counter intuitive for a while, as the user gets rewarded whether they actually consume the material or not. After getting feedback that this approach feels weird in practise from both our own user testing and from the testing conducted by Insert Coin on the live course, we decided that we would have to take

another approach to this matter. The approach we decided on was to combine certain objectives into one larger objective, containing several subobjectives. As an example, we combined an objective to read an article with another objective to pass a quiz with questions related to the article. By doing this, the user only gets the reward after both reading the article and passing the quiz, eliminating the case where a user can get rewarded for practically doing nothing.

5.6.1.2 Submodules

Submodules was a feature we had disussed very early in the project, but which was down prioritized in favour of other features deemed more important. Submodules work similarly to regular course modules in the sense that they both contain a set of objectives for the user to complete. However, submodules are intended to be completely optional, and only encourage learning about advanced topics, not necessarily required for the course. A submodule is related to a parent course module, in order to show that the topics of the submodule is advanced knowledge related to the parent course module. They do not reward the user with experience, in order to symbolize that the knowledge they contain are outside of the scope of the course, and hence does not reward experience towards it. Instead, they reward the user with coins, in order to still provide an incentive to complete them.

This feature is a further motion to instill the user with the sense of autonomy according to the SDT 3.1.1, as well as an attempt to let users specialize their knowledge in specific areas, much like a skill tree (see 3.2.1.13).

5.6.1.3 Reply threads

After some feedback regarding the discussion forums, we realized that the discussion topics quickly can become filled with various comments, especially since the platform is actively incentivising posting comments, and when a discussion topic has a considerable amount of comments, it runs the risk of becoming cluttered and make it hard for users to find specific answers or reply to specific comments. To counter this, we decided to implement reply threads. These threads contain all replies to a specific comment, and appears directly under said comment. The replies can be toggled between hidden and displayed, and are hidden by default to make it easier for users to find specific top level comments. This is an approach used by many other systems, some examples being Slack and the YouTube comment section.

5.6.1.4 Opt-out settings

During user testing sessions in both iteration one and two, some testers displayed scepticism towards some of the gamification elements. The scepticism was directed mostly, but not exclusively towards the shop related elements. This led us to believe that if certain elements don't have a motivating effect on the user, they will only be in the way or may be downright off putting. While this probably

will not be a problem for the majority of users, it can still have a considerable impact on some users. Some testers also displayed concern that the notifications could potentially become too intrusive after extended exposure. Our approach to this problem was to implement some simple user preferences, which gives the user the option to downright disable certain elements in the platform. These preferences include the option to disable the level system, which removes the users level and any experience rewards from objectives and achievements, the option to disable achievements, which simply removes the achievement view and the ability to gain achievements, the option to disable the shop, which removes the shop view and any coin rewards, as well as the option to disable all notifications.

5.6.2 Third draft of guidelines

This section covers the additions made to the guidelines during the third iteration.
Option to opt out: While a gamified experience may help some students to motivate themselves, it has the potential to have an opposite effect on students who are already adequately motivated. To these students, gamification elements such as levels, achievements or constant instantaneous feedback may feel unnecessary and therefore obstructive. Because of this, an option to, to some extent, disable certain elements in the system should be considered.

6

Results

The presentation of the results of this thesis will be split into three parts. The first two are about the LMS prototype Convas developed during this project. First the LMS features will be presented to give an overview of how the actual prototype looks. Following that the gamification elements will be presented, both how they work and the aesthetics of them. Lastly a set of guidelines meant to aid in future similar projects will be presented.
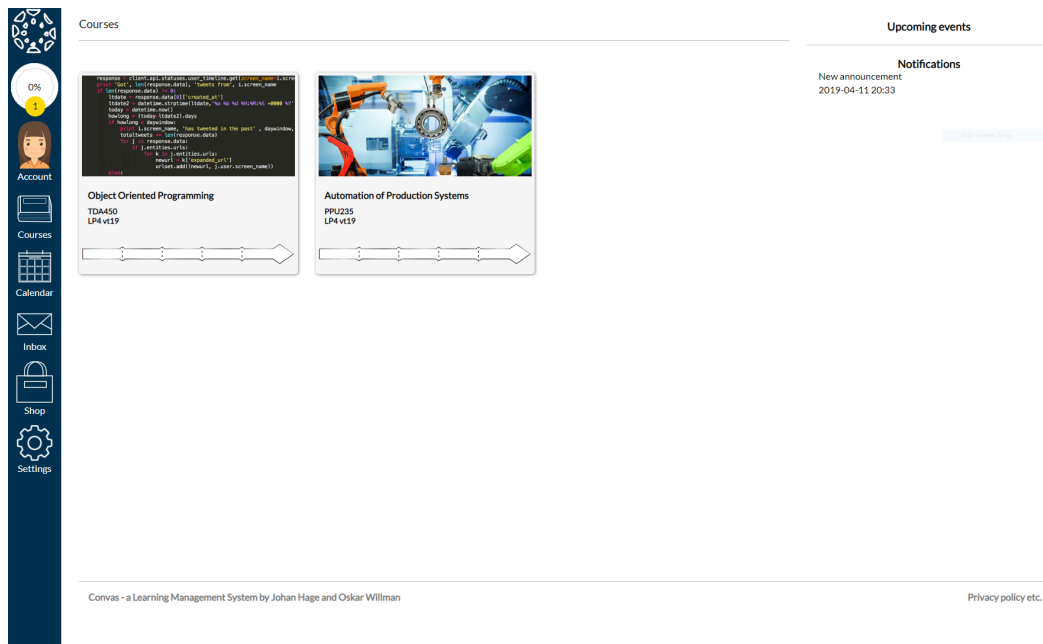
Figure 6.1: The landing page of Convas

6.1 Convas - LMS features

The Convas Learning Management System is a high fidelity prototype containing most of the regular features normally found in an LMS. The interactive elements are similar to how they would work in a real context, however to save on development time most of the features are implemented to work visually but not necessarily functionally. The overall layout of the platform is similar to Canvas, the LMS developed by Instructure and used by Chalmers, also in order to save time to focus on the gamification design. This section will depict the features of Convas which are expected to be found in a LMS, and which makes up for the backbone of the

platform, features which the gamification elements aim to motivate the students to use. The actual gamification elements will be described in a future section.

6.1.1   Start Page

When first entering Convas a list of the different courses that the user is somehow part of is displayed in the form of cards. Each card contains the name of the course, the course code, an image related to the course, and a progress-bar (see 6.2.3). To the left is a menu containing navigation to the more administrative parts of the platform, such as the settings and the account information but also pages such as the shop, inbox, calendar and, of course, the course overview. The Account view contains some basic information about the student, such as program, university, e-mail address as well as a free text description the student can use to describe themselves. It also shows the students current and previous courses. The settings view contains options for the student to turn off specific gamification elements, including the level, achievements, the shop and the notifications. The inbox and calendar views does not affect the gamified experience, and as such, we have left them very basic and void of functionality. In the current version, they exist mostly to represent functionality which you would commonly find in a LMS. The shop will be thoroughly detailed in a future section. There is no introduction or tutorial displayed when first entering the platform. A feature such as this might have been implemented, would there have been more time for development and testing (see 7.11.2)

6.1.2   Course features

When a course is selected, there are a set of course specific features and views which can be accessed. The course specific views include the course module overview, course announcements, course information, course materials, assignments, groups, people and achievements. The course modules overview contains the different course modules, further detailed in the future section depicting the gamification elements of Convas. The same goes for the view containing the course achievements. The course announcements view lets the student view important announcements from the people responsible for the course. The course information contains relevant information about the course and its structure, such as contact information, grading information and course PM.

The course material view contains a list of the course's actual teaching material. The different types of materials include texts (or anything which can be presented in .pdf format), videos, and quizzes. Clicking on a text or a video takes the student to a view which displays the material as well as a comment section related to it.
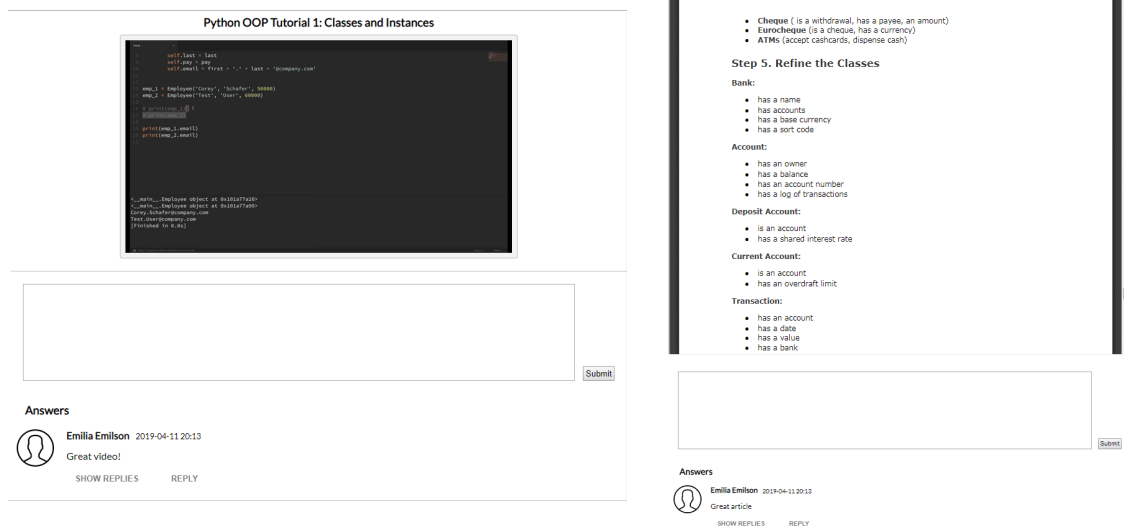
Figure 6.2: Views displaying an article and a video respectively.

Figure 6.3: A quiz question after it has been answered incorrectly.

The course materials also contain quizzes. Quizzes are built up of simple multi-choice questions, where each question has one correct and three incorrect answers. In order to pass a quiz, a student needs to answer correctly on a specific number of questions. Students have unlimited attempts to pass a quiz, to remove the fear of failing and encourage repetition.

The assignments view contains features for both handing in assignments and for peer reviewing other students hand-ins. The student can select an assignment from a list of assignments, which takes them to a description of the assignment where they can either hand in their own solution, or choose to peer review another students hand-in for that specific assignment.

You scored 4 out of 5, Great job, you passed!

Question 1

❌ Which of the following is a correct Java class declaration?

You answered: public class Class1 {}
Correct answer: public Class Class1 {}

Question 2

✔ Which of the following is not a Java keyword?

You answered: String
Correct answer: String

Question 3

✔ What is the correct syntax for a Java main method declaration?

You answered: public static void main(String[] args) {}

Figure 6.4: Results after completing a quiz.

Assignment	Peer-review

| Laboration | Generics | Incomplete |
| Due: 2019-04-19 23:55 | | |

Description

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Sed a pellentesque massa, in posuere est. Sed eleifend suscipit iaculis. Quisque ante tellus, consectetur at gravida non, tincidunt ut odio. Ut condimentum faucibus sem a finibus. Nam eget rutrum nisi, vel suscipit risus. Nam commodo neque imperdiet, volutpat enim sed, ornare justo. Fusce ultrices massa vel mattis hendrerit. Morbi id eros at libero suscipit tristique a et augue. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Pellentesque at venenatis ex, vitae viverra lorem. Morbi ultrices lacus mauris, sit amet maximus massa congue vel. Vivamus laoreet dignissim ex, vel pretium nibh consectetur nec

Hand-in area

Files: [_____] Select file...

Description: [_____]

Submit

Figure 6.5: Hand-in area for an assignment.

Discussions is a feature which can be used quite freely. Convas, at the time of writing, allows any user to create a discussion board about anything. The idea is that if a student has a question, or has found some information which could be relevant to other students, discussion boards are a great way to share knowledge with others. Discussions are also automatically attached to course material such as videos and articles. This way students has a convenient place to ask questions regarding the material.

Each discussion board consists of a main message and responses to that message. Each response in turn can be responded to, grouping sub-discussions and answers in a convenient way. In the case of discussions connected to articles and videos the main message of the discussion is replaced with the material instead.

In order for students to be able to conveniently do things cooperatively the group view offers an easy way to form groups with other students. In the view a student can simply create a group or join an existing group. This can be used for certain assignments which requires a group to be handed in. At the time of writing important features, such as to limit group sizes, are not implemented, the reason being that such features were not necessary for the research.

The people view is simply a view listing the members of the specific course. Each member is marked with what type of member it is, be it a course administrator, teacher, or student.

6.2 Convas - Gamification features

The platform is gamified with the help of GWEN, a gamification API developed and maintained by the gamification company Insert Coin. The gamification elements are implemented with the intent to motivate students to consume the course material by giving instant positive feedback, offering rewards in the form of experience points and coins which can be spent in a shop, and by presenting progress in specific courses as well as in their studies as a whole in a nice and structured fashion.

6.2.1 Course Modules

When entering a specific course, by giving students clear goals and a clear view of how much progress has been made the motivation to keep going would likely go up. Figure 6.6 shows how this is done in Convas. Each course is split up into different modules where each module contains objectives concerning a specific topic, area, time span etc. The modules can be used differently depending on the course itself but the main purpose is to split the knowledge that the students should learn into smaller parts, making it easier to know what the next step is and to make progress. If used properly there are different ways for the students to learn what's needed.
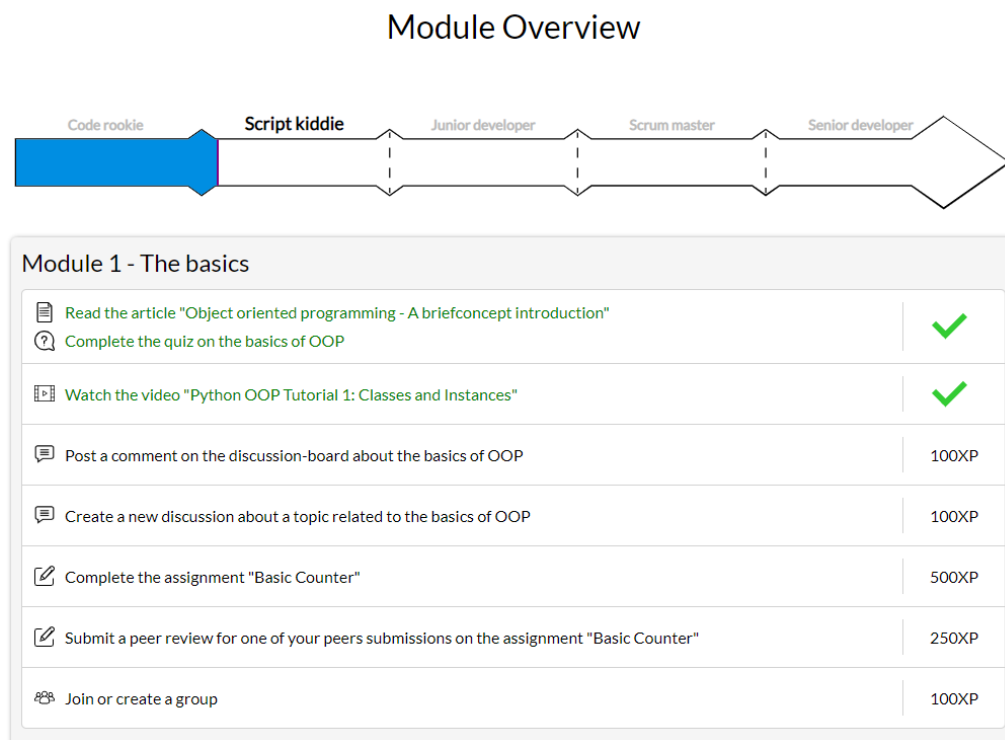
Figure 6.6: A module where a few objectives have been completed.

There are also sub-modules available. Sub-modules are there to separate specific content from the rest of the module. Reasons for doing that could be to have advanced content which are not obligatory but can aid in getting a higher grade. Sub-modules could contain content available for those who wish to specialize on a subject, or it could be there just to present extra interesting content, related to the subject but not necessarily to the course itself.

6.2.2 Objectives

As seen in the module overview of a course each module contains a set of objectives for the student to complete. Objectives are smaller goals for the student to reach during the course in order to be able to learn the required knowledge included in the course. There are a lot of different kinds of objectives available, each with its own strengths and weaknesses.

6.2.3 Feedback

As stated multiple times throughout this thesis, feedback is a big part of gamification (see 3.2.1.4). In Convas feedback is received through a plethora of ways. For example, a progress bar is displayed near the top of the module overview page (see Figure 6.6). When completing objectives a portion of the progress bar is filled. Connected to this progress bar is a rank. At certain points of progress the student

gains a new rank. Rank names differs between each course but the amount of ranks are the same. This way the students can easily compare progress between the different courses and can also feel some sense of accomplishment by reaching the different ranks with names supposedly related to the course itself (see 3.2.1.6).

Figure 6.7 shows another example which is Emil, a Chalmers student providing feedback for when bigger goals are achieved such as leveling up, reaching the next rank in a course or getting an achievement. While Emil is a character particularly fitting for the average Chalmers student it could be another character depending on the school or even the specific course.
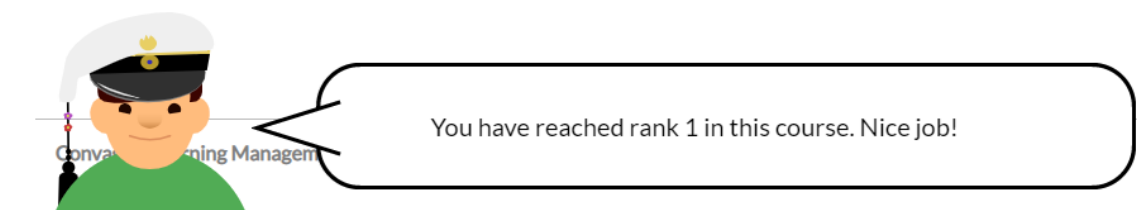
Figure 6.7: The Chalmers student Emil appearing to congratulate you on reaching the next rank.

Other forms of feedback are the progress bar to the left, right above the avatar of the student, showing how much experience the student has, increasing animatedly as experience is gained, and the panel shown in Figure 6.8 which appears as soon as an objective has been completed.
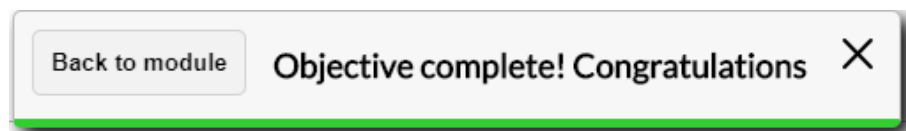
Figure 6.8: When the student completes an objective this panel appears at the top of the screen.

6.2.4 Gamification elements

There are a lot of game design elements used in gamification (see 3.2.1), some more common than others. In Convas there are a multitude of different gamification elements included with the intent of increasing student motivation and participation.

6.2.4.1 Levels

Levels (see 3.2.1.8) are one of the most common elements used in gamification. In Convas each user has a level which is constantly displayed at the left hand side for those who have not disabled the feature. Each user starts at level 1 and increases his/her level by gaining experience. Experience is gained by completing

objectives. While similar to the progress bar and rank in each course, the level is kept between courses. It is not a display of progress on a specific course but rather a display of how far the user has come since the start of his/her studies.

6.2.4.2 Achievements

While there are a lot of goals for the user to reach in the form of modules and objectives, having extra difficult and longer lasting goals and rewards to strive for can be really motivating (see 3.2.1.9). The implementation of achievements in Convas is more of a proof of concept with not many achievements actually functioning. The intent of the achievements in Convas are to be goals which takes longer to complete but that offers a bigger reward upon completion. Achievements can be tied to a specific course but can also require participation in multiple courses.

Some examples of achievements tied to a specific course could be completing every objective in a specific module or watching all videos in the entire course. Achievements not tied to a specific course could require that the user completes a number of article related objectives, more than what's available in a single course.

6.2.4.3 Currency

Another common gamification element included in Convas is some sort of currency. In order to further motivate users to gain levels and complete achievements currency is rewarded for doing this. The currency appears in the form of coins and can be spent on different items available in a shop implemented in the platform.
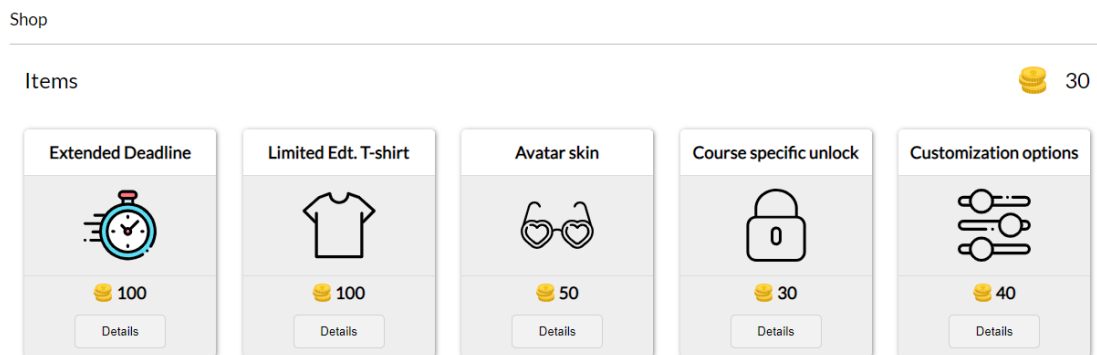
Figure 6.9: The shop page of Convas containing a few examples of purchasable items.

The shop is accessed through the navigation bar to the left. Figure 6.9 shows how the shop looks and a few examples of items available for purchase. Note that the items are only conceptual and not necessarily good items to have in such a shop.

6.3   Suggested guidelines

The following section will entail the final set of guidelines as a culmination of the insights gathered when developing the platform as well as from the various user testing sessions conducted. The guidelines aim to provide designers with a foundation when designing gamified learning platforms targeted at higher education students. The set of guidelines consist of refined versions of the guidelines specified in the process section. Each guideline will be rendered in the form of a short title followed by a description, containing its motivations and applications, as well as examples from which the guideline was derived.

It is important to note that following these guidelines does not guarantee a successful implementation of gamification in learning platforms, mainly because of two reasons. Firstly, the majority of time during this project was spent on the implementation of Convas. Following this, we have only been able to do user testing in the form of observing users initial reaction and feedback after only interacting with the system for a few minutes. As such, because of time constraints, no long time study has been performed, which is preferred when testing gamified platforms as the gamified experience aims to increase engagement and retention rates. Secondly, the users which Convas has been tested on all belong to a fairly homogeneous group of people, all being of Swedish background and all being students at Chalmers. This leads to the feedback the guidelines are based on being derived partly from Swedish culture and partly from the student culture found at Chalmers. As such, applying the guidelines in a context with another culture or at another university may yield differing results.

6.3.1 Avoid competition

Don't implement features which supports competition between students
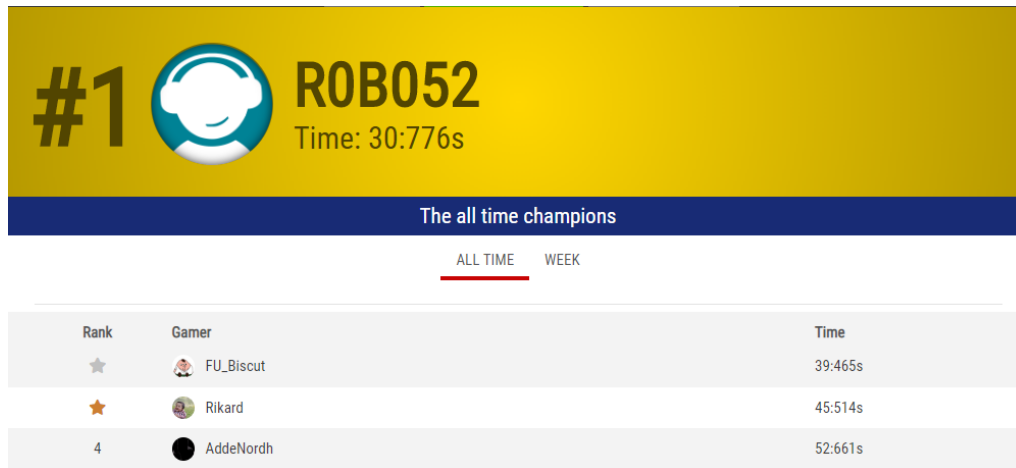
Figure 6.10: An example of a leaderboard. The leader is displayed much more clear than every other participant. Being closer to the bottom can feel quite discouraging.

Avoid implementing features that encourages competition, such as leaderboards or actual competitions. Competitive elements are one of the more common elements when it comes to gamification (see 3.2.1.12). As with anything, people are different when it comes to how competitive they are. Competition can therefore be very motivating to some, and less motivating to others (example seen in figure 6.10). In the case of games in general, competition can be a fun way of seeing how well you perform when compared to others, and motivate you to try and perform better. In the case of higher education, however, what might be a fun and motivating element to some, can be the opposite to others, especially as education is something which can affect your life a whole lot more than what games usually does. The positive benefits of people getting motivated by competition, in this case, does not outweigh the negative effect it can lead to. These reasonings were confirmed during our various user testing sessions, beginning with the questionnaire. The question regarding competition as a motivating factor gave very mixed results, which can be seen in its entirety in the appendix B. When asking about it during the user testing sessions, the results were similar, with testers being generally sceptical towards the concept. This is described in more detail in the process chapter. 5.4.10.1.

Our recommendation is therefore to avoid such elements when gamifying learning platforms. However, as previously stated, this is based on feedback from students at Chalmers. Should the same questions be asked to students at universities where the culture is more inherently competitive, then the feedback would likely be very different, and implementing competitive elements might actually be encouraged.

If competition is considered an important enough element that this guideline is disregarded, a suggestion which might reduce the negative effects of the competition is by not enforcing it. Having the competitive elements be *Opt-in* features could allow people not interested or motivated by competition simply ignore the feature. Important to note is that this suggestion directly contradicts the *Opt-out* guideline which is written further down in this chapter.

6.3.2   Level of seriousness

Be cautious about making the design too playful or "unserious".
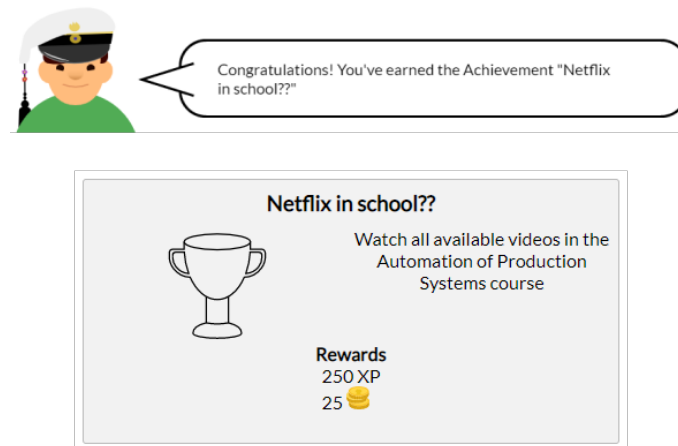
Figure 6.11: Keeping the language in accordance with the rest of the system is important as well. The above example from Convas is one of the less serious examples of achievements.

Keep the design, both aesthetically and functionally, serious enough for its context while keeping the gamification elements as effective as possible. High level education is a serious endeavour as it often has a big impact on the life of those who participate. A platform which can be perceived non serious can have a negative effect on users who are discouraged by this.

Usually this is heavily related to how the platform looks and how the feedback is received, rather than the actual behaviours that the gamification tries to push. For example, if a platform looks like a clean, well designed LMS with the expected functionality but with gamification integrated, it doesn't matter if using the system in certain ways rewards the user with points or not. On the contrary, users will most likely be encouraged by this, as is the entire purpose of gamification. If the system would have looked like a princess castle, or a space battle between alien species, the aesthetics might not be as appealing to everyone and therefore discourage some users from using the system, despite the functionality being the same and the gamification pushing the same behaviours. This issue depends highly on personal preferences. There is unlikely to be one aesthetic that everyone will like. Offering different themes or other aesthetic customization options could mitigate this issue.

This guideline is based mostly on results from a questionnaire (see 5.4.1) where a concern among potential users was that gamification is not serious enough. During user testing, when asked about the level of seriousness of Convas, most students found it to be serious enough to not have a negative impact. Some users were however skeptical to some of the gamification elements e.g. the shop (see 5.4.10.1).

6.3.3 Clear goals

Make the platform support setting goals as easily as possible.
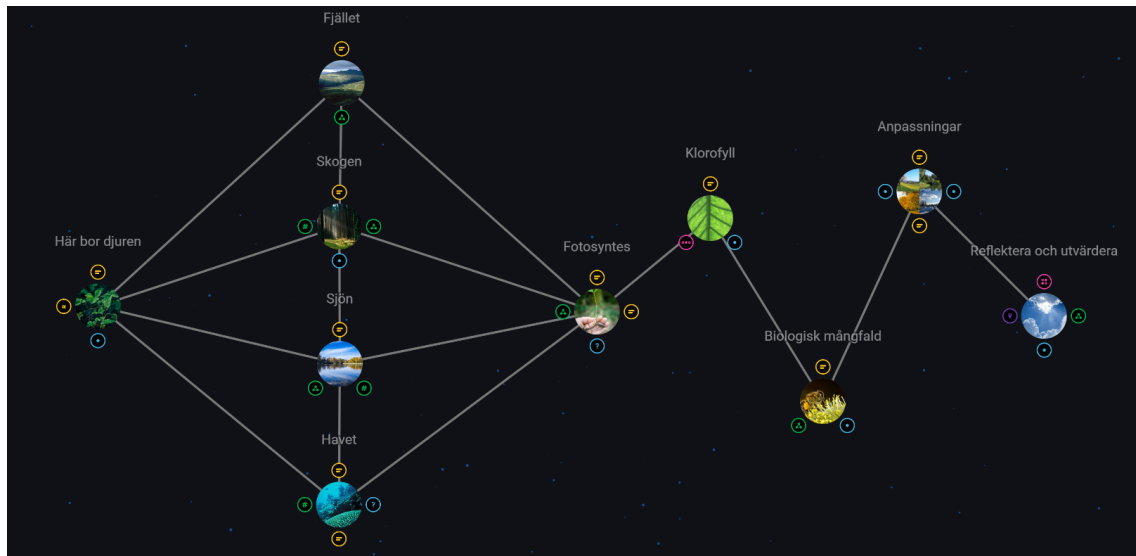
Figure 6.12: In the LMS *Loops* users are guided through a structured set of knowledge areas [85].

Something which can affect ones motivation to continue doing something quite drastically is having clear goals, which is why it is important to have the platform support setting goals as easily as possible. It can be quite frustrating as a student is not knowing what next steps there are to take in order to continue making progress. Gamification can bring a good solution to this by presenting the available actions to the user in a very clear manner, more so than if the gamification hadn't been there, making it much easier to know what there is to do as well as what has already been done. Some examples of how available actions are conveyed via gamification is through "objectives" or "quests". In Convas (and Canvas) this is done mostly through the objectives as explained in section 6.2.2, but also through the various achievements and the level system, explained in 6.2.4.2 and 6.2.4.1 respectively. Figure 6.15 shows another example.

While this guideline is applicable to gamification in general, it is particularly applicable to the context of education, as clear instructions of what the next step towards progression is can sometimes be especially difficult to find. It is also particularly good for when developing interfaces, as there you have a lot of control over how everything is presented to the user.
This guideline is supported by various theories about gamification and motivation, some examples being described in the theory chapter about goals (see 3.2.1.5), as well as by user testing sessions (see **??**) during which the majority of testers found the structuring of objectives to be a big advantage of Convas.

6.3.4   Relation between course material and the gamified experience

Try to design the platform so that it's easy to connect course material with a gamified experience.
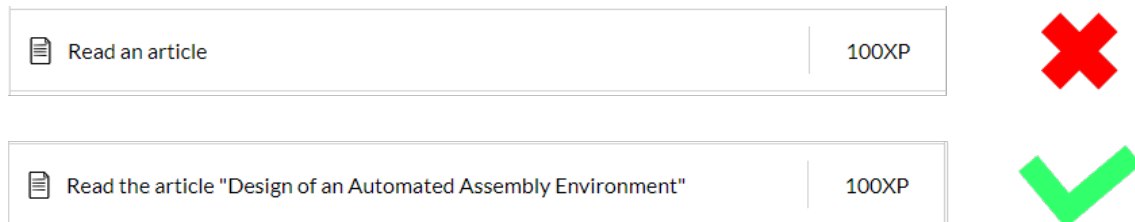
Figure 6.13: More specific objectives makes them more relevant and in turn increases motivation.

In order for the points, levels, achievements etc. to feel relevant, objectives has to feel relevant. It is very important that the behaviours pushed by the gamification plays a clear part in learning the course material. For example, while having an objective which tells the user to "read an article" could make users more prone to reading the course material, replacing the text with "read article X" where X is a specific article related to a specific topic within the course the objective feels relevant and motivates the user more than the previous example.

It is equally important to design the course material with the gamified experience in mind. Since a substantial part of gamification is providing users with clear goals and showing progress, it is essential that the course material allows for being split up and categorized into smaller steps, such as in the course modules of the platform. While this part is up to the person(s) responsible for the course it is still important that the platform supports this kind of education as best as possible in order to simplify the process.

This guideline can be tied back to the narrative element (see 3.2.1.1) as for a narrative to be effective it is important that it feels like the content is relevant to the story being told. The guideline is also heavily connected to the previous guideline of *Clear Goals* as if the objectives feels relevant it is much easier to know what to do and why.

6.3.5   Feedback, feedback and more feedback!

Put effort into making the feedback loop feel as good as possible.

Figure 6.14: The animation played when opening card packs in Hearthstone is well known for being designed purely to feel satisfying and to motivate the user to keep purchasing and opening packs [86].

Feedback is the backbone of gamification. Knowing when progress has been made and allowing the user to feel good about it is the biggest part of what pushes the user to continue being productive. A positive feedback loop (see 3.2.1.4). Therefore, while it may feel like a small part of development, putting effort into how progress and feedback is presented is very important. Progress-bars, notifications, rewards, levels, ranks, animations and so on are just a few of the ways of giving users feedback. Making sure they are presented in a nice fashion can make a big difference in how the user is affected by the gamification.
This guideline is also useful for gamification in general. However, as frequent positive feedback is usually lacking in education, adding more of it through gamification can have great effects. This is supported by user-testing done where it was noticed that the users had a noticeably improved attitude towards Convas after improvements had been made on the feedback, new and returning testers alike 5.4.10, 5.5.2.

6.3.6 Opt out

Don't enforce features which aren't clearly positive for everyone.
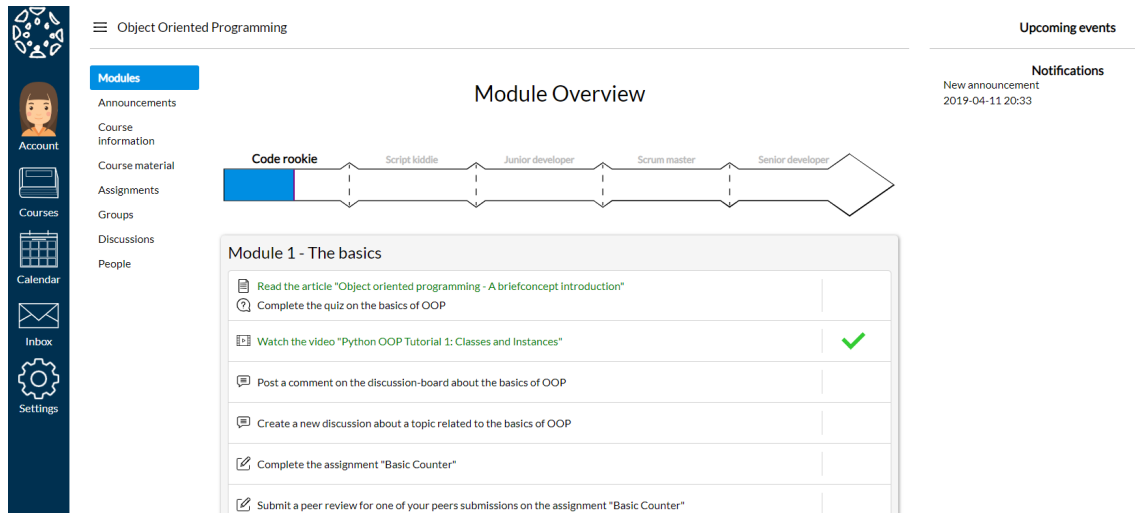
Figure 6.15: The course module view with all gamification elements disabled, which can be seen by the missing level, rewards and navigation options to shop and achievements.

While the main focus of gamification is to provide users with extra incentive for specific behaviours, if the users are already motivated enough to do the tasks even without gamification, or simply is not motivated by the different elements, the gamification might only serve as a distraction. The goal of the LMS is to be a useful tool for every student, and that goal is not satisfied if we actively push away students which the gamified elements does not appeal to. Therefore, any gamified learning platform should have options to disable some or all elements which exists as a separate layer of the platform with the sole intent of increasing motivation.

This issue became apparent during various user testing sessions (see 5.4.10, 5.5.2), where some testers declared outright that specific elements in the platform would have a negative impact on their motivation rather than a positive one. This issue is addressed in our platform in the form of four different settings which allow the user to disable levels and experience, achievements, coins and the shop, and notifications respectively.

6.3.7 Rewards only when they're earned

Make sure that rewards are given when it feels like they're earned. Not too early.
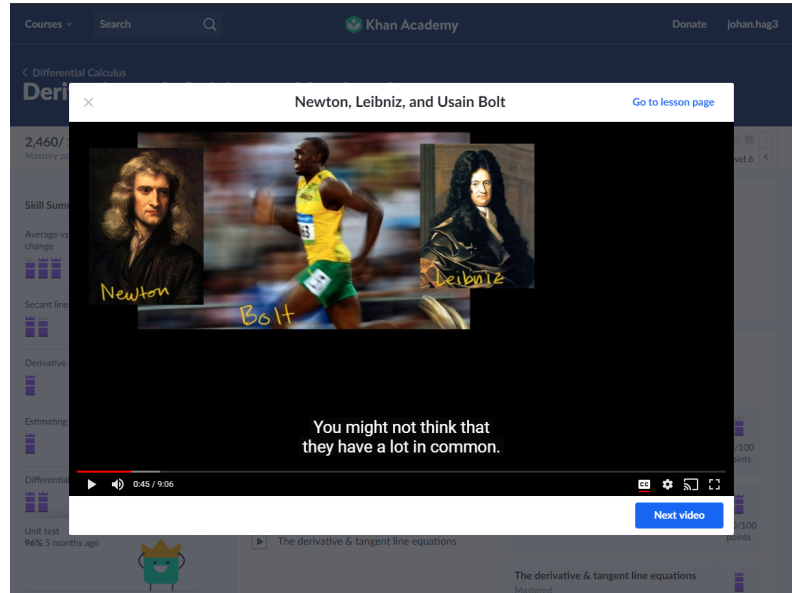
Figure 6.16: *Khan Academy* gradually rewards the user with so called energy points as the user is watching a video [87].

Receiving a reward after completing a challenging task feels great. Receiving a reward before completing the task or when doing something very easy can become quite tedious and risks having the opposite effect after a while. Having very frequent rewards for easy tasks is inadvisable. If a user receives a reward before he/she feels like the task was complete it might make the user feel like he/she is cheating, that the systems broken or that there was something that the user didn't understand which made him/her feel dumb. This should be avoided at all cost as it could quickly start reducing the motivation of the user.

While testing Convas it became clear that it did not feel good to complete an objective of reading an article when all that you had done was to click the link to the article, and not read a single word yet. The same applied for videos where the objective of watching a video was completed as soon as the video started playing, rather than when the whole video had been watched. Instead, completing the objective when the entire video had been watch, or having the user click a button when he/she had read the entire article would have removed the risk of the user feeling unjustly rewarded. Khan Academy shows a great example of how to reward users for watching videos (see figure 6.18).

This guideline relates to the previously mentioned guideline about feedback, but instead of promoting quantitative and qualitative feedback this guideline is more about the timing of the feedback.

6.3.8   Overarching progress

If the system spans over more than one course, make sure to incorporate rewards that lasts.
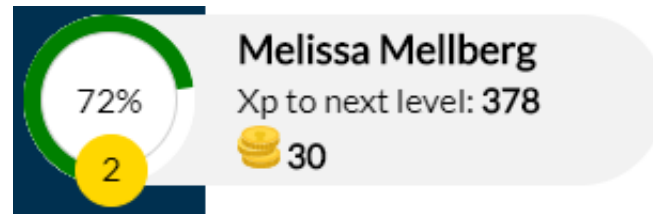
Figure 6.17: In Convas the level of the user is kept at all times, increasing as the user gains experience in different courses.

Something which can be very frustrating and in turn demotivating is the loss of progress. It feels better to know that your progress will last, and not be reset after some time or after reaching a certain goal. It is important to design the gamification in a manner where the progress made in the different courses does not become irrelevant as soon as those courses are over. We suggest including some sort of overarching progress, e.g. a level representing how much the student has engaged with the courses in the platform.

In the initial design of Convas, each course had a level, achievements and coins tied to it, representing how much the student had engaged in that specific course. All progress was tied to the specific course the progress was made in, and that progress became meaningless when the student would pass the course and enroll in new ones. After some discussion we figured that this could be a demotivating factor, and user testing during the first iteration confirmed our suspicions. We solved this through moving the level and the shop out from specific courses, letting progress in any course count towards these two elements. We then replaced the course specific levels with course ranks, which are basically simple progress bars representing how close the student is to consuming all the material in the course. This approach lets students keep progress between courses, while also having progress indicators tied to each course to better see their progress in that specific course.

This guideline stems from user testing interviews where testers agreed that a reward which lasted between courses would be nice to have (see 5.4.10.1). After adding this feature to Convas and conducting further testing, this proved to be a nice addition.

6.3.9   Design the system to have content available by default

Apart from specific deadlines and exams, students should be able to choose their path through the course material.

Figure 6.18: In *The Legend of Zelda: Breath of the Wild* [88], the player can proceed to the final boss immediately when starting the game, but it would be very difficult to defeat it.

Design the platform so that all the content in a course is available by default. Locking content behind time constraints or behind progress should be an option that requires actions to enable, not the other way around.

According to the Self Determination Theory (see 3.1.1) one of the important parts of feeling mental well being during a situation is autonomy. Allowing students to browse and consume content in the order that he/she sees fit increases autonomy. The feeling of competence is another important part of STD. As most users are likely to consume the content in the order that it is presented in it is therefore also important that the content is ordered properly and is paced such that it doesn't get too hard or too easy too quickly. Designing a form of narrative (see 3.2.1.1) also requires content to, to some extent, be put in a sensible chronological order

Nevertheless, there is little reason to not allow the students to astray from this order as they please, which is why the platform should have as much of the course content available for consumption at all times. Our recommendation would be to present the user with content in a sensible order for both competence and a potential narrative, perhaps encourage them to consume it in that specific order, but never to disallow the student to consume it in any order they want.

6.3.10   Social learning

Aim to support and encourage social interactions and learning.
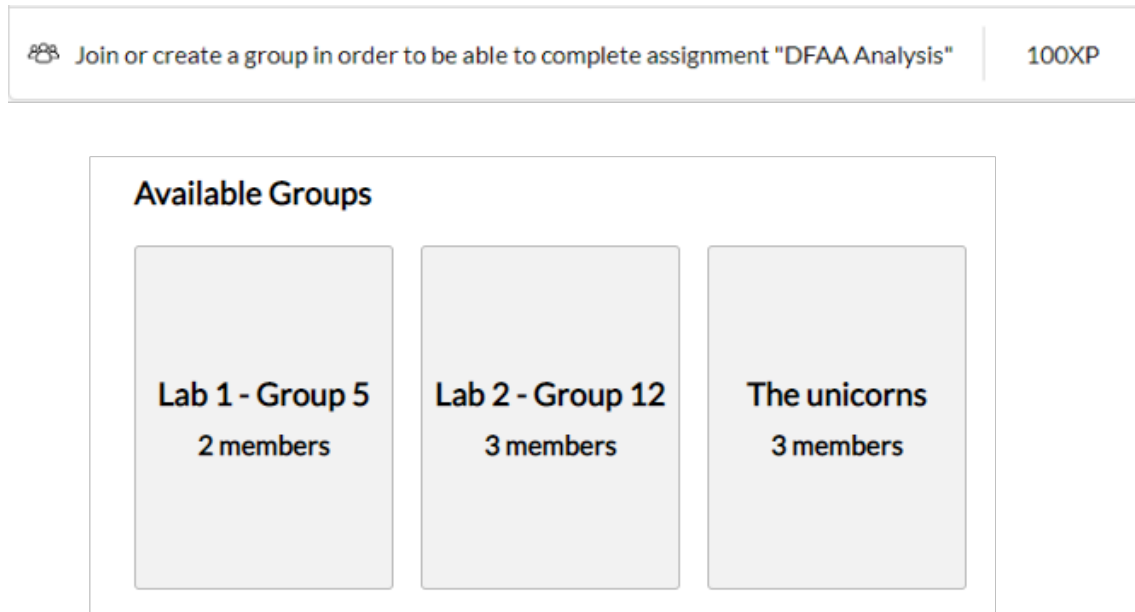
Figure 6.19: Giving student that extra push to interact with other students could have a positive impact.

Standing as one of the three main needs according to the SDT (see 3.1.1), social behaviour, or relatedness, is an imperative part of a gamified experience. Through implementing features in the platform which support students communicating, collaborating and helping each other one can not only satisfy this basic need, but also amplify student learning (see 3.2.1.2). During user testing sessions, the various social features of the platform were well received, and testers generally thought incentivising social behaviour would have a positive impact on their motivation. Therefore, we recommend not only implementing features which supports this, but also actively encouraging these features through the various gamification elements.

Examples of ways this can be implemented in a digital learning environment, some of which we have implemented in Convas, could be discussion forums, where students are encouraged to ask questions related to the course material and to help answering questions from their fellow students, student groups (see figure 6.19), which allow students to organize collaborative work and communication within project groups, peer reviewing, allowing students to give each other feedback on handed in assignments, or instant messaging, allowing students to send messages directly to other students, allowing for more streamlined communication.

7

Discussion

This chapter entails some topics related to the project which could have been further expanded upon or which could be included but was decided not to. It also describes potential future work on this subject.

7.1   The use of methods

During the project a variety of methods were used. Interviews (4.3.4.1), questionnaires (5.4.1), affinity diagrams (4.3.4.3), brainstorming (4.3.1.1), sketching (4.3.1.3), wireframing (4.3.2.2) and think-aloud protocol (4.3.3.3) all took part in the project on different occasions and with varying results.

Brainstorming, sketching and wireframing were really useful in moving the process along and constructing a thought out prototype. While sketching was used to a minimum, when it was used it was a quick way of conveying an idea, despite lacking particularly good drawing skills. Wireframing saved us a lot of time as it would most likely have taken a lot more time to implement the actual interface, had we not known how the layout of each page would be beforehand.

In order to do user elicitation we utilized questionnaires, interviews and think-aloud protocol. The interviews were one of the most useful methods used as it gave us a lot of insights on what the students actually liked about gamification in higher education. Think-aloud protocol was very nice as we could observe the reactions from the testers and get insights on the different features of the system. The questionnaire is something we most likely would have done differently. Our intent was to find out what peoples perception about gamification was, which we got. We also wanted to find out what people would like to see in a gamified LMS, however, the way that the questions were phrased resulted in people saying what they would not like to see instead. The affinity diagram resulted in a set of categories as seen in the process chapter. While these were something we somewhat had in mind during the implementation of the LMS there were most likely other methods which could have yielded what we needed but quicker.

7.2   Implementation of our own LMS

As described in the process chapter (see 5.3), we decided during the pre-study to implement our own prototype of an LMS and gamify it using GWEN, rather than

working with Insert Coin to create the GWEN implementation in the LMS Canvas intended to be used in courses at Chalmers. In hindsight, we believe that this was the better course of action, as it allowed us to have full control over the design and in turn the gamified experience. After working closely with Insert Coin during the course of the project, we have come to realize that the resulting gamified experience implemented in Canvas has been less than satisfactory, primarily because of heavy limitations in Canvas regarding the implementation of GWEN and the communication between the two platforms. Because of this, the resulting implementation lacked some key elements vital to a successful gamified experience, such as the ability to provide instant feedback. Through the implementation of our own system we could avoid these limitations, and therefore design the gamified experience exactly the way we intended, which we believe had a very substantial impact on the results.

Derived from this, it is worth having in mind that, in the case of designing gamification for an already existing system, these sort of limitations may exist, which might inhibit the possibilities of creating an effective gamified experience.

7.3   Level of seriousness

During the initial user research of the project one aspect which worried many was the combination of the quite serious topic of education and the much less serious topic of games. People felt that by including game design elements into education it would feel a lot less serious which perhaps would reduce the motivation to study for some, as the content would perhaps start to feel less relevant. This might be because of the fact that people connect education to productivity and entertainment, such as games, to the opposite. A few questions came to mind: What is it about games and gamification that makes it feel less serious? What determines the level of seriousness of a system? The graphics or the activities? Or both? We would argue that as the goal of gamification is to increase motivation and to drive certain behaviours it doesn't matter a whole lot if the 'look and feel' of the system is that serious or not as the behaviours being pushed are still the same. The 'look and feel' of a system comes down more to preference. The entire topic of seriousness could most likely take up an entire thesis which is why it wasn't a bigger focus of this one. However it could be very useful to look further into why people think that games and the elements that goes into game design aren't serious despite its clear improvements on motivation.

Since we would not have the time to allow for customization of the entire look and feel of the system we decided to keep it to what could be considered a fairly "serious" look and feel. To maintain this level of seriousness we decided to exclude certain elements which to some extent can be found in other gamified systems, such as avatar customization. This was because we found them to be "too playful" in the sense that it clashed with the level of seriousness associated with higher education.

7.4   Personalization

One element we decided to not flesh out as much as we could have was the element of personalizing your profile through the use of for example avatar customization. Avatar customization is an element commonly found in games, which allows the user to, to some extent, design their own avatar through changing features such as body features, clothes or accessories. The different options for customization could be unlocked through completing certain achievements, leveling up or purchased in the store. The main reason this was omitted from the prototype was our concern that it could potentially make the platform too playful for the context of higher education, to the extent that it would do more harm than it would do good.

Despite this, we do believe that the inclusion of more customization and personalization elements could have its benefits to the system and the user experience as a whole, as well as amplify other elements in the system. Introducing unlockable avatar customization could for example give more meaning to levels, achievements and the shop. Specific customization options could be rewarded to the user on level up, giving further incentive to raise ones level, on achievement unlock, giving the user more reason to pursue unlocking specific achievements, or through purchase in the shop, providing users with extra motivation to get more coins. All options for unlocking customization require the user to further engage with course materials, which stimulates their learning. By providing the user with various different ways to customize their avatar, it also both satisfies the need for autonomy according to the SDT, as well as lets the user form a closer bond with the system through their avatar. Finally, avatars could give way for further social interaction through viewing other users profiles and their avatars, making each user more unique and memorable.

7.5   GWEN

GWEN, or Gamify the World ENgine, aims to be an agnostic tool which implements great gamifcation out of the box (see section 2.4.1). For the specific context of higher education there are a few things which made this difficult to achieve. During the time of writing GWEN aims to drive the user towards certain behaviours by supplying an endless pool of missions, objectives, goals, feedback and rewards. While this works really well for other contexts where the goal is to encourage productive behaviours and increase participation in certain activities, education usually has a finite amount of content, as well as a preferred order in which the content should be consumed. This makes the GWEN approach less viable.

Nevertheless, the tool is still very useful. With some workarounds the gamification experience can become more in line with what fits education, Convas being an example of this. Even so, workarounds could lead to a worse gamification experience as the balancing of the platform could en up being inadvertently done

by the person implementing the LMS, rather than the developers of GWEN who has the expertise, which is the original intent. A suggestion which would allow GWEN to further open up to this kind of context is to add an option for users to create a more specific set of available missions, and also a recommended order of completion, all of this while still leaving the actual balancing to GWEN.

7.6 Competition

As mentioned in the process section, we decided to completely omit any kind of competitive elements from the platform, because of the potential detrimental effects it could have on the motivation of students who are not winning and because of the mixed feedback received when asking testers. This, however, assumes the case where the competitive elements are mandatory. It may be possible to mitigate the potential drawbacks by letting students choose whether they want to partake in the competitive elements or not. This way the students who are inherently competitive can use the competitive elements as an additional motivator, while the students who are not can simply choose not to partake.

7.7 Reinventing the wheel

There are features we chose to not implement which we believe would have impacted the platform in a positive manner, partly because of time constraints but also because the features already exist as third party services well-established enough for them to be considerably difficult to replace. One such feature is an instant messaging system, where students can communicate through instantaneous text messages, either one-on-one or in groups. This feature could not only further satisfy the need for relatedness and increase social learning, but could also be helpful for making initial contact with group members in the case where you don't previously know them, which is often the case in higher education.

The reason we decided not to include this feature is that we assume that students using the platform would only use this feature for first contact, and then move on to another already established communication service such as Facebook Messenger or Slack, in which case the first contact could be achieved through simply sending an e-mail, making the instant messaging feature redundant in most cases.

7.8 Teacher adaptability

This thesis focuses solely on the motivation and user experience of students interacting with a gamified learning platform, and no focus have been put on the design or implementation of tools for teachers or examiners to create, edit and manage courses in the system. As one of the guidelines state, the design of the course material is essential for a positive gamified experience, meaning that a

large portion of the responsibility for creating such an experience lies on the people designing the course and its material. Therefore, it is important that some sort of clear standard of how to best design the course material to fit the platforms way of presenting it exists and is made easily available for teachers. Without it, courses run the risk of being viewed as bad by students simply because the course material is not designed with a gamified experience in mind. In order to help teachers with the design of courses, some sort of detailed onboarding could be utilized, which explains the different kinds of objectives and course materials used in Convas, and how to use them in the best way. It might even be valuable to take the onboarding process one step further and also give the teachers an introduction to gamification in general and why it is useful. Since gamification is such a new area and because of its relation to games, there will probably be teachers with a negative attitude towards it. By explaining it in more detail, how it works and why, that attitude might change for the better, and the teacher will probably have an easier time when designing the course material.

Another thing worth having in mind is that different subjects may fit the layout of Convas differently. For example, a course in a largely theoretical subject such as math will probably see no problem being translated into a course in Convas, while courses in more practical subjects like cooking might not be such a good fit. This has more to do with the fact that learning management systems are digital platforms, which is hard to fit with practical courses, rather than it being a gamified system. This problem might not be too substantial, as the majority of courses offered at higher educations are mainly theoretical.

7.9 More diverse user testing

The user testing of Convas was only conducted with testers studying at Chalmers University of Technology, mostly because we ourselves are students at Chalmers, making it the most convenient University for us to find students willing to test our platform. All testers also had a Swedish background. This means that the guidelines partly based on feedback gained from the user testing sessions may be more focused on creating a successful gamification design for students at Chalmers rather than higher education in general. Had we prioritized spending time on finding testers outside of Chalmers and from cultures varying from the one found in Sweden, our result could have been more representative for the general case.

7.10 Ethical issues

As gamification in most cases require the use of technology it might be excluding of people who either do not have access to this kind of technology or is not able to use this technology for a particular reason. While gamification does not necessarily have to be implemented using technology, as this paper focuses on gamifying online learning platforms technology is a necessity which might become an issue

in some scenarios.

Depending on how the system is designed, it has the potential to negatively impact people who easily fall into addictive or compulsive behaviours, through the reward aspects which are commonly found in gamified systems. Perhaps further research should be done in order to mitigate this issue.

A common use case of gamification is to track user statistics, such as average level, time online or how much a specific task has been done. While the intent of this might be to make the general user experience a better one, it runs the risk of becoming a practice with malicious intent. While researching the user needs and improving the user experience is a good thing it can easily lead to manipulation which drives unintended behaviours.

While this may not be as big of an issue when it comes to gamification in education, there are other risks instead, such as users not being anonymous. Keeping track of the overall performance of a class can be quite useful and can lead to improving a course, but if it starts to affect the individual student, for example teachers targeting specific students because of their performance, be it good or bad, that's when it starts to become very problematic.

7.11 Future work

This section will entail some further work we would have done if the time to do so would have presented itself. It includes changes to the platform, the introduction of various new features, as well as plans for further user testing.

7.11.1 Long term study of the effects of gamification in higher education

As is the case with research through design studies, the majority of the time and resources producing our results was spent on the design and implementation of the platform. As a result of this, the feedback we got from the various user testing sessions solely consisted of first impressions and speculations. As the value of gamification lies in keeping a user motivated for a longer time span, a further study would have to be conducted, where users would be interacting with the system consistently over a period of time. The ideal scenario would be to test it in an actual course, much like the Vinnova project did with the GWEN implementation of canvas used in live Chalmers courses. A good approach to gather data in such a scenario would be to conduct A/B testing with our platform and the standard Chalmers implementation of canvas, comparing the engagement of the users through e.g. time spent interacting with the system in both versions to see if the gamified experience has a notable effect. Should the gamified platform perform better, we can put more weight behind our produced guidelines.

7.11.2 Onboarding

During testing, some users (particularly those who had very little previous experience with games) misunderstood the role of some of the gamification elements. An example of this was that several testers initially thought the percentage displayed at the level represented the progress made in a course, when it actually displays progress towards the next level. This led us to believe that some sort of onboarding for new users could be helpful, such as a short tutorial explaining how the system works and what the different elements mean. It would need to be skippable, as we would assume that the game design elements behind the gamification patterns are fairly widely known.

7.11.3 Further integration of Emil

Currently, the Convas mascot, Emil, is only used for giving the user instant feedback of their progress in the form of notifications. We think that he can be applied to handle more communication between the platform and the user. Areas where he could be applied include the previously mentioned onboarding, providing the user with general tips and tricks, giving short introductions to different course modules or giving the user encouraging words when e.g. taking a quiz. It is important to not make Emil too intrusive to the point where he becomes a nuisance rather than a help. It is also possible to add more avatars like Emil and use them for differing purposes, such as one avatar for helping the user with information, and one for instant feedback.

7.11.4 Upvoting-system in discussions

A potential problem with the current implementation of discussions and having objectives for posting in/creating them is the risk of users posting comments and creating topics with no meaningful content only to complete the accompanying objectives. One idea we have to counter this is to allow users to upvote or like comments and topics they find interesting or helpful, and then rework the platform to incentivise getting a certain amount of upvotes on the comment or topic instead of just incentivising the creation of them. This could help with keeping the content of the discussion boards meaningful and valuable, while it could also help users to find the most useful information through sorting the discussion topics and comments after how many upvotes they have. This could, however, have negative effects such as certain comments getting upvotes early on, making other, perhaps even more relevant comments not getting the attention it might should have gotten. This entire feature could warrant an entire thesis which is why it won't be discussed further here.

7.11.5 Course selection skill tree

Another idea we discussed was adding a skill tree like view depicting all available courses in different trees, depending on which discipline they belong to. The basic introductory courses would appear as the root of the skill tree, with the more

advanced courses being branches of the courses which are required to take the advanced course. When clicking on one of the courses in the tree, the platform would either display information about the course or link the user to a course page. The leafs of each tree could be related to areas or professions in the industry where the teachings of the courses in that specific branch are applied. Passed courses would be displayed in the tree in the same way that a learned skill would be displayed in a common skill tree. This view could also be used for course selection, making the process a bit more interesting and informative as the student can easily see which advanced courses rely on specific courses, as well as where the course content is used in the industry. By adding some further information, such as the requirements for the students programme as well as the students progress towards completing those requirements, this view could also serve as a good overview of the students progress towards graduating.

7.11.6   Industry suggested projects

In the initial questionnaire, we asked users if they would be motivated by more involvement from the industry in their education. The majority of the people answering the questionnaire explained that more involvement from the industry would have a positive impact on their motivation to study. In the end, the current version of the platform does not have any specific features letting the industry be more involved in courses, but we have discussed an idea which would achieve this. It is a feature where companies can provide courses with project suggestions related to the course. Students can then voluntarily sign up for projects they find interesting. Taking a project would both let the student get connections with actual companies, which could lead to potential work opportunities, and it would give the student perks in the related course, where the project could give extra credits for the exam, or possibly replace the examination entirely. A potential drawback of this feature is that if a project leads to a student being hired by a company, that student is less likely to complete their education, resulting in fewer students graduating.

8

Conclusion

The purpose of this thesis was to try to find ways of increasing student motivation in higher education by answering the following question:

What factors should be considered when implementing gamification patterns into a digital learning platform with the intent of increasing student retention rates in higher education?

To help answer this question, studies on gamification and the underlying theories such as self determination theory has been conducted, as well as interviews with students, teachers and gamification experts. To make use of this knowledge *research through design practise* (see 4.1.1) has been utilized. A learning management system prototype, Convas, has been developed, along with a set of guidelines for implementing gamification in such systems and for higher education contexts.

Convas is a web application developed using React.js, a JavaScript framework for front-end development. It was created in order to make findings about the effect of gamification in higher education and about what gamification elements work better in that type of context. To confirm these findings user elicitation was conducted in the form of questionnaires and interviews. The prototype was developed over three iterations, the first two iterations being followed by extensive user testing using the think aloud protocol as well as semi structured interviews. The user testing was performed solely on students of Chalmers University of Technology.

To further validate the guidelines the prototype was compared to an ongoing project at Chalmers University of Technology where a course has had gamification implemented into Canvas, the LMS used at Chalmers. The implementation in Canvas was done by the company Insert Coin AB. We developed our prototype with supervision from Insert Coin.

Based on these findings a set of guidelines was created with the aim of aiding future similar projects in making a system and gamified experience well suited for higher education. The resulting guidelines are as follows:

1. Don't implement features which supports competition between students
2. Keep the design serious enough for its context but with gamification ele-

ments

3. Make the platform support setting goals as easily as possible.
4. Try to design the platform so that it's easy to connect course material with a gamified experience.
5. Put effort into making the feedback loop feel as good as possible.
6. Don't enforce features which aren't clearly positive for everyone.
7. Make sure that rewards are given when it feels like it's earned. Not too early.
8. If the system spans over more than one course, make sure to incorporate rewards that lasts.
9. Apart from specific deadlines and exams, students should be able to choose their path through the course material.
10. Aim to support and incentivise social interactions and learning.

The guidelines presented here are short summaries of the guidelines presented in the Results chapter (see 6.3), where they are rendered more thoroughly, being presented as an informative title followed by a description containing its motivations and applications, as well as examples from which the guideline was derived. While these guidelines could be useful for their purpose it is important to note that in order to further confirm the effect of utilizing them a longer study would be required, along with studies on a more diverse set of users than what was done in this thesis. With the limited time reserved for this project the long term effects were difficult to attain.

Furthermore this thesis only looked at gamifying LMS software from a students point of view. To expand upon the results of this thesis more guidelines supporting the administrative side of the LMS would be useful. In the end, teachers and course responsible have a lot of say in how the gamified experience turns out. Making the process of shaping a course along the lines of gamification is very important in making a gamified LMS which will be utilized to its full potential.

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A

Questionnaire questions

Questionnaire sent to a collection of students at Chalmers University of Technology.

Questionnaire about education

This questionnaire aims to find out students preferences when it comes to education, learning management systems and gamification. Your answers are completely anonymous and will be used by us (Johan and Oskar) to create a better prototype for our master thesis work. The result will hopefully aid in improving education in the future.

Learning

This section regards different forms of learning and motivation.

Which forms of education do you feel that you learn the most from?

- Lectures
- Reading course litterature
- Doing exercises
- Project work
- Watching videos
- Writing essays
- Teaching others
- Serious games (Games with educational intentions)
- Other...

Which forms of education do you think is the most fun?

- Lectures
- Reading course litterature
- Doing exercises
- Project work
- Watching videos
- Writing essays
- Teaching others
- Serious games (Games with educational intentions)

• Other...

Do you agree with the following statements?

I prefer studying in groups
1 - Completely disagree   5 - Agree completely

I prefer when I can make my own schedule
1 - Completely disagree   5 - Agree completely

I believe that I understand the relevance of what I'm learning to the course
1 - Completely disagree   5 - Agree completely

I believe that more involvement from the industry (be it guest lectures or projects) would be motivating.
1 - Completely disagree   5 - Agree completely

I believe that I get enough feedback during the course to know when I have learned what I am expected to learn.
1 - Completely disagree   5 - Agree completely

I am motivated by competition
1 - Completely disagree   5 - Agree completely

Learning Management Systems

Learning management systems (LMS) are systems that aims to aid the learning process throught features such as being able to hand in and get assignments graded online. Some examples are PingPong, Canvas or GUL.

Have you used a LMS before?
Do you believe that the LMS you have used have had a positive impact on your studies? (If yes, what features have been the most useful. If no, what do you feel is missing?)

Gamification

Gamification is defined as "using game design elements in non-games". For example when receiving points, levels, achievements etc. for completing missions, challenges or quests in a learning app.

I think that a gamified LMS would have a positive impact on my motivation to study.
1 - Completely disagree   5 - Agree completely

Which gamification elements do you think would have a positive impact on your motivation to study?

• Missions and Challenges

- Experience points and Levels
- Achievements and Badges
- Highscores/Leaderboards
- Personalizable avatars
- Currency rewards used to purchase goods and services
- Knowledge trees (e.g. choose your own path through a course)
- Other...

Do you think gamification could have a negative impact on your education? If so, why?
Do you see any ethical issues with using gamification to increase student motivation?

A. Questionnaire questions

B

Questionnaire answers

Which forms of education do you feel like you learn the most from?
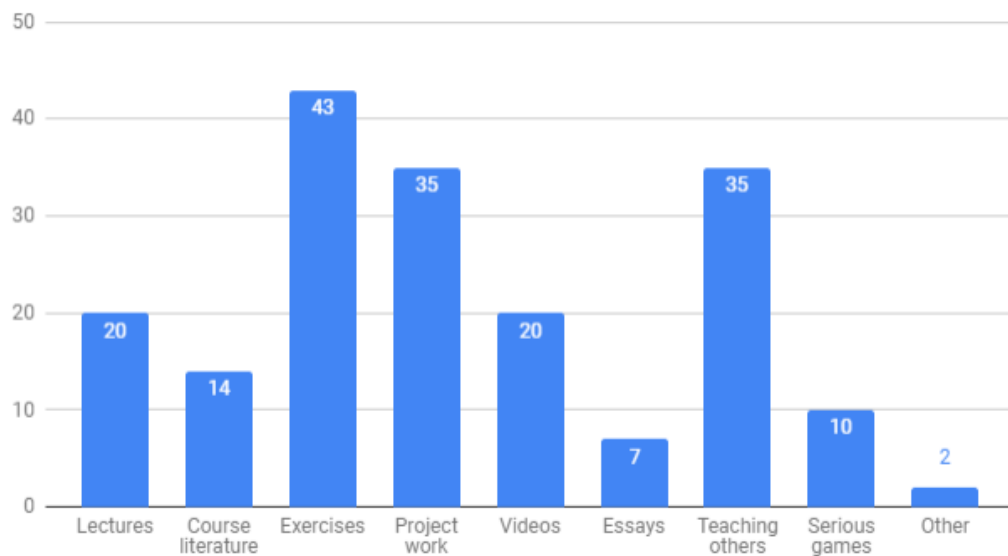
Which forms of education do you think is the most fun?
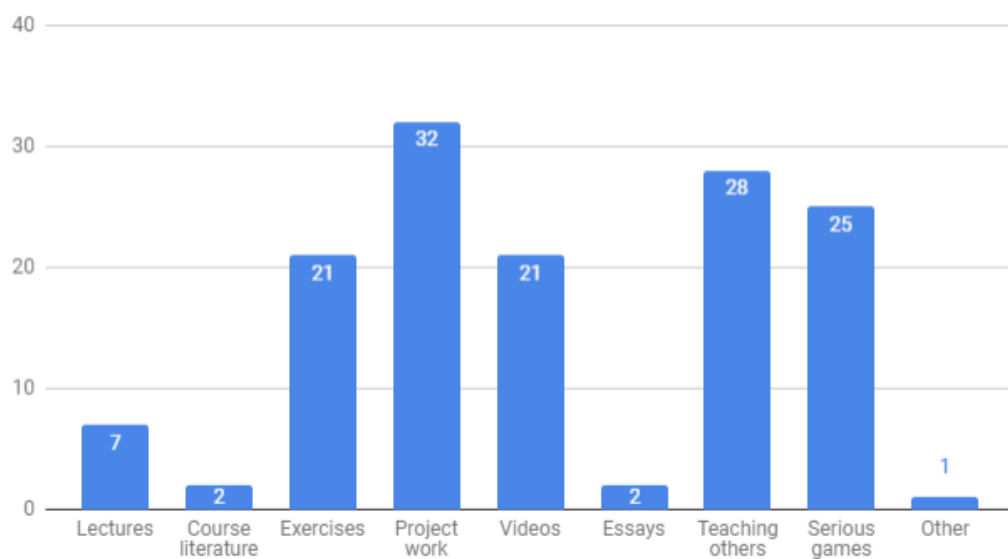
B. Questionnaire answers

I prefer studying in groups
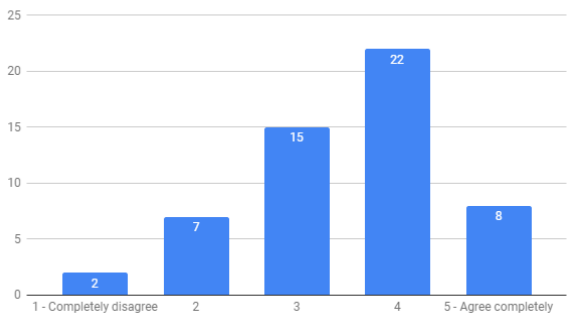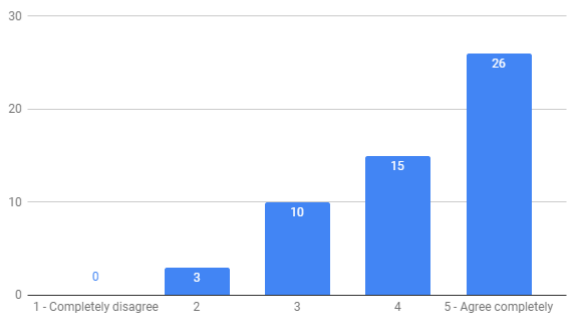
Response	Count
1 - Completely disagree	2
2	7
3	15
4	22
5 - Agree completely	8

I prefer when I can make my own schedule

Response	Count
1 - Completely disagree	0
2	3
3	10
4	15
5 - Agree completely	26

I believe that I understand the relevance of what I'm learning to the course

Response	Count
1 - Completely disagree	0
2	4
3	18
4	27
5 - Agree completely	5

I believe that more involvement from the industry (be it guest lectures or projects) would be motivating.

Response	Count
1 - Completely disagree	1
2	6
3	10
4	19
5 - Agree completely	18

I believe that I get enough feedback during the course to know when I have learned what I am expected to learn.

Response	Count
1 - Completely disagree	0
2	22
3	18
4	11
5 - Agree completely	3

I am motivated by competition

Response	Count
1 - Completely disagree	10
2	10
3	9
4	14
5 - Agree completely	11
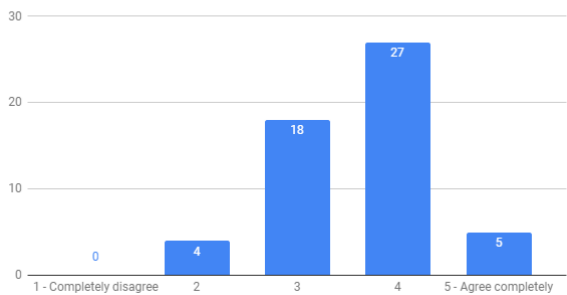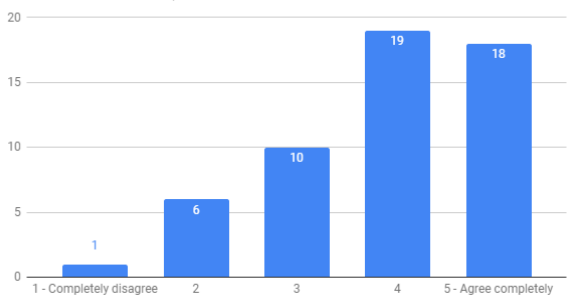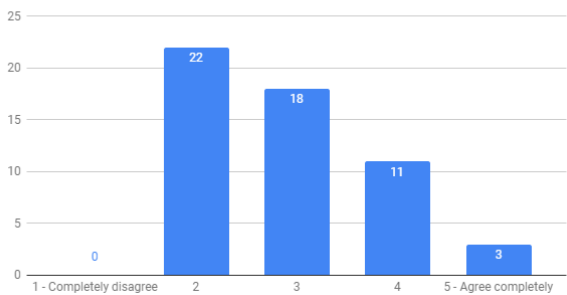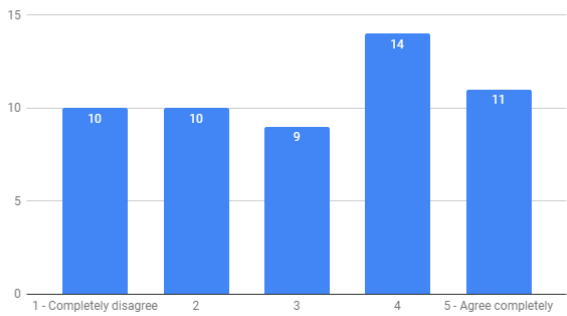
Have you used a LMS before?

- Yes — 90,7%
- No — 9,3%

Do you believe that the LMS you have used have had a positive impact on your studies? (If yes, what features have been the most useful. If no, what do you feel is missing?)

It wasn't used properly and most of the time there was some kind of problem during the courses with it

Keeping the pace up to see an early goal to work towards.

not really, shitty systems

Yes. They're useful for organizing documents and similar things

Yes, since I get all the papers and assignments there. But I can be better and clearer. Many teacher uses it in different ways

No. They have only focused on "progress" in a "true/false" manner for certain objectives/hand-ins/goals etc. Not so encouraging and not so motivating, just a tool.

No they are often bloated, hard to use and no single course uses them the same way as any other course.

No. They have all been badly designed.

Yes. I find it useful when a course provides exercises, study questions, and similar through the LMS. I also find that automated tests through LMS, the few times I've encountered them during my education, have had a positive impact on my studies. I do, however, wish there were more exercises with automated "grading", similar to Hackerrank and other sites. These are however difficult in some scenarios, but fit very well for for example programming imo.

No, they're usually a hassle to use.

"Canvas has a feature to make modules to split the teaching. Really useful.
Least useful: complicated guidelines that makes navigating and finding files hard"

I can't think of anything. For me it's just a tool in which I submit papers. Sometimes you have to find and download information from Ping-Pong, which often is really cumbersome.

Yes, canvas modules allow tracking progress through the course.

B. Questionnaire answers

Yes, removing physical boundaries enables faster responses in many cases and time spent with Professors, Lecturers, TA;s and so on can be spent on productive work.

Ja. Tror att duggor via pingpong kan ha hjälpt. Beroende på kurs är det också väldigt bra att ha all material på ett ställe, typ gamla tentor, övningar, power point etc.

No, I have mostly used PingPong and it is a mess. However, Canvas way of structure (clear list for deadlines, hand-ins etc) makes my studying a bit easier

It's an easy way to hand in assignments

Neither

The quizzes on ping-pong are pretty useful, the notice board where you can post about problems are useful, that students can grade each others papers are useful

Yes. Easier process

Not sure? The point of them seems to be to make it easier to manage the course; distributing material, handing in assignments etc. so it doesn't directly impact me, aside from being a platform for doing this. I do not know a version of my education without it, so I don't know the impact of it, I guess?

"Yes- Being able to hand in things online and get feedback online helps by taking away some of the mental burden of keeping track of hand-ins.

Also, when done correctly, helps with finding relevant course lit & info compared to non lms solutions."

Yes and no, as I think it's made it easier to get some things done as things tend to gather in the same place. No because I just don't feel like I've used it enough to actually make a significant difference

Ping-pong is good because all information is readily available and structured in a clear way.

It's useful for making project groups, submitting assignments and having documents in ome collected place

Being able to see exercises and litterature before lectures

Yes, it is easy to find administrative information (course pm, deadlines for assignments, etc)

In some sens with the information What to Do in the course

Missing structure of where to find things and how these are sorted

I think that they are useful to keep track on course material and updates as well as being a good way for hand-ins.

Compared to PingPong, a punch in the face is preferable. Canvas is PingPong with css-makeup

Getting feedback on hand-ins

Do you think gamification could have a negative impact on your education? If so, why?

I badly designed gamification could incentivise focusing on wrong things.

Leaderboards or similar competing environments would probably discourage people towards the bottom.

No

Stress and pressure to perform could be made worse if more emphasize is put on competition with highscores or achievements

If it is only designed with extrinsic motivations (compared to intrinsic), I think that it will be too naive and too much like a game. But using more intrinsic - yes!

I can imagine I whould get stuck on some things, trying to complete or perfect them, when in reality there are other areas in a course where I should put more focus.

It might increase students inciting each other for higher grades in an unhealthy way.

Maybe. Some may focus more on the game itself than the studies or think it is "nonsense" and thus not use it.

It might lead to me doing just the things that will give me point, which might or moght not be what I actually need to learn.

B. Questionnaire answers

Depending on how grades are awarded gpr example leaderboards might increase stress. Also a system that is "winnable" by some trick or subset of knowledge rather than knowledge of the entire course is of course bad.

If mandatorly competitive, any course I would find hard would be even harder due to how bad everyone would know I am.

No

If students become required to play a game when they already have a study method that works for them

Maybe if it is too wierd or difficult to the extent that it makes my studying harder and more complex rather than fun

Might be distracting and feel more as polish than depth

No

It shouldn't become an obstacle in the studies, so you need to to extra stuff before you can actually start studying. Or, if it's a requirement to log your work etc, because that also becomes something extra for the student to do (apart from the actual studies).

It's not taken as seriously as traditional education so you put it off

I dont think there would be any negative effects. Although I believe education and gamifaction are two things that are very hard to mix properly, and still feel genuine and fun. So, in a sense if you don't enjoy a gamified education system, you will not want to continue with that education.

Another element to think about and could make a course "complex" and adding more stress. Changing the focus in the course.

nope

Yes, competition isn't always good.

"Maybe if it gets too competitive. Then maybe students would avoid helping one another in order to ""win"". or if students just focus on getting the right solution to one speciefic problem (to get som kind of reward for example) without really understanding how to solve problems of that kind , or why that procedure should be used. "

X

No

Maybe one will start competing against friends in the same course?

Might lead to cluttering

Create a more competitive environment which leads to higher stress levels

To much fun, destroys concentration

I really don't see how a system like, say, pingpong can be gamifies in a meaningful way? If you add stuff to make it more game-like, then it's just fluff on top which makes the actual content more difficult to use. If you "add" what I've selected above then you just found new names for and tweaked assignments, grades and csn. I would also be very hesitant to the use of a high-score or a leaderboard. I like it in lectures, because you're anonymized due to the quick nature of the questions, no-one really takes one lecture too seriously, and it helps break monotony. But if there always was a leaderboard, everyone could see how good/bad everyone else is, which is begging for elitism and people feeling like crap.

"Yes, adding the input of what excersises I'd done / what pointss Id got etc would add an unneccesary overhead. Unless it's mostly automated, it's just be annoying. Missions and challenges could be stressful. Experience points and levels would be useless unless you could use them for alternative things (increases damage in game, etc. Just going from lvl 1 -> 2 is pointless).

Achievements and badges ... We already have those in the form of ""You've successfully handed in the paper and it got accepted"".

Highscores / Leaderbords could very easily turn into a toxic stress element.

Personalizable avatars are meaningless unless you have social interaction where others can see your avatar. Unlocking different customization options for your avatar could be a source of pride & a target goal for someone, but it'd require that several courses use the same avatar system, and that people recognize the importance of certain customizations.

Currency rewards ... that discussion quickly turns political; people who are good studies get richer, is that marginalizing the students who need most help?

Knowledge trees... We already do that, you choose specializations three times during your educational career. Gymnasium choice, bachelors choice, and masters choice. (And those are just major choices, we also pick 3rd language in school, and many courses are manually selected during university.)"

No, not even I do, and I hate competition haha.

There might be some elements of a course that is hard to present through games and is better explained through laboration, practices etc.

I think it would feel a bit childish. Maybe it would work well for children, but at university it would feel silly and awkward. Some might be put down if they don't have as many points as others.

None that I can think of

To stressful for very competative people

I think it is misleading and only spreading information in a more unstructured way

It could add further pressure and could overwhelm the user with information. Some people might not want to be compared with in things such as leaderboards. Could be voluntary.

Applying gamification for the sake of gamifying risks being very counter productive. IF it can be a natural appliance, I think it could be good.

If it's too competitive or I have to compare myself to others all the time. This is something I already do too much which is lowering my self esteem

Do you see any ethical issues with using gamification to increase student motivation?

Problem with people suffering from game addiction since before

No

if it is gamification in the form of competition against others (leaderboards etc) then yea

Nothing specific

It could end up with too long/intensive sessions and be bad for daily routines (time for sleep, time for studies/work, time for spare time activities etc.). ...Freedom of time doesn't suit everyone in learning. Some need (help with) routines.

No

In the case of leaderboards it can be tough on some students to have their score "publicicly" displayed to their peers. Not all students are competitive and want others to know how good or bad they are in a subject or certain areas of a subject.

No.

A bit, yes. It might turn a serious thing (becoming a better person, learning things, researching for the future benefit of all) to something that can be seen as "just a game". It could therefore lessen the prestige of attending a university.

Feeding addictive reward systems might decrease "normal" motivation in other aspects of life

Not really.

No

Depends on design and how much ipact the game element have on a students chance at good grades. A compliment or requirement.

Not really

I'm not sure if it counts as ethical, but gamification for a class shouldn't be constructed in a way that you have to learn the idea behind gaming and achievements and such beforehand. Some people are gamers, some are not, and I guess the gamers shouldn't really be in too much of an advantage, because then maybe other students will feel "left behind"/"stupid"

Competition and highscores for grades can cause an unnecessary stress factor

Students who are low on the leaderboard, with low achievements, or basic avatars for example, could be shamed and thus lower their motivation/self-esteem. Especially in cases where students are truly struggling to absorb the teaching material.

Highscores/Leaderboards

nope

Maybe should be opt in. Since many student are not at all interested in competing in their studies. Also, the very motivated students may very well see the gamified tools as ridiculous overhead.

No not really

No

See above

I guess if it could put more pressure on people, who already have enough pressure as it is; instead of just feeling like they have to pass the course, the also feel like they have to finish a quest or something.

"Yes.

Adding a competitive element could cause stress and social anxiety to people who perform poorly. We are social creatures, and if we have a system that emphasises points and easy-to-compare scores in a gamified system that contain mechanics meant for social comparison (achievements, highscores) we could create socially awkward situations for people who need help."

Not at all!

None that I can think of

No

It could add further pressure and could overwhelm the user with information. Some people might not want to be compared with in things such as leaderboards. Could be voluntary.

Gamification isn't for everybody - education should be

Competitiveness leading to lowered self esteem and achievement if you compare yourself to the "wrong" people, or maybe just by comparing yourself to others at all

C
Mockups

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Course progress
6/10 modules complete

Emil Emilsson
Code rookie
350 exp left to become Hack3r

Module overview

Module 1: If-statements

[Advanced] Module 1.1: switch-statements

[Advanced] Module 1.2: Ternary operator

Module 2: Loops

Current mission
Objective #1
Objective #2
Objective #3

Reward 2 🪙

Upcoming events
* Read article x
* Hand in ass
* ???
* Profit

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Introduction
Lorem ipsum dolor sit amet, consectetur adipiscing elit. Maecenas congue magna leo, ut auctor turpis elementum non. Nullam neque ligula, semper quis laoreet in, volutpat ut ligula. Pellentesque in lacinia mi. Ut semper leo id lectus ornare, quis malesuada dui consequat. Cras posuere sapien nisi, id porta turpis pharetra quis. Donec at mi sit amet neque porta auctor vel metus. Praesent pharetra purus eu nibh sollicitudin maximus. Maecenas quis sodales ex, nec viverra orci.

Learning outcomes

* Learning outcome 1
* Learning outcome 2
* Learning outcome 3
* Learning outcome 4

Course components

Literature

Grading

Current mission
Objective #1
Objective #2
Objective #3

Reward 2 🪙

Todos
* Read article x
* Hand in ass
* ???
* Profit

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Discussions   + Discussion

Why does this not work??   13 answers

Posted 21/3 14:52 by Emil   Last response 24/3 23:02

Current mission

Objective #1

Objective #2

Objective #3

Reward   2

Todos

* Read article x
* Hand in ass
* ???
* Profit

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Course material

Obligatory reading

Java 4 newbies   Download   Discussion board

Videos

Booleans: To be, or not to be   Discussion board

Relevant articles

Files

Current mission

Objective #1

Objective #2

Objective #3

Reward   2

Todos

* Read article x
* Hand in ass
* ???
* Profit

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C. Mockups

Calendar

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Week / Month / ◁ Mars ▷	26	27	1	2	3	4	5
	6	7	8	9 (Math hand-in)	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
	27	28	29	30	31	1	2

Current mission

Objective #1
Objective #2
Objective #3

Reward   2 🪙

Upcoming events

* Read article x
* Hand in ass
* ???
* Profit

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Calendar

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
◁ Mars ▷	26	27	1	2	3	4	5

Math hand-in   Edit

Date:
Time:
Description:
Location:

6	7					12
13	14					19
20	21					26
27	28	29	30	31	1	2

Current mission

Objective #1
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Reward   2 🪙

Upcoming events

* Read article x
* Hand in ass
* ???
* Profit

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Groups

| Lab group 1 | Lab group 2 | Project group 1 | + Create/Join New Group |

Members

Emil Emilsson   Emilia Emilsson   Emilio Rodriguez   + Add new member

Send e-mail to group   Leave group

Assignments

Group assignment 1: A simple calculator

Group assignment 2: Memory game

Current mission
Objective #1
Objective #2
Objective #3

Reward   2 🪙

Todos
* Read article x
* Hand in ass
* ???
* Profit

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Create new group

Name your group

Choose assignments

Laboration 1: A simple calculator	Max group size: 3	☑
Laboration 1: A simple calculator	Max group size: 3	☐
Laboration 1: A simple calculator	Max group size: 3	☐
Laboration 1: A simple calculator	Max group size: 3	☑

Invite members

Enter name or email

Already invited

Emil Emilsson

Create group

Current mission
Objective #1
Objective #2
Objective #3

Reward   2 🪙

Todos
* Read article x
* Hand in ass
* ???
* Profit

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C. Mockups

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People

Name	Section	Role
Emil Emilsson	Interaction Design and Technologies	Student

Current mission

Objective #1
Objective #2
Objective #3

Reward   2 🪙

Todos

* Read article x
* Hand in ass
* ???
* Profit

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Assignments

Module 1

Laboration 1.1	Approved
Peer review laboration 1.1	Done
Quiz about indentation	14/18
Laboration 1.2	2019-04-13 23:55

Module 2

Module 3

Current mission

Objective #1
Objective #2
Objective #3

Reward   2 🪙

Todos

* Read article x
* Hand in ass
* ???
* Profit

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☰ Example Course > Assignments > Laboration 1.2

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Assignment   **Laboration 1.2**

Description

Hand-in area

Files: [   ] Add file...

Description:
[   ]

Submit

Current mission

Objective #1
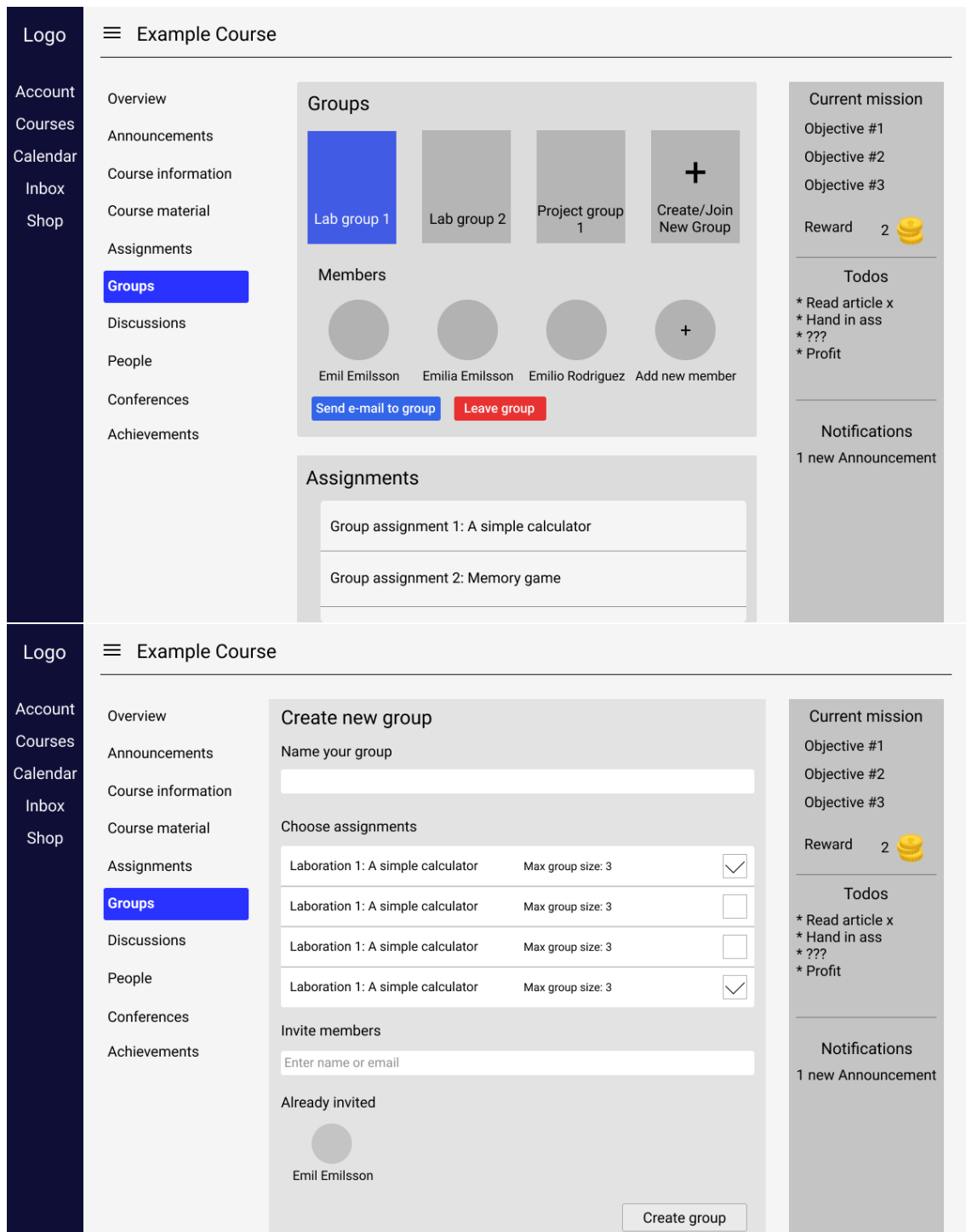
Objective #2

Objective #3

Reward   2 🪙

Todos

* Read article x
* Hand in ass
* ???
* Profit

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Hand-in | Peer review

Assignment   **Laboration 1.2**   Awaiting review

Description

Files

Laboration 1.2   Grade: NAN   2019-04-24

Peer review   Name/ID   2019-04-24

Hand-in area

Files: [   ] Add file...

Description:
[   ]

Re-Submit

Current mission

Objective #1

Objective #2

Objective #3

Reward   2 🪙

Todos

* Read article x
* Hand in ass
* ???
* Profit

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☰ Example Course > Assignments > Laboration 1.2

| Hand-in | Peer review |

Laboration 1　　　　　Name / Anonymous ID　　　　　File download

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Reward   2 🪙

Todos
* Read article x
* Hand in ass
* ???
* Profit

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Peer review   Laboration 1.1

Laboration 1.1
By Emil Emilsson

Lorem ipsum

Submit

Current mission
Objective #1
Objective #2
Objective #3

Reward   2 🪙

Todos
* Read article x
* Hand in ass
* ???
* Profit

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Example Quiz

Deadline: none   Attempts 1/3   Score: 20/25

Description

Take quiz

Current mission
Objective #1
Objective #2
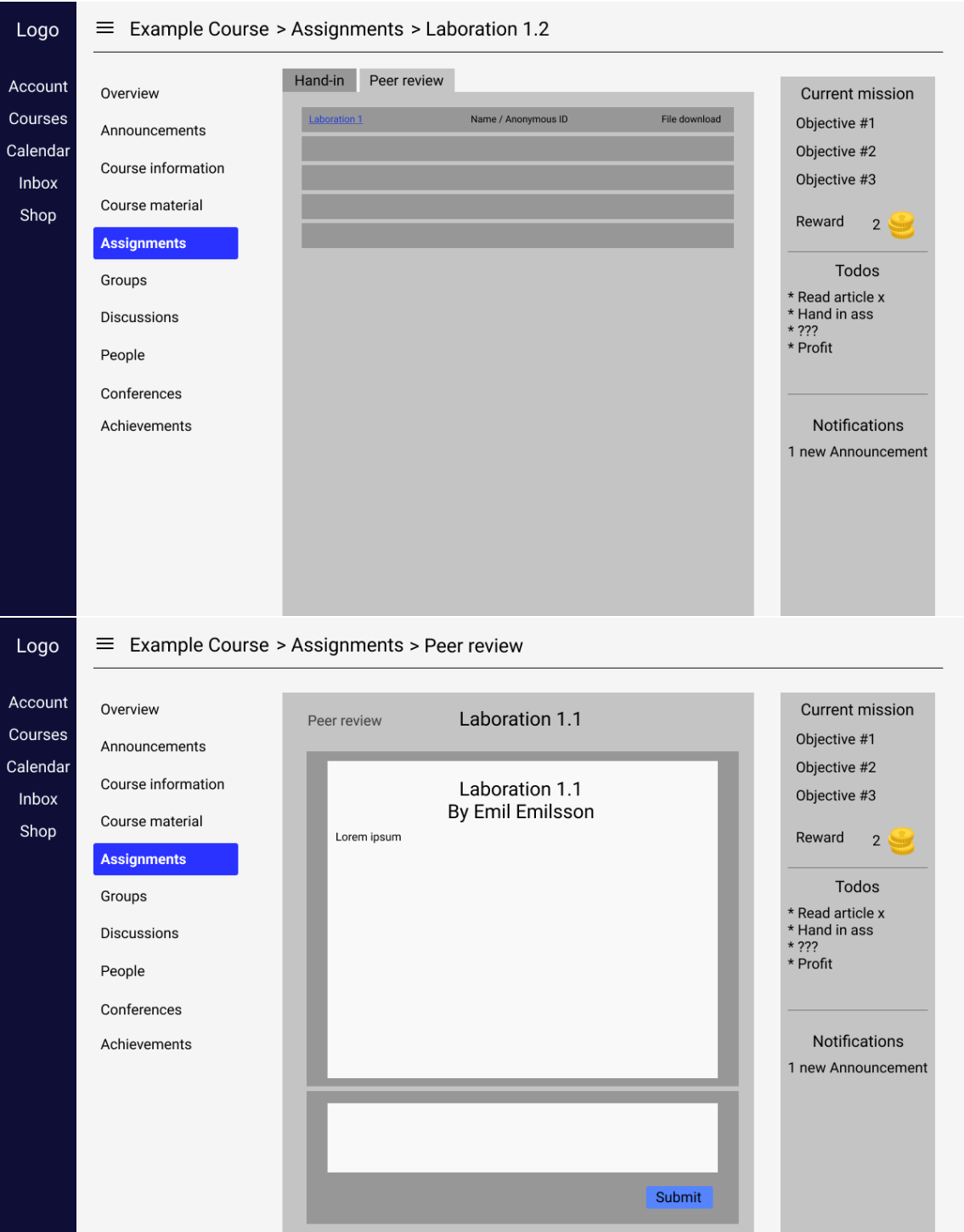Objective #3

Reward   2 🪙

Todos
* Read article x
* Hand in ass
* ???
* Profit

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Example Quiz

Question 1

Question 2

Question 3

Submit answers

Current mission
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Objective #2
Objective #3

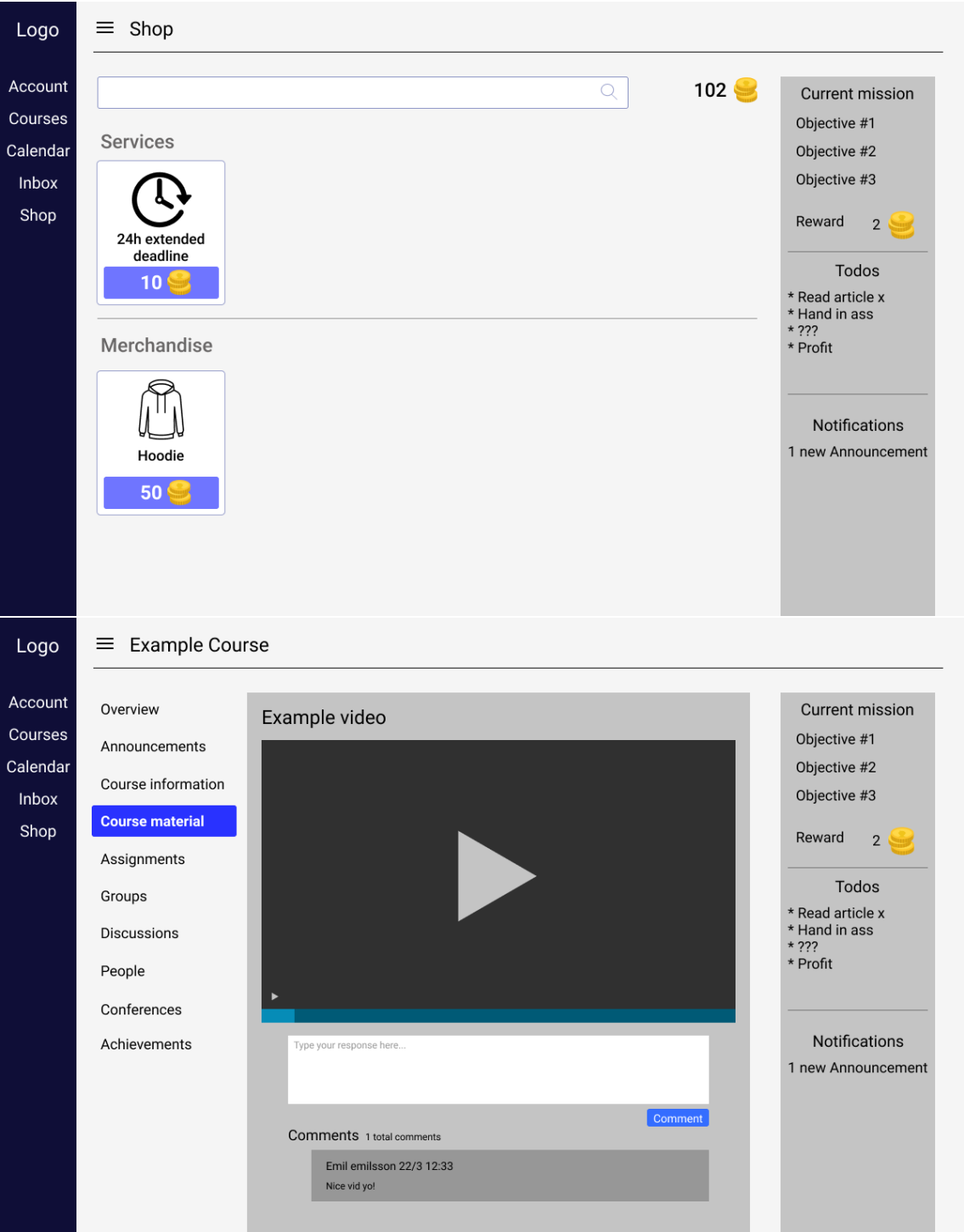Reward   2 🪙

Todos
* Read article x
* Hand in ass
* ???
* Profit

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Services

24h extended deadline
10 🪙

Merchandise

Hoodie
50 🪙

102 🪙

Current mission
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Objective #3

Reward   2 🪙

Todos
* Read article x
* Hand in ass
* ???
* Profit

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Example video

▶

Type your response here...

Comment

Comments 1 total comments

Emil emilsson 22/3 12:33
Nice vid yo!

Current mission
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Reward   2 🪙

Todos
* Read article x
* Hand in ass
* ???
* Profit

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☰ Profile

Melissa Mellberg

Edit profile

Chalmers University of Technology

Software Engineering (TKITE)

meme@student.chalmers.se

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam aliquam ex et quam laoreet laoreet. Suspendisse suscipit justo vel urna faucibus, ut fringilla ligula ornare. Praesent facilisis, nisl id convallis maximus, neque justo molestie ante, vitae fermentum nisl neque sit amet tortor. Nullam auctor, leo non viverra laoreet, dolor est laoreet libero, id convallis enim risus quis purus.

Active courses

Object-oriented Programming
TDA450
LP1 2019

3

+25

Past Courses

Current mission

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Reward   2 🪙

Todos

* Read article x
* Hand in ass
* ???
* Profit

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Achievements

Name
Icon
Earned

Name
Icon   Description
Earned

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Reward   2 🪙

Todos

* Read article x
* Hand in ass
* ???
* Profit

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