



**Gamification mechanics against dropout**

Towards improving the motivation and engagement of university students  
against dropout with gamification mechanics

By Flavio Camardella

Media Technology: Strategic Media Development  
Master Thesis, 15 credits, advanced level (ME620A)

Malmö University

Supervisor: Bahtijar Vogel

Examiner: Daniel Spikol

Date of submission: 20/08/2019

## **Abstract**

In 2016, 30 million university students in the European Union obtained their tertiary degree, but over 3 million young scholars that were to university had left their studies, according to a Eurostat survey. The university student dropout is a serious issue because young people will not have enough professional qualifications and they will risk a major probability of unemployment, poverty, and social discrimination. At the base of this relevant phenomenon of early abandonment, there is a lack of motivation and engagement to continue the course of study. In the age of digitalization, the gamification can have an important role to advance the overall experience of education. The main aim of this thesis is to identify the gamification mechanics that can improve the enthusiasm and commitment of university learners. Across a research design method, using structured surveys and interviews, several gamification mechanics are identified and evaluated to explore which allow students to be more motivated and engaged. Students of Media Technology from Malmö University participated in the research process and found the gamification mechanics to be useful and effective for their learning experience.

**Keywords:** Gamification, mobile application, user experience, engagement, motivation, university students, dropout.

## TABLE OF CONTENTS

1 INTRODUCTION .....	5
1.1 THE PROBLEM.....	6
1.2 AIM OF THE STUDY .....	7
1.3 RESEARCH QUESTIONS .....	8
1.3.1 LIMITATIONS.....	8
1.4 OVERVIEW .....	9
2 LITERATURE REVIEW .....	10
2.1 GAMIFICATION.....	10
2.2 GAMIFICATION AND ENGAGEMENT .....	11
2.3 DEFINITION AND ELEMENTS OF GAMES AND GAMIFICATION .....	12
2.4 GAMIFICATION MECHANICS .....	14
2.5 MOBILE APPLICATION DESIGN .....	18
2.6 USER EXPERIENCE .....	22
2.7 REFLECTIONS .....	23
3 METHODOLOGY.....	26
3.1 RESEARCH DESIGN .....	28
3.2 ONLINE SURVEY ABOUT MOTIVATION AND ENGAGEMENT .....	30
3.3 SURVEY FOR THE PROTOTYPE .....	31
3.4 SURVEY AND INTERVIEW ABOUT GAMIFICATION MECHANICS.....	31
3.5 COMMUNICATION OF THE RESULTS.....	32
3.6 DATA COLLECTION .....	32
3.7 DATA ANALYSIS .....	33
3.8 RESEARCH CONTEXT .....	33
4 RESULTS .....	35
4.1 MOTIVATION.....	36
4.2 ENGAGEMENT .....	40
4.3 DESIGN OF THE PROTOTYPE.....	43
4.4 GAMIFICATION MECHANICS .....	49
5 THE PROTOTYPE.....	53
6 DISCUSSION .....	59
6.1 MOTIVATION AND ENGAGEMENT .....	59
6.2 EVALUATION OF THE DESIGN OF THE PROTOTYPE AND GAMIFICATION MECHANICS.....	61
7 CONCLUSION.....	65
REFERENCES.....	68

APPENDIX A: FIRST SURVEY .....71

APPENDIX B: SECOND SURVEY .....75

APPENDIX C: THIRD SURVEY & INTERVIEW.....77

APPENDIX D: FIRST PROTOTYPE.....79

APPENDIX E: SECOND PROTOTYPE .....80

## 1 INTRODUCTION

In 2016, 3 million university students in the European Union decided, for several reasons, to leave their studies uncompleted (Eurostat, Work beats study for 25% of university drop-outs, 2016). The university dropout rate is increasing, and the phenomenon is a serious concern because, without a high level of education, the young generation could be affected by poverty and social discrimination (Schnepf, 2014). As a matter of fact, the graduation rate during tertiary education has an average of 50% in many countries (Organization for Economic Co-operation and Development, 2019).

Unfortunately, the decision of leaving from studying is mostly considered permanent (Schnepf, 2014). This problem is largely present in the European Union, and the average percentage of university dropout is about 10% in every country (Schnepf, 2014). One of the main consequences of this problem is that the university students who decided to retire early usually receive lower salaries than those who completed their studies (Hällsten, 2017).

Sweden has a total of 21% of dropout from each type of education and 12% of university students that decide to leave their studies (Schnepf, 2014). Furthermore, in Scandinavian countries, it is becoming risky to retire early from the studies because in future the salary of the dropout students will be insufficient (Hällsten, 2017). A study conducted in different Swedish universities revealed that during one's first year at university, it is essential to help and encourage students to continue studying (Andersson, Johnsson, Berglund, & Jehagen, 2009). The beginning of the year is decisive because there is a strong correlation between stress and dropout. Therefore, it is significant to resolve the issue of the dropout because it affects not only the labor work but also the health of the students. Furthermore, 35% of students thought of retiring from studying during the first six months (Andersson et al., 2009). This means new students are the most vulnerable to this problem. Thus, it is crucial to prevent and encourage students to engage more with their studies in the first years.

The purpose of this study is to identify the gamification mechanics that can be used in a mobile application to improve the motivation and the engagement of university students. To achieve this result a prototype of a mobile application will be used to test the gamification mechanics by involving students in the design process. Gamification mechanics were chosen because this method, adapts perfectly to the field of education (Kapp, 2012). Because gamification is the combination of gaming elements in other contexts (Werbach & Hunter, 2012), it is essential to explore the literature of gaming to better understand how gamification mechanics work.

University students frequently use their smartphones. In fact, in the European Union, 94% of people who are 16-24 years old use a smartphone. In particular in Sweden the usage of the device (84%) is higher than the European Union's average (79%) (Eurostat, 2016). Thus, creating as a prototype a game-based application for engaging students on a mobile system can be the most suitable solution for the university students. The author of a previous study declares that a gamified application for mobile had a great effect on the maintenance of knowledge (Bartel & Hagel, 2014).

The main target of this study is the first-year Media Technology students of bachelor's degree at Malmö University. The aim is to help these students overcome the problem of leaving university studies, it is also important to analyze their experience with education in general (Marcus & Wang, 2017). Other scholars focused their research on the effectiveness of gamification applied to education (Ymran, Akeem, & Yi, 2017), following a passive application of the games' rules, without including the students in the development side.

## **1.1 The Problem**

As mentioned above, when it comes to education one of the most serious problem is the risk of dropping out from studying. When the students are not enough engaged and demotivated, they can retire from studying at any stage of their study program (Caruth, 2018), causing them future problems in their jobs and occupations (Schnepf, 2014). If the university and other educational

systems do not encourage enough young people to remain as students, then the outcome can be the dropout of the students who will try another path to achieve their ambitions of working.

According to a Eurostat (2016) study, the reasons for which the students drop out can be categorized into three main motivations. The *first motivation* is related to economic needs and the aspiration of having a full-time job. Nonetheless, the students who dropout will have lower salaries than others (Schnepf, 2014). Thus, dropping out of university is a huge risk. It can prevent one from obtaining full-time work because people without degree or certificates will not have the same qualifications and opportunities of those who graduated. The *second motivation* is that education does not meet the interest and the needs of students, and this affects their engagement and motivation. The *third motivation* is connected to the difficulty of studying. If a student encounters difficulty studying and a lack of engagement and motivation, then his or her grades will be negatively affected, leading to dropout.

## **1.2 Aim of the Study**

This research is focused on the identification of the gamification mechanics that can improve the motivation and engagement of university students and prevent an early dropout. Other previous studies concentrated on the improvement of learning, but not on the prevention of dropout.

Nowadays, it is important to design a system of support through the period of studying that contrasts and prevents the risk of dropping out (Casanova, Cervero, Núñez, Almeida, & Bernardo, 2018). In fact, the study conducted by Casanova et al. (2018), reveals that the main cause of dropout from university is the academic success influenced by engagement and motivation. One of the possible solutions to this issue is identifying the gamification mechanics that can motivate and engage the students to succeed in their studies. This important strategy can be experienced through a prototype of a mobile application that can be reached at any time by students.

In the context of media technology can be useful to make an application for the students with gamification because during the design process the users are the ones that shape the design of the prototype, which means that they are included in the development part. This involvement is an innovation respect to previous studies. The result can be interesting to explore and even further the needs of the students and their particular issues.

Thus, the researcher aims to identify the gamification mechanics that can be used in a mobile application to improve the motivation and the engagement of university students. The first step is to get enough data about the motivation and engagement of the students to know what are the gamification mechanics that can encourage them. Then the identified gamification mechanics can be used to create the prototype, which can be tested to get the evaluation from the students about the gamification mechanics and the design of the application.

### **1.3 Research Questions**

Considering the aim of the study the first research question is:

1. What are the gamification mechanics that can be used in a mobile application to improve the motivation and the engagement of university students?

There is another related research question:

2. How can these gamification mechanics be evaluated by university students?

#### **1.3.1 Limitations**

This study does not focus on the socio-economic and cultural level of the students. The sample is only from the Department of Media Technology of Malmö University. The prototype is not tested over the whole period of studying of the participants. This research is focused on the level of motivation and engagement of the students in the sample. Furthermore, the prototype is tested twice to acquire the evaluation of the gamification mechanics and its usability.

## **1.4 Overview**

In this section, it is shortly presented and explained each chapter and its content. The chapters are structured as follows: the first chapter is an introduction to the main theme of the study, which also contains the problem and the motivation of the topic's choice. There is a focus on the aim of the study and the possible gap in the scholars' research. The first chapter briefly illustrates also the research questions. The second chapter is about the theories and rules that concern the gamification part, mobile application design, and user experience that involve the participation of the users as stakeholders. The third chapter is based on the methodology that was chosen to conduct the study, the analysis of the data and the possible issues that occurred. In the fourth chapter, the author presents the results of the research. In the fifth chapter, the researcher presents the steps used to create and design the prototype. In the sixth chapter, there is a discussion over the findings of the study of the relationship between the theoretical background and the research. In the seventh chapter, the author presents what was learned through the whole period of study, there are included also the limitations and the future steps that can be undertaken.

## **2 LITERATURE REVIEW**

In this chapter, the author introduces the theories and theoretical concepts related to the research question and the topic of this research study. This chapter is divided into three main categories: games and gamification mechanics; mobile application design; user experience.

The technical terms are explained to provide a deeper knowledge of the theories that are the base of this study.

### **2.1 Gamification**

Gamification is a method that can be described as “the use of game elements and game-design techniques in non-game contexts” (Werbach & Hunter, 2012, p. 26). As a matter of fact, the rules and features of the games are applied to other backgrounds, such as ranking system, achievement, rewards and other game’s qualities (Clarke, Kehoe, & Broin, 2017). The effectiveness of this system is trustworthy because the main aim of gamification is to persuade the players to do a task with a great involvement of interactions (Basten, 2017). Indeed, the usage of gamification can be found in the field of marketing because of the high engagement that gamification can provide to the users. Furthermore, the massive use of gamification techniques has led out the innovation of the business of several companies of management (Hamari, Koivisto, & Sarsa, 2014). According to Hamari et al. (2014), there is also a growing interest in the academic world toward gamification, but there is not a clear overview of what the researchers want to explore within the context of the topic. Besides, another purpose of gamification is the replication of the feelings and emotions elements produced by gaming in a different context (Huotari & Hamari, 2012).

This means that it is important to persuade the target of a gamified service, with the usage of playful mechanics of gaming. However, the designers of a game-based program have to take in consideration the final purpose of the users, so that they can still achieve the result. Otherwise, the

game part can be enough expansive and cover the real goal of the users. Thus, it is crucial to balance gamification methods with different contexts.

According to Freitas, Lacerda, Calado, Lima, and Canedo (2017), gamification it is suitable for the young groups of people because they can discover independently, thanks to the support of the new technologies, which are connected to the world wide web. This need for interaction can be perfectly satisfied thanks to the application of gamification elements. As a matter of fact, many young adults play games, especially teenagers (Perry, 2015). A total of 97% of them play videogames and the average age of the players is 35 years old. According to Perry (2015), gamification is only applicable to the learning side, but gamification is a polyhedric tool that can be employed in any case that reacquires the achievement of a task (Narayanan, 2014). This means gamification can be used as an alternative method to engage more people with their job.

## **2.2 Gamification and Engagement**

Some elements of gaming can be used to improve the overall experience of education. There is a rapid growth for the usage of gamification in the learning background (Kocadere & Çağlar, 2017). This remarkable development and interest in studying gamification can be related to the evidence of the effects on the participants. A gamified learning system can help students confront difficult assignments (Hew, Huang, Chu, & Chiu, 2016). Furthermore, it increases the quality of the learning (Buckley & Doyle, 2014) as well as the quantity of engagement of the students (Akpolat & Slany, 2014). Thus, the efficacy of applying gamification to education is widely demonstrated with previous studies. According to Ferro, Walz, and Greuter (2013), it must include the differences between students in the development part, such as the differing levels of their skills, their reasons, and their opinions. Therefore, for the correct process of improvement, a game-based service must take user experience within the learning environment into consideration.

Gamification can be hypothetically applied in every job that has a mission to accomplish (Muntean, 2011). Therefore, education is also a possible target that can be gamified. Gamification can heavily enhance learning, by improving the effectiveness of the whole experience. The behavior of the students is affected so much by gamification because of the empathy with the technology which is enforced by the game's features (Fogg, 2009).

### **2.3 Definition and Elements of Games and Gamification**

However, it is crucial to explain why gamification is so much efficient. Gamification is a method that applies gaming's mechanics to non-game services (Deterding, Sicart, Nacke, O'Hara, & Dixon, 2011). Its origin is directly linked to the entertainment part of a game. Essentially the definition of a game is "a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome" (Salen & Zimmerman, 2004, p. 51). Every component of the definition has a fundamental and important part of the structure of a game. If some of these fundamentals are not present, then the application itself cannot be defined as a game.

The system is mainly the field of the game that has to be close, to limit the game (Kapp, 2012). Then according to Kapp (2012), the players are the people that play the game and interact with it. Something that is game needs to have rules that define one or more winners. The central part of a game is essentially the competition between two or more players. When there is a winner, there has to be a result that is measurable, for instance, a ranking system. Another important part of a game is the challenges that set the goal of the players that they have to complete to win the game. Then there are feedbacks and the emotional parts. The first one is the part that provides the players with a reaction, which can be correct or incorrect based on the players' actions taken during the match. The second one is the feelings that concern the game. A game always involves human emotions, which can be positive or negative, depending on the feedback and the results (Kapp, 2012). If some of these elements are missing, then interaction cannot be considered a gaming experience but, rather, a toy.

Gamification is defined by Kapp (2012) as the usage of game mechanics for non-game functions, mainly oriented to the user of web and mobile sites because it helps people embrace the functions. This means that gamification is more suitable for a digital environment than an analogic one. According to Tugce, Berkan, and Goknur (2018), gamification is starting to be applied to the daily habits of people through mobile applications, such as FourSquare, which encourage people to collect badges as a reward. Nonetheless, according to Seaborn and Fels (2015), there is not a certain definition accepted by the other scholars, but rather some elements that are shared between the gamified applications. However, there are plenty of definitions of gamification, all together address gamification as a method that combines gaming features within non-game contexts to persuade people to achieve a specific task and goal.

For instance, according to Zichermann and Cunningham (2011, p. xiv), gamification is defined as a “process of game-thinking and game mechanics to engage users and solve problems,” so gamification can be seen as an alternative method to help the customers or the users of a specific target. According to a previous study, one of the main effects of applying gamification is the presence of entertainment, that can reinforce the external context in which the method is used (Sharples et al., 2013). This means that the elements of game can transform something that is not a game into something that is one.

Hence, if gamification is a method that merges games and non-games, then it is important to state what is involved in the design of a game and every characteristic that concerns it. First, to create a game, it is fundamental to know the target audience of the game (Daul, 2014). This is because the knowledge of the target audience can shape from the very start the type of game. Then the game must have several players decided by the rules of winning the game (Fullerton, Swain, & Hoffman, 2008). Another element that a game could have is storytelling (Daul, 2014). If a game is story-driven, then the story has to be defined by the actions of the characters that are impersonated by the players (Fullerton, Swain, & Hoffman, 2008). In a game, emotions can affect the perceptions and

experiences of the players. A complete game should have a dramatic part that involves the players through feelings that they can develop by playing with the characters of a story. As mentioned before, a game is a competition that involves players battling against each other to win the match. Therefore, a game must have rules that define the limit of the players and the objectives that players must fulfill to win the game. The players during the game can perform actions which are called mechanics. These actions are the basic functions that players can use during the challenges to win. For instance, to complete a level of Super Mario Bros. (1985) the player can only jump to overcome the obstacles or run toward the finish line. These two simple actions are the mechanics of the game, that can be used by the players to complete all the levels. The mechanics define the dynamics or objectives of a game, which are fundamentally the real-time application of the players' behavior. For instance: in the dynamic capture, the player has to destroy or take something from the opponent to win the match, for the objective chase the player must catch or escape from the opponent. A game should be fun to play and balanced so that potential players will find playing the game stimulating. For instance, to balance and make a game more exciting to play there is a method called flow theory (Fullerton et al., 2008). This theory explains that for every stage a player has to learn new mechanics and once they are assimilated by the player the difficulty increase to the maximum until the player wins or starts another level and the cycle restarts, from easy to difficult. This system provides a fun and comforting experience because the game is enough balanced between anxiety and boredom.

Therefore, designing a game is a complex task that requires a set of skill that cannot be gained without experience and sometimes failure. If gaming is a topic that is massive and difficult to develop, then applying games to non-gaming contexts is also rather difficult.

## **2.4 Gamification Mechanics**

Gamification can be used as a tool to make users experience being in a game (Barata, Gama, Jorge, & Gonçalves, 2013). The users are more engaged and excited to be part of the experience because

they are exposed to the flow theory. Thanks to this system the users are constantly between experiencing anger or monotony. This kind of method of balance fosters user entertainment and engagement. According to Barata et al. (2013), several studies expose the positive effects of using gamification into education. For instance, McClean et al. (2001) report that the students who used a videogame for learning in the faculty of biology have improved the results by 30%, respect to those who did not play the game. Moreno (2012) reveals that the students who played a videogame for learning purposes, they have improved their performance by 12%.

However, some studies reveal that using gamification for learning has no effects on long periods (Hamari, 2013). This is caused because gamification is a method that is recent and has no traditional guidelines (Hamari, Koivisto, & Sarsa, 2014). Furthermore, according to Thom et al. (2012) using gamification can have unsafe effects because the users tend to lose interest in the rewards they have obtained (Hamari, 2011). Thus, if gamification is applied to the context of learning, then the gamified service should be used not only for a short period, but it should become a default tool and used regularly for some session of studying. Nonetheless, because the users can become accustomed to a game's mechanics, the developers and designers must find new ways or techniques that allow the game-based system to be always interesting and appealing so that the students do not find tedious the whole system.

Thus, the repetition in game design and gamification must be avoided to prevent the same effect of traditional education, which could be disengagement and boredom. The solution can be found in supporting an innovation that always encourages users to complete and succeed in their tasks, especially for education.

According to Kapp (2012), gamification cannot be considered to be only a method of giving away rewards, points, or badges. Rather, gamification should include in the experience also other powerful game elements, such as the ability to solve problems, a plot that involves characters and some kind of interactivity within the gamified application. Kapp (2012) explains that gamification

is not a system that provides merely some knowledge of a subject. The process has to contain both gaming features and learning purposes because an effectively-structured gamified service can improve heavily the skills of a student, who uses for the first time this type of tool. Gamification cannot be used for every single learning session because the system can be useless and not so effective as for the first moment. Thus, it is essential that the gaming system is used mainly for the most important and difficult parts of a period of studying. Besides, it is important that the designers of gamification create a platform that includes both game mechanics and the experience of the students. This is because if there is not enough balance between learning and gaming, then the results are a complete failure. If there are more game's elements, then the system can be considered only as a game while if there are more learning features, then the service is not enough engaging for the users, and they will lose interest in using the application.

According to Buckley et al. (2017), gamification is a powerful persuasive tool that rewards the users with points or badges if they manage to overcome the problems and complete their task. This feature of gamification needs to increase the satisfaction of the users because the prizes and rewards are irrefutable evidence that they have surpassed their obstacles. Another gamification mechanic that is used to push players to act is the levelling scheme.

The levelling system is a feature, which is used by designers into games to provide players special rewards, such as new levels, ranks, and skills (Zichermann & Cunningham, 2011). In the context of gamification, the levelling system is an important part of learning because it provides the players with instant feedback, which is related to the path of failure. A game-based application has to include rules for gaming because the instructions describe the limits of the game, and obviously, the aim is to win the competition (Buckley et al., 2017). According to Nicholson (2012) what makes gamification effective is that it encourages competition between the players. This is caused by the desire of being the best player in the contest. Thus, the players fight against each other to perform better to gain the best position or the best rewards.

Regarding applying gamification in the field of education, it can have positive effects, especially on the level of engagement. However, the success of gamification depends on the background where it is used and the users involved (Hamari, Koivisto, & Sarsa, 2014). Besides, it is stated that gamification could support some dependencies that could distract the users from learning (Zichermann & Cunningham, 2011). According to Domínguez et al. (2013), the usage of gamification in a learning background is useful, but there are still some problems related to the engagement: some participants do not find game's mechanics more engaging and others think that gamification is another obstacle. Nonetheless, Buckley et al. (2017) report that there are not any studies on the reasons that cause this type of phenomenon. As a matter of fact, the developers of a gamified service should adapt the platform according the needs and feedback of the users. That is one step further into acquiring the problems of the participants. After getting the opinions of the students the application has to be shaped following the comments of the users. Besides, the developers should create several upgrades that challenge the players in different ways, so that they are always motivated to play.

In fact, according to Botha-Ravyse et al. (2018), the creation of an application for learning purpose has some positive and negative aspects. Indeed, on the study conducted by them, it is stated that the users found the application simple to use despite the novelty of the system. Nonetheless, the students find not useful the usage of the application. In the study, the cause is addressed on this weakness of the lack of students' inclusion. As a matter of fact, the scholars point out that even if the service is addressed to teachers, the application has to be verified by the students.

Therefore, the main aim of a developer when he designs a gamified application is to reach a desirable level of motivation. Kapp (2012) reveals that there are two types of motivation: one is called intrinsic motivation while the other is known as extrinsic motivation. Intrinsic motivation is the type of motivation, which is related to the person himself. That is, the action is taken because of his own will. The person is intrinsically motivated when he or she is doing something to develop his

or her talent without expecting some kind of reward. For instance, when a person read a book or do some sports is mainly intrinsic motivation. When a person is intrinsically motivated, he or she is focused on the action rather than the final result. The other type of motivation is extrinsic motivation and it is the opposite of intrinsic motivation. As a matter of fact, extrinsic motivation is an action motivated by some sort of prize. This kind of motivation is focused more on the final results rather than the action itself. For instance, an extrinsic motivation is when the person does not care about the action, but he only cares about the reward, so it is forced to act even if he does not enjoy doing the action.

According to Kapp (2012), gamification can be used to increase the motivation of the users in an educational context, for instance, as well as for teaching concepts and engagement. In fact, Kapp (2012) stated that some game mechanics can transform the boredom of repetition into exciting activities and rise the motivational side of the users. The game mechanics are: storytelling that is involving facts into a story with characters and a plot, snorting which is a game where the players have to put the facts into the right spot, matching the sentences of the concepts with the right pictures, creating a game that can always be replayable and making a trivial game which is a simple game that includes questions about a specific subject.

## **2.5 Mobile Application Design**

For the aim of this thesis, it is important to discover how to design a mobile application and integrate gamification mechanics.

Nowadays, one of the most used technology is the mobile phone. The first mobile phone was born and commercialized in the first years of the 1980s by Motorola, an American company (Anderson, Gilardi, Sennett, Westerhaus, & O'Rourke, 2017). Soon, the development of the technology increased, and today, mobile phones have evolved into devices that can perform multiple functions at the same time. The evolution of new mobile phones is also known as the smartphone revolution.

A smartphone is a mobile phone that has a high computational capacity and advanced system of connectivity (Purdy, 2012).

One of the first smartphones presented to the public was the iPhone, during a conference of the American company named Apple (Mendoza, 2013). The conference was held in 2007, and the CEO of the company of that time was Steve Jobs. During the conference, the announcer presented a device that combined a mobile phone, an iPod for digital music, and an internet connection. However, the real novelty was represented by three important innovations: improvement of usability, multitouch technology, and the appearance of mobile applications. The first innovation was the most important one because the designers and developers managed to create essential interfaces and gestures that allowed a simple usage of the device. This was achieved through a careful study of the user experience. As a matter of fact, the presentation of the iPhone was the birth of the user experience as a discipline, in the field of smartphones (Mendoza, 2013). The second revolution presented was the implementation of multitouch technology: the front of the mobile phone was completely made of glass because it was an entire screen. The main input of the device was the touch technology that covered the whole monitor. So, the user could interact with the phone with his fingers, through simple gestures that could change the interface in real-time. The third novelty was the introduction of mobile applications. The applications had the same concepts of programs of the computer. That is, they are software that can be installed into the device.

When it comes to mobile application design, it is important to consider different the concept and design of the mobile applications and desktop programs (Mendoza, 2013). This is because smartphones are completely different from computers. Mobile phone screens have different screen sizes than computers, and the type of input is distinctive. The mobile users utilize their device with their fingers through the touchscreen while the computer users use mainly as input the keyboard or the mouse. Besides, the architecture of the information is consequently different in both of the devices. The information architecture is how the information is placed and presented into a digital

environment (Resmini, 2014). As a matter of fact, on a desktop website, the structure of the information is like a tree: the body or central node is the homepage, the branches are the other sections of the page, and the leaves are the all the subsections of site. While on the phone, there is not enough space for the information because of the smaller size of the screen, so the information architecture can be considered sequential, that is a group of tasks that the user must follow. Thus, it is essential that are present only the useful information to the user (Mendoza, 2013). This is because the users of desktop computers spend more time on each session, with an usage of 39 minutes, which is high compared to the average 17 minutes per session among mobile users (Google, 2012).

Thus, to design and develop an efficient and usable mobile application it is essential to know deeply the target users of the application. In fact, the feedbacks of the users about the application are necessary to design the user journey and the various screens of the service. To achieve positive results, it is important to know what the users want to have in the mobile application so that it is easier to start to design the experience. Another important part of designing an application to consider, it is the navigation flow system. On mobile phone often the applications are closed in their environment and the navigation can become uncomfortable, especially if the users have to scroll heavily to search for specific content (Mendoza, 2013).

The first step in developing a mobile application is knowing the basic features of the application. Then after an accurate study on the user experience, there is a study on the platform that will be used. In the smartphone market, there are many different devices that have different screen resolutions. The two most common design styles for smartphones are iOS for Apple devices and Android for most other mobile phones. Each operating system has a different design. For instance, iOS uses a graphic style called flat design, which is based on the linear and essential representation of the graphic elements. While for Android, the owner of the software (Google) created an official guideline that can be used to design the mobile applications, which is called material design. This

particular design is influenced by the simulations of different materials. The main feature of material design is the correct usage of shadows and shapes.

After the decision of the platform, there is another complex question to resolve, that is the difference between the screens of the smartphones. Principally, every device present in the market has a singular size of the screen, so even the resolution of the smartphone is different. However, there is a solution that can adapt every design to every screen: the usage of breakpoints and responsiveness. The breakpoints are static resolution limits that are the average size of the screens (Mendoza, 2013).

For instance, most smartphone screens are wider than 320 pixels, so the smallest size for designing the interface can be equal or higher to 320 pixels. This system provides the safety of designing an interface that can be applied and used by most mobile phones. Another system for designing interfaces for different screens is responsiveness. The design of the interfaces has to be responsive, that is making them adapted for each breakpoint. For instance, if the resolutions of the smartphones are dissimilar, then the elements of an interface have to change following the resolution: the size of the elements can be narrower so the user can always see all the parts of the screen.

Then the application can be developed by completing the flow of what the user can do (Mendoza, 2013). Thus, in this part, it is essential for the functions of the mobile app to be completed finished and defined. Afterward, the design team can start to define the sections of the application and the journey that the user can take in the application. After the definition of the sections of the application, the graphic elements that define the functions of the application can be added to create a graphic user interface (GUI).

For instance, if the application is a social network, then the graphic environment present is various: there are images, text, videos, buttons, headlines, and a menu.

## 2.6 User Experience

During the development of an application is important to include in the process the end-users to customize the appropriate experience for them. Therefore, it is important to investigate more about the experience of the students.

User experience is a field that focuses on and studies the user and its interaction with a certain product or service (Rosenzweig, 2015). The main aim of user experience is to make more usable a creation, so mainly the principal achievement is to create a positive outcome from the usage of something. Because if something is highly usable, it will be highly effective. Besides, if a product is highly usable, then there will be an overall improvement of the quality of life. Usability is a particularity that defines an object which is easy to use for human beings. User experience is the experience that is present when there is an interaction with the object and a person. The object can be analog or digital.

Furthermore, user experience also deals with everything that concerns an object, for instance: the internet site, the instructions, and the physical marketplace. Usability is the method of creating usable devices and platform that are handy and useful to use. Usability was standardized by the International Standards Organization of Geneva in 1999. The organization stated that usability is described as “the active involvement of users and a clear understanding of user and task requirements; an appropriate allocation of function between users and technology; the iteration of design solutions; multi-disciplinary design” (Rosenzweig, 2015, p. 9). The organization also affirmed that usability is a form of structure that combines target users and goals with efficacy and pleasure related to the usage of the system. So, it is important to study each potential target to know every issue that could present when using a certain product, digital or physical. As a matter of fact, every human has differences that can be mental limits, physical limitations, and emotional restrictions. The purpose of the user experience is to collect and analyze information to create usable products that become innovative and help every kind of user to achieve his or her goal.

User experience is a methodology that was inspired by human factors and ergonomics, together with computer–human interactions (Rosenzweig, 2015). Ergonomics and human factors are studied among humans and their interactions with external components. While computer–human interaction is a study that covers the interface of machine that people can follow to use a specific task.

However, not every user reacts in the same manner, so there should be a classification of each possible type of user. As a matter of fact, designers can use personas to cluster the users. A persona is a form with some information about a group of users. A persona can contain data about age, gender, education/job occupation, main aim, problems, reasons and background of the use of the product. After collecting data about the users, the process of creation involves creativity and innovation. Both can be achieved through an iterative process that requires user tests. A digital product must be simple to use and understand, so it is important to create a GUI. The GUI is composed of simple graphic elements (see Chapter 2.6) that facilitate the user experience of using the product. To test the effectiveness of a mobile application is a good use to make a prototype. The prototype can be used to make an evaluation, that measures the level of usability (Tullis & Albert, 2013). The prototype can be digital or analog, and the fidelity can be low or high. A useful practice is to use the prototype to create some user test, that can give results about the usability of the application.

## **2.7 Reflections**

Because the aim of this study is to identify what gamification mechanics can improve the motivation and engagement of university students with a mobile application, the theoretical part contains the essential elements that can be used to reach the final goal. The first element explored are the general rules of gamification: what is gamification and its connection to games, and what are the general mechanisms that can be used in education to improve the motivation or engagement of the students. Gamification mechanics can increase the motivation of a student because of the objectives and challenges that can be completed by the users. Furthermore, gamification mechanics

can improve the engagement of the students because they are entertained by playing. The second element studied is mobile application design, so that it can be used to develop the prototype of the application that holds gamification mechanics. The third element reviewed is user experience, that is a design approach, which is based on the investigation of the issues of the users to evaluate a specific product. User experience process can be used to delineate the methodology of this research.

**Table 1. Lessons learned**

<b>(A) Gamification mechanics</b>
1. Storytelling
2. Reward system
3. Matching
4. Trivial game
5. Competition
6. Levelling system
7. Ranking system
8. Snorting
9. Flow theory
10. Intrinsic/extrinsic motivation
<b>(B) Mobile application design</b>
1. Sequential information architecture for displaying the information and the features

2. Graphic user interface for engagement and interaction
<b>(C) User experience</b>
1. Personas for clustering needs and issues of the students
2. User test for evaluating effectiveness and usability
3. Design process that involves users

Table 1 contains a list of the main topics from the findings of the literature review. This list is important because the present elements will be used to shape the methodology and reach the aim of the thesis. The list (A) will be used to identify and evaluate the best ways to improve motivation and engagement. The list (B) will be used to design the prototype of a mobile application related to gamification mechanics. The list (C) will be used to cluster the needs and issues of the participants.

### 3 METHODOLOGY

In this chapter, the author shows various methods that are used to conduct a research study about gamification mechanics and mobile development. According to the aim of this research, the author chose a mixed methodology (participatory design, quantitative surveys and qualitative user test), because this approach can be more flexible, effective and pragmatic, when it comes to investigate the needs of the participants and create the prototypes necessary to evaluate the impact of gamification mechanics on the motivation and the engagement. Clark et al., (2016) explain that a mixed methodology can create more solid and useful studies that can generate targeted and supportive indications about the research problem. This methodology can be considered as a form of research through design because it creates usable outputs, matched for a specific place in the reality. Involving several stakeholders in a research enriches results and helps to assure wider backing for its findings (Maher, Maher, Mann, & McAlpine, 2018). The prototype is used to explore the students' needs and reach the aim of the thesis.

To collect information from the sample of the participants both quantitative and qualitative methods are used, in particular, three surveys and an interview. The survey format is used because it can be exploited to collect enough data in a short period (van Staden, 2017). The interview format is used because is a method that can be suitable to obtain qualitative data (Edwards & Holland, 2013).

The fundamental novelty of this methodology is the involvement of university students as stakeholders in the development part, to achieve a customized prototype of the mobile application. The best approach that can ensure a reachable result for the research is to plan several sessions of participatory design (Rosenzweig, 2015). The primary stage of this study is to collect quantitative data that are originated from the user experience. Furthermore, the development part of the research requires another step to be taken, to design a prototype for a mobile application. The first phase of

the methodology includes the collection of data as an essential resource to develop new features and layout for the prototype. Later, the prototype must be tested with a user test to evaluate the students' opinions about the mobile application. The qualitative and quantitative data collected are used to answer the research questions. The research design was influenced by the strategies of the user experience that places the users at the center of the process (Rosenzweig, 2015). Another step of the research is to measure the performance of the users when they engage the product with a user test to get the evaluation of the prototype. The metrics measured comprehend effectiveness, usability, and satisfaction (Tullis & Albert, 2013). The research also includes the results of the gamification elements and their interaction with the students.

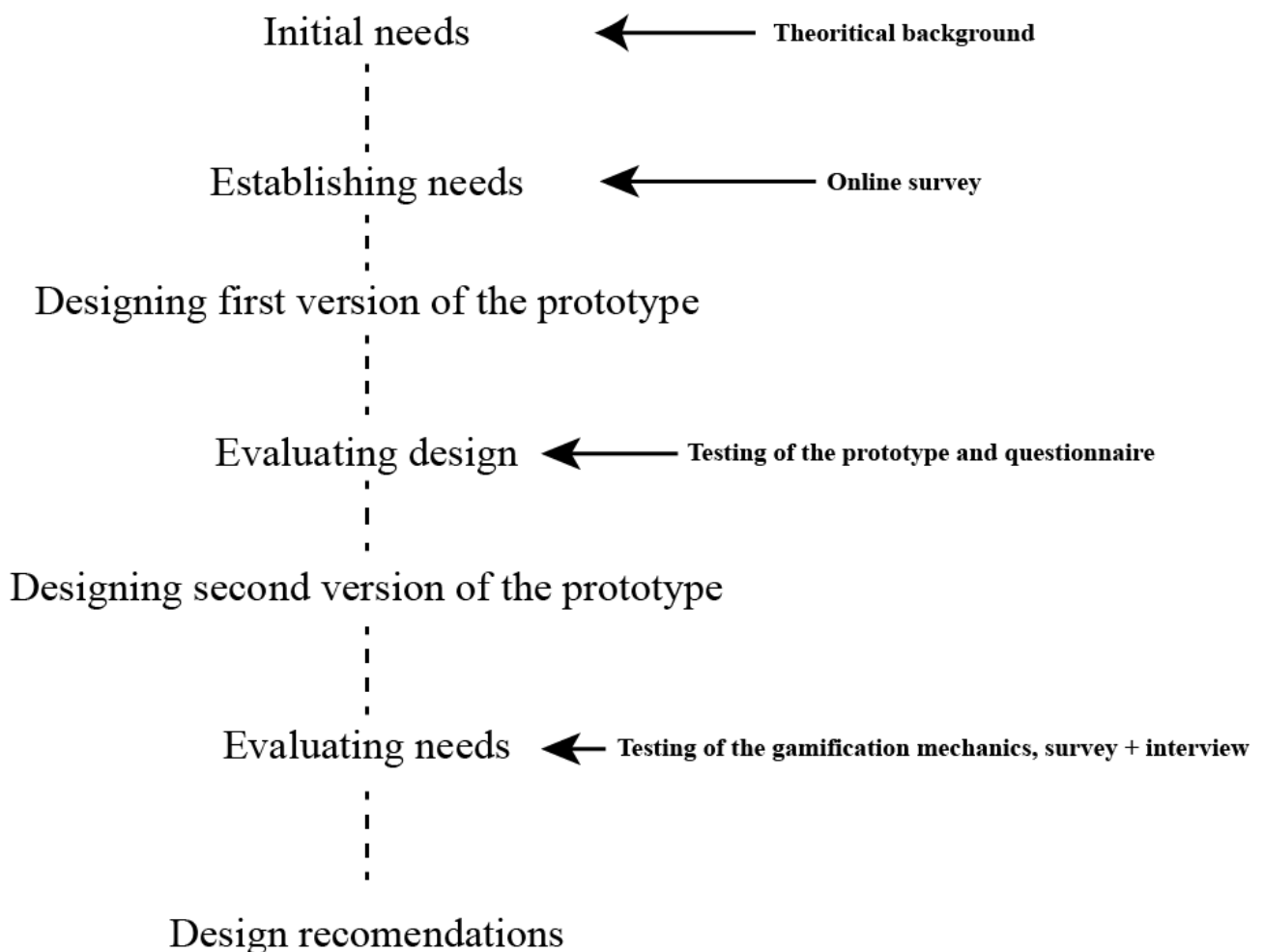


Figure 1 Research process

Essentially the study is the adaptation of user engagement methods of Rosenzweig (2015) and Tullis et al. (2013). Every step of the research process is illustrated in a logical and linear sequence (see Figure 1).

Other possible approaches to reach the aim of this thesis that could have been relevant are: a exclusive qualitative research (ethnography, phenomenology, narrative reserch and case study) for instance to collect more participants meanings and study the context of the participants, or a exclusive quantitative approach (experiments and surveys) for example to observe and measure numerical and unbiased information.

### 3.1 Research Design

To reach the aim of this study, a methodological path that integrates quantitative and qualitative approaches and digital and analogic tools it was developed with the involvement of the first-year students from Media Technology of bachelor’s degree at Malmö University. All the phases of the methodology are based on the approach of the user experience because the design process is composed of iterative steps that involve the end-users (Rosenzweig, 2015).

Table 2 below lists the steps of the research design of this thesis.

**Table 2. Research methodologies**

Methods	Approaches	Tools	Participants
1. Online survey for the motivation and engagement	Quantitative	Google form	11

2. Design of the first version of the prototype	Prototyping	Illustrator/Invision	
3. Test for evaluating the design of the prototype with survey	Quantitative/Qualitative	Google form	11
4. Design of the second version of the prototype	Prototyping	Illustrator/Marvel App	
5. Test for evaluating the gamification mechanics with survey	Qualitative	Google form	10
6. Evaluating the gamification mechanics with a semi-structured interview	Qualitative	Face to face interview	1

Due to time limitations and the aim of this study the participants were recruited through an advantage sampling made up from students of the same university and department of the author, who were easier to access. The admittance criteria for the participants was that they had to be students of the first year from Media Technology at Malmö University. There were chosen 11 participants, 36% were female and 64% of them were males. Their ages ranged from 19 to 27 years. The age of participants is various, and it gives a wider set of data that came from a broad age range. The average age of the participants is 22 years. The sizing of the sample is determined by the choice of a mixed methodology that includes quantitative and qualitative approach. Besides Rosenzweig (2015) declares that for a effective collection of data, both qualitative and quantitative, the optimal number of participants can be higher than 10. The final interview was conducted by only one

students, because he was the only one from the sample who already committed dropout, so the author wanted to get more useful data about the impact of gamification mechanics against dropping out.

### **3.2 Online Survey about Motivation and Engagement**

The first survey had 40 questions that were divided into five categories: gender, age, motivation, engagement, and quality of the university system. The majority of the inquiries are closed, and it has four possible answers while the last question is open. The survey is used to know why and how much the students are motivated and how much they are engaged. The questions were formulated from the theoretical background, in specific from the intrinsic and extrinsic motivation paragraph (see Chapter 2.5) and the user experience paragraph for the engagement (see Chapter 2.7). To customize and develop a user-friendly prototype of a mobile application, it is essential to know and investigate the characteristics of the sample. If the problems of a group of users are identified, then it is simpler to create a solution that can solve the issues. In this initial stage of the research, the author developed an online survey that focuses on the following:

- what increases the motivation of the students in the university;
- whether the students are unmotivated;
- whether the students can plan their activities to pass their exams.

In this part, it is fundamental to get quantitative information about the types of students. This collection of data is useful because acquiring information about the user experience of the students can give a more in-depth knowledge of the dynamics that occurs in the university. Besides, the survey was used to cluster the group of users through the usage of personas (Rosenzweig, 2015), so the design of the prototype can be more human-centered and fulfill the students' requirements.

### **3.3 Survey for the Prototype**

The survey for this second part of the study is composed of 11 questions, 9 with closed answers and 2 with open answers. The questions were formulated to get the evaluation of the participants about the usability, efficacy, and satisfaction of the prototype created from the data collected in the first round of surveys.

After collecting the data from the students about their experience and their relationship with the problem, the next step is to start designing the prototype. The initial prototype is a set of high-fidelity interactive screens that are the result of the theoretical background and the analysis of the data collected through the surveys. The next stage is to let the students try and use this first prototype. After this phase of the test, the feedback was collected to improve the design, functions, and layout of the mobile application. The comments are collected through an online survey that measures the effectiveness, usability, and satisfaction of the participants. Thus, after gathering data, it is possible to evaluate the prototype and upgrade it according to the feedback of the participants. The aim of the prototype is to get the evaluation from the students, to reach the goal of this study.

The method of testing was chosen because it is a useful approach to get enough qualitative and quantitative data from the usage of the prototype, to evaluate the effectiveness of the mobile application (Rosenzweig, 2015).

### **3.4 Survey and Interview about Gamification Mechanics**

After the data from the second survey was collected, the second version of the prototype is developed according to the feedback of the participants. In this last stage, a third survey is made, to get the evaluation of the gamification mechanics. The study is composed of eight questions, which are open-ended and created to obtain qualitative data about the gamification mechanics presented in the second version of the prototype. The eight requests are also used in a semi-structured interview with a student of Media Technology from Malmö University who already dropped out another

university. Every response collected can be used to answer the second research question (see Chapter 1.3).

### **3.5 Communication of the Results**

The final part of the process model is a discussion on what is the real value of the prototype in the field of gamification applied to motivation and engagement, as well as mobile application design. Then there is a final consideration of the research process model and the results of the study.

### **3.6 Data Collection**

To evaluate the usability and the effectiveness of a product it is necessary to include in the whole design process the feedback of the users (Rosenzweig, 2015). This type of feedback is qualitative and quantitative because the evaluation is based on the conceptual capacity of the users (Tullis & Albert, 2013). This types of data, qualitative and quantitative, can be gathered by two main forms of research design: a quantitative survey of the user experience and a qualitative survey that collect data from user tests. Furthermore, the needs of the users can be clustered in groups, so that the flow of the design process becomes more straightforward. Users tests are essential for gathering qualitative and quantitative data because they measure the usability of a possible prototype and its efficacy.

According to Cooper et al. (2007), qualitative is are most suitable for an initial design stage because they are more valuable concerning information. The first stage of the collection of data is represented by a session of questions done by using an online survey that investigates the experience of the students in the field of engagement and motivation. After this initial stage, there is the creation of the initial prototype, which is the combination of the theoretical background and the quantitative data. Then there is the stage of evaluating the first prototype, for getting positive and negative feedback that affects users. The first user test is taken by university students that try for the first time the mobile application and its functions. After collecting quantitative data from the usage

of the prototype, another version of the prototype was developed and designed according to the students' opinions. The last session is to test the second version of the prototype to get the evaluation of the gamification mechanics, used in the prototype.

### **3.7 Data Analysis**

The aim of data analysis is to understand the data collected in every step of the research process, to answer the research questions (see Chapter 1.3). The quantitative data of the first survey are used to cluster the different answers and create personas (Rosenzweig, 2015). Personas represent the different users and groups that are classified within the data collected through the survey. This method simplifies and improves the development part of the research because it identifies the possible students' needs and profiles. To simplify the analysis and data visualization the answers are closed and measure the opinion of the participants for specific topics and events. The answers are collected in specific diagrams and charts. The analysis is interpretative and can be used to proceed to the second step of user testing of the first prototype.

The quantitative and qualitative data collected in the second survey was analyzed to evaluate the design of the first prototype. The analysis is interpretative of three parameters effectiveness, satisfaction, and usability (Tullis & Albert, 2013). The data are processed to shape and design the second prototype.

The qualitative data collected in the third survey and interview is used to evaluate gamification mechanics. Then the qualitative feedback is analyzed to answer the second research question.

### **3.8 Research Context**

The study conducted for this research was guided to follow an ethical and suitable social science. Both the report and prototype are made respecting the international standards and guidelines for ethical and fair research. Every step of this study was made to harm nobody that joined the research

science. Furthermore, the research was respectful with the participants and it defended the anonymity and the privacy of the contributors.

Each type of research requires a different kind of ethical considerations and encounters that must be faced by the scholar and author. For instance, a research method that has to deal with the experience of students in a university context, it is challenging because the participants' privacy has to be protected to not disrespect the private life of a single person. Principally the purpose of user experience is to investigate on the overall experience of a user in a determined context, in this specific case of a student. Every step in the methodology part of this research was designed and intended to preserve the anonymity and the privacy of the users. Both the surveys and user tests were adapted to assist the confidentiality of the participants. In the surveys, there are no questions related to private matters that directly involve the personal lives of the students. In the user tests, there was useless to gather personal information because the tests focus on the experience of the users with the prototype.

In relation to the aim of this thesis the author delineated a methodology, which was a mix of the best practices for research and design, adapted from the theoretical background (Rosenzweig (2015), Tullis et al. (2013)). This process allowed a continuous and profitable interactions between the author and the participants involved in the process. The author tried a innovative method of studying, that allowed him to have a wide overview of dropout (reasons of the phenomenon and statistical data), the distinctive aspects of motivation and engagement in a university context, and the possible contribution of the gamification mechanics to prevent the risk of dropping out.

Some limitations need to be declared. The time constraints did not allow the author to evaluate the gamification mechanics for more than a single session. Nonetheless this study is starting point for following studies that could evaluate the impact of gamification mechanics on a wider time frame and a greater sample size.

The surveys did not focus on the socio-economic and cultural level of the participants. Besides, in the beginning, it was not simple to convince the students to join the study. Nonetheless, 11 students of Media Technology from Malmö University decided to participate in the research. The participants were attending the first years of their study program at the university. Furthermore, the contributors were contacted via email and using Google Forms for collecting data, mainly because of the different schedule of lectures and commitments that they had, and because of the limitation of time that affected the research. The first questionnaire was conducted with a survey made on Google Forms, that allows the collection of data in a cloud system and provides the visualization of data with graphs. Even the user tests were made using the platform of Google Forms to collect feedback, Invision, and Marvel for making the prototypes.

#### **4 RESULTS**

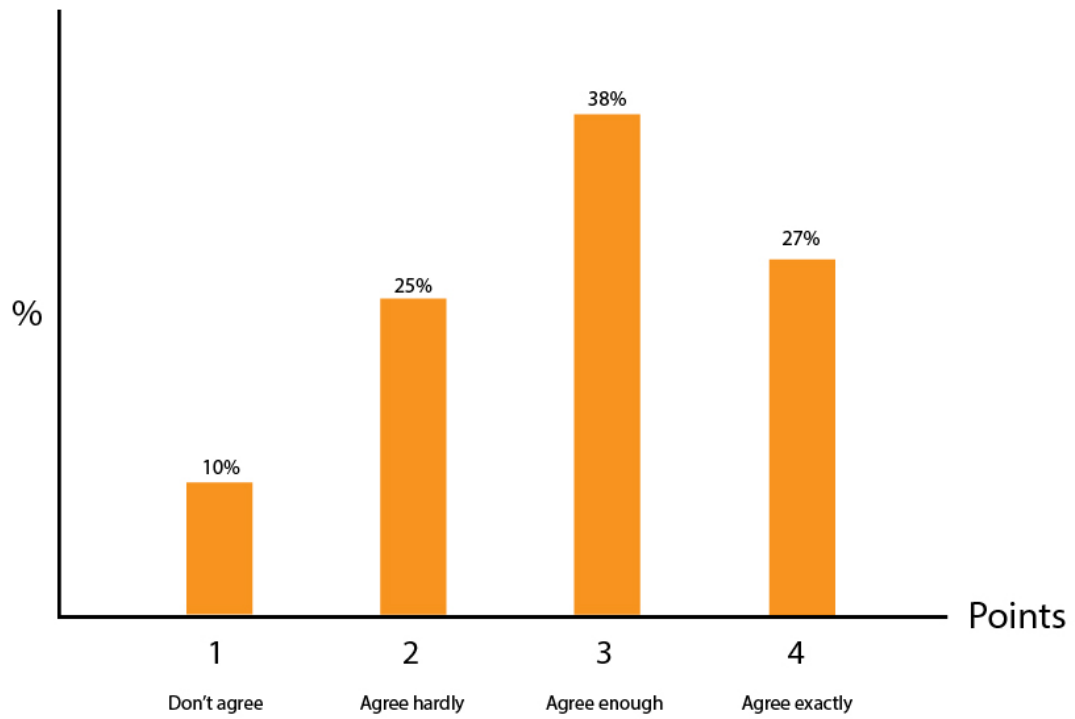
The results of the research (3 surveys and 1 interview) can be clustered: motivation, engagement, evaluation of the design of the prototype, and evaluation of gamification mechanics. The results of every step of the research process are functional for each next stage. The results show that the level of the motivation of the participants is higher than the grade of the engagement. In particular, the students are motivated more by extrinsic factors than intrinsic ones. Furthermore, the report shows an engagement to improve. After the test of the prototype, the sample was found to value usability, clarity, effectiveness, and usefulness in particular. Finally, the identified gamification mechanics were positively evaluated by most participants.

## **4.1 Motivation**

The first part of the survey contains the questions related to the motivational side of students (see Appendix A). The questions are constructed by the purpose of exploring what can be the possible elements that cause a reason and a motivation to attend and complete the university course.

In particular to promote the data analysis the author chose to grade the answers into even levels of reply (1 = don't agree, 2 = agree hardly, 3 = agree enough, 4 = agree exactly). This choice was used to bring out in evidence the strengths and weaknesses of the motivational aspects. Furthermore to facilitate the data interpretation and the detection of relevant information, there were aggregated the points 3 and 4, which represent the highest levels of motivation. The histograms show the percentage of the answers. While the box plots display the dispersion and the average of the answers. The same criterion was applied also on the survey used for the comparison of extrinsic and intrinsic motivation and to measure the level of engagement.

# Motivation



*Figure 2 Results about motivation (percentage of answers)*

Figure 2 shows the general level of motivation which results elevated (65%, points 3 & 4).

# Motivation

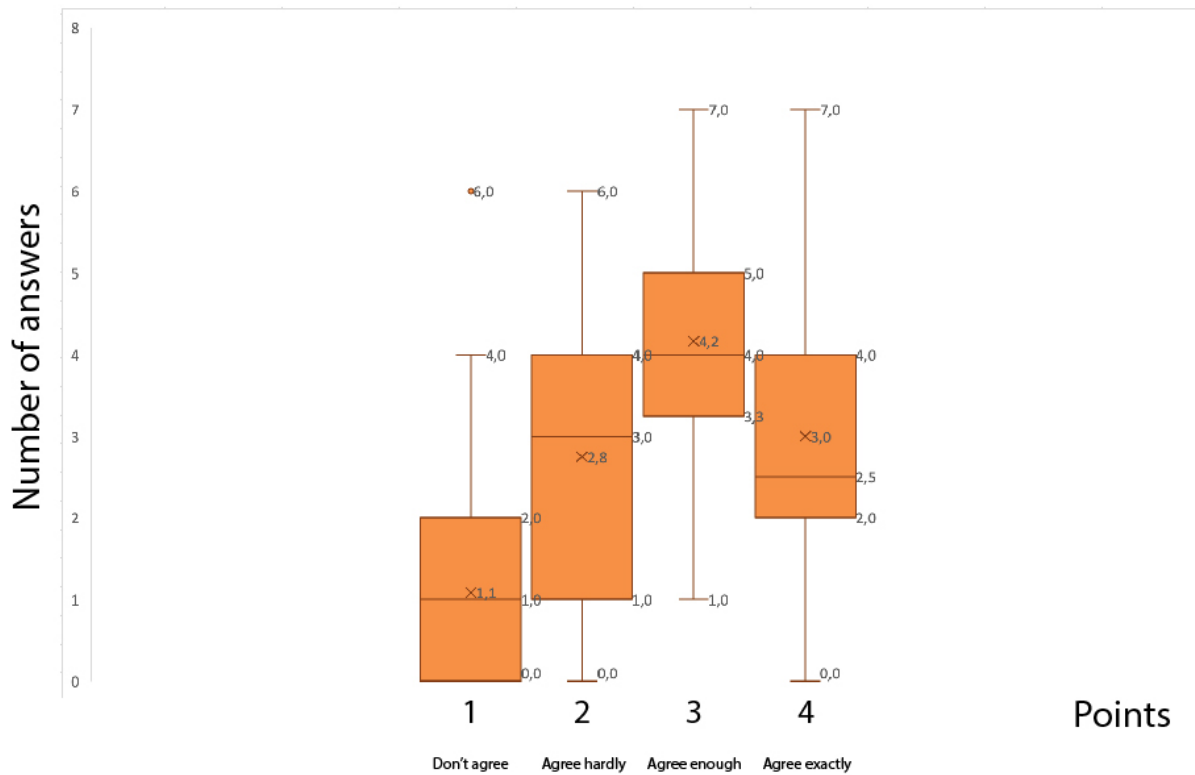
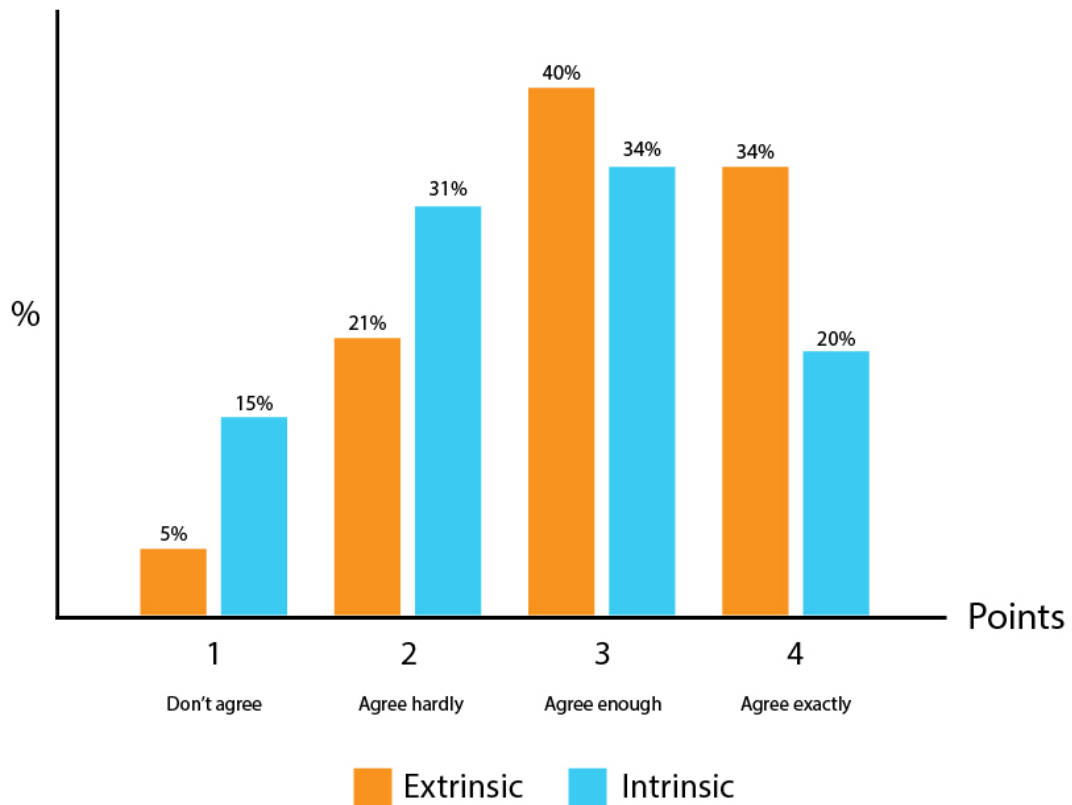


Figure 3 Box plots about motivation (number of answers)

In Figure 3, the box plot of point 3 shows the highest level of concentration of answers (interquartile range: 1,7), while the box plot of point 2 displays the highest grade of dispersion (interquartile range: 3,0). In general, the concentration of the answers in the points 3 and 4 (sum of interquartile range: 3,7) appears higher than the level of points 1 and 2 (sum of interquartile range: 5).

# Motivation



*Figure 4 Results about intrinsic and extrinsic motivation (percentage of answers)*

In Figure 4, the results show that the 74% (points 3 & 4) of the sample's answers are mainly oriented toward extrinsic factors (future job occupation, prestige, richness, career). Meanwhile, the intrinsic motivation factors (satisfaction, passion, self-esteem) are less relevant than extrinsic ones (54% points 3 & 4).

# Motivation

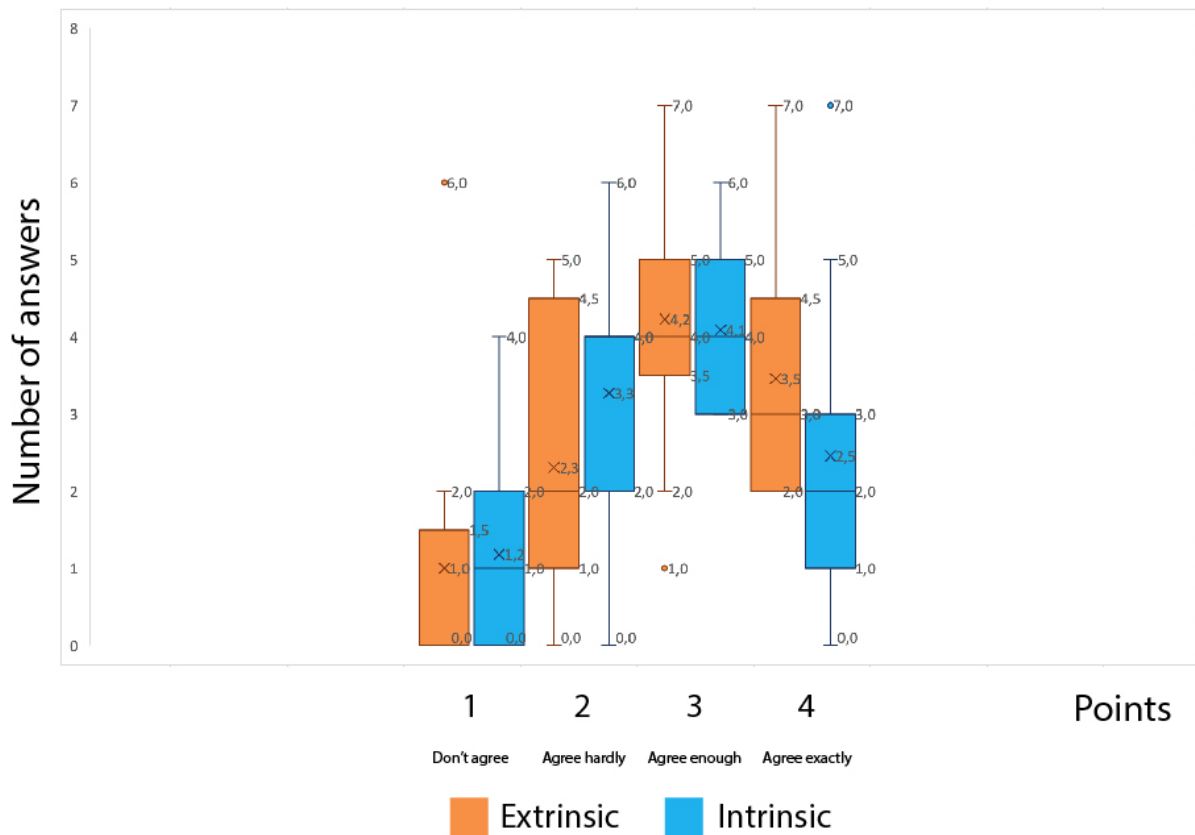


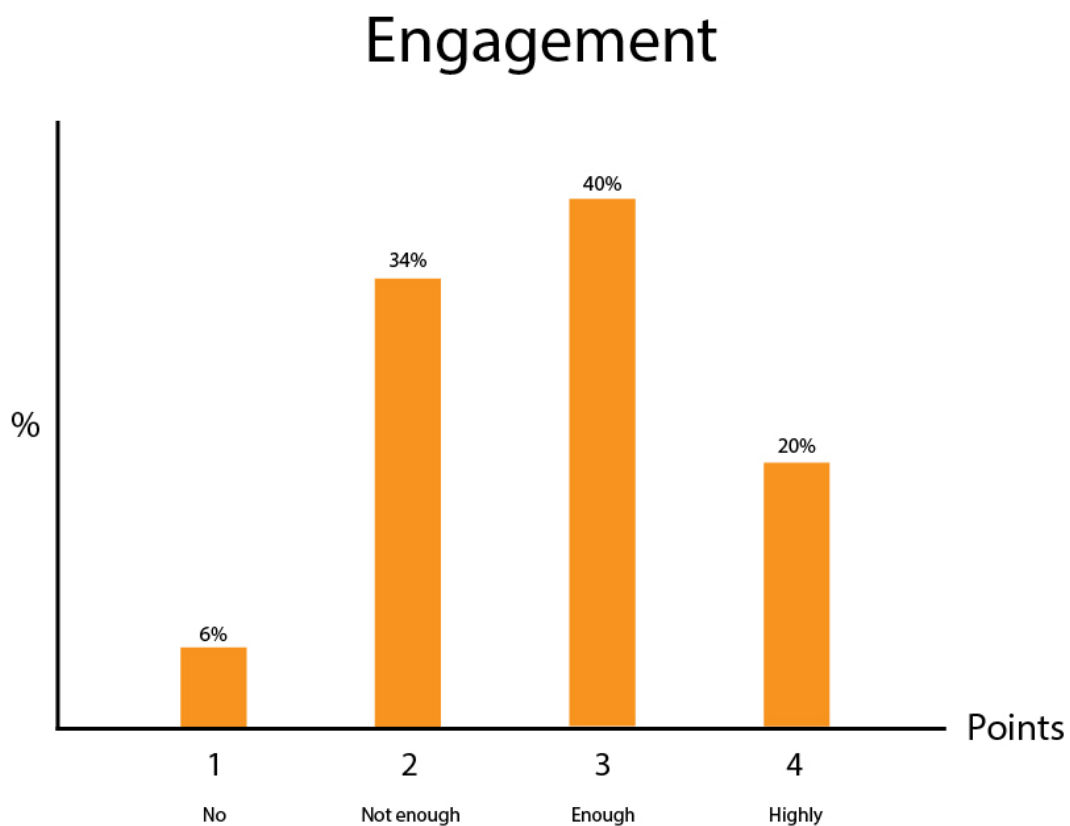
Figure 5 Box plots about extrinsic and intrinsic motivation (number of answers)

In Figure 5, the box plots of points 1 and 3 of extrinsic motivation show the highest level of concentration of answers (interquartile range: 1,5), while the box plot of point 2 of extrinsic motivation displays the highest grade of dispersion (interquartile range: 3,5). In general, the box plots of intrinsic and extrinsic motivation of points 3 and 4 appear with the same level of concentration (sum of interquartile range: 4). However, for the points 3 and 4, the average's amount of extrinsic motivation is higher (7,7) than the average's amount of intrinsic motivation (6,6).

## 4.2 Engagement

In the second category, the questions proposed to the students focused on their engagement with studying (see Appendix A).

To promote the data analysis the author chose to grade the answers into even levels of reply (1 = no, 2 = not much, 3 = enough, 4 = highly). This choice was used to bring out in evidence the strengths and weaknesses of the engagement aspects. Furthermore to facilitate the data interpretation and the detection of relevant information, there were aggregated the points 3 and 4, which represent the highest levels of engagement.

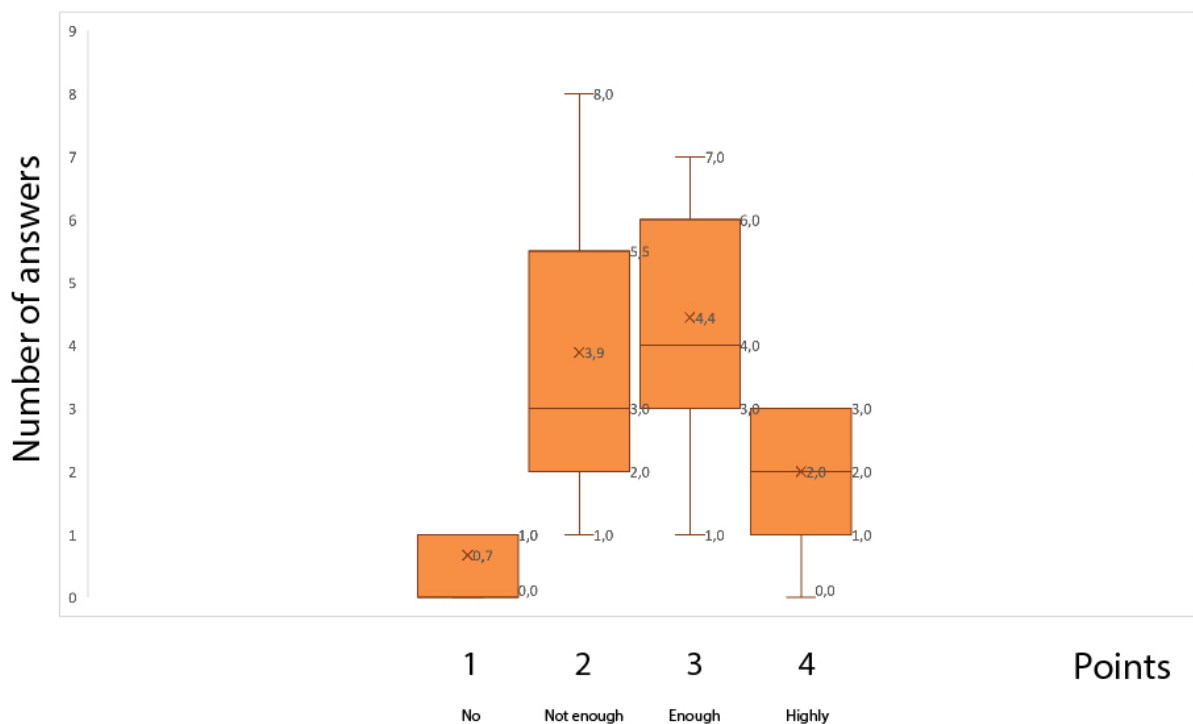


*Figure 7 Results about engagement (percentage of answers)*

In Figure 7, the general level of engagement appears outstanding (60%, points 3 & 4). Nonetheless, there is a remarkable side of participants who is not enough engaged (40%, points 1 & 2). In particular, the major concentrations of positive answers (points 3 & 4) are represented from these aspects: the students appear to be engaged in studying the entire program for every exam even if there are more interesting things to do, then they are able to plan their university activities and cooperate with other students (see Appendix A). But the lowest points of positive answers (points 3

& 4) are represented by those elements: the learners have difficulty in focusing their attention during studying without being distracted, in researching articles and books and taking exhaustive notes during the lectures (see Appendix A).

## Engagement



*Figure 8 Box plots about engagement (number of answers)*

In Figure 8, the box plot of point 1 shows the highest level of concentration of answers (interquartile range: 1), while the box plot of point 2 displays the highest grade of dispersion (interquartile range: 3,5). In general, the concentration of the answers in the points 3 and 4 (sum of interquartile range: 5) appears lower than the level of points 1 and 2 (sum of interquartile range: 4,5).

In relation to the aim of this study the choice of a small sample size allowed a more efficient and time-saving process for collecting and analyzing data to know the needs of the participants.

However the eventual limit of the sample size is compensated by a mixed methodology which involved the participants in several steps (see Figure 1 & Table 2) to create a more solid study on different topics. Indeed a small sample allowed the exploration of various arguments in a short period of time (general motivation, intrinsic and extrinsic motivation and engagement).

#### **4.2.1 Improvement Suggestion**

In the last part of the survey, there was an open question about the quality of the university system. The goal of this question is to get more qualitative data about the problems and solutions which could influence the motivation and the engagement of university students. One student affirmed that he would not change anything. Another answer declared that the student would like to have more days to study for the exams. Two answers stated that the teachers should do more immersive and understandable lessons and they should teach within their work field. One student said that he would change Canvas, a website tool for the students because it is too complicated. Other students affirmed that he would improve the engagement in the university context and another one would do more interactive lessons. Instead, one student answered that he would improve the student office, a place where students have direct contact with all the university collaborators.

#### **4.3 Design of the Prototype**

After the collection and analysis of the data from the first survey, the next part was the development of the first version of the prototype, which is formed by high-fidelity interactive screens of a mobile application. During the tests, the participants tried for the first time to navigate and use every feature of the application, throughout the prototype thanks to a web application, which was used to create the interactive part. After the tests, the participants answered another survey (see Appendix

B). This second survey was used to the feedback from the testers, and the questions were focused mainly on three aspects: usability, satisfaction, and effectiveness.

**Table 3. Results of the first prototype**

<b>Usability</b>		
<b>Options</b>	<b>Number of answers</b>	<b>Percentage</b>
1 - Hard to use	<b>0</b>	<b>0%</b>
2 - Enough hard	<b>0</b>	<b>0%</b>
3 - Pretty easy	<b>8</b>	<b>73%</b>
4 - Really easy	<b>3</b>	<b>27%</b>
<b>Total</b>	<b>11</b>	<b>100%</b>
<b>Average = 3,2</b>		
<b>Clarity</b>		
<b>Options</b>	<b>Number of answers</b>	<b>Percentage</b>
1 - Not clear	<b>0</b>	<b>0%</b>
2 - Enough ambiguous	<b>3</b>	<b>27%</b>
3 - Pretty clear	<b>4</b>	<b>36,5%</b>
4 - Really clear	<b>4</b>	<b>36,5%</b>

<b>Total</b>	<b>11</b>	<b>100%</b>
<b>Average = 3</b>		
<b>Appeal</b>		
<b>Options</b>	<b>Number of answers</b>	<b>Percentage</b>
1– No	<b>0</b>	<b>0%</b>
2 - Sometimes	<b>6</b>	<b>55%</b>
3 - Often	<b>2</b>	<b>18%</b>
4 - Yes	<b>3</b>	<b>27%</b>
<b>Total</b>	<b>11</b>	<b>100%</b>
<b>Average = 2,7</b>		
<b>Motivating</b>		
<b>Options</b>	<b>Number of answers</b>	<b>Percentage</b>
1 - Not much	<b>0</b>	<b>0%</b>
2 - Not enough	<b>0</b>	<b>0%</b>
3 - Enough motivating	<b>9</b>	<b>82%</b>
4 - Motivating	<b>2</b>	<b>18%</b>
<b>Total</b>	<b>11</b>	<b>100%</b>

<b>Average = 3,1</b>		
<b>Usefulness</b>		
<b>Options</b>	<b>Number of answers</b>	<b>Percentage</b>
1– Useless	<b>0</b>	<b>0%</b>
2 - Enough useless	<b>1</b>	<b>9%</b>
3 - Enough useful	<b>6</b>	<b>55%</b>
4 – Useful	<b>4</b>	<b>36%</b>
<b>Total</b>	<b>11</b>	<b>100%</b>
<b>Average = 3,2</b>		
<b>Satisfaction</b>		
<b>Options</b>	<b>Number of answers</b>	<b>Percentage</b>
1– No	<b>0</b>	<b>0%</b>
2 - Not enough	<b>0</b>	<b>0%</b>
3 - Enough satisfied	<b>7</b>	<b>64%</b>
4 – Satisfied	<b>4</b>	<b>36%</b>
<b>Total</b>	<b>11</b>	<b>100%</b>
<b>Average = 3,3</b>		

<b>Effectiveness</b>		
<b>Options</b>	<b>Number of answers</b>	<b>Percentage</b>
1– No	<b>0</b>	<b>0%</b>
2 - Not enough	<b>2</b>	<b>18%</b>
3 - Enough effective	<b>5</b>	<b>46%</b>
4 – Effective	<b>4</b>	<b>36%</b>
<b>Total</b>	<b>11</b>	<b>100%</b>
<b>Average = 3,1</b>		
<b>Engaging</b>		
<b>Options</b>	<b>Number of answers</b>	<b>Percentage</b>
1– No	<b>0</b>	<b>0%</b>
2 - Not enough	<b>2</b>	<b>18%</b>
3 - Enough	<b>5</b>	<b>46%</b>
4 – Yes	<b>4</b>	<b>36%</b>
<b>Total</b>	<b>11</b>	<b>100%</b>
<b>Average = 3,1</b>		

The results of the second survey are graded in 4 points: the points 1 & 2 represent negative answers, while the points 3 & 4 are positive replies.

In Table 3, the results show that satisfaction with the design of the prototype is the most relevant (average of points: 3,3). Then, the students appreciated the usability, usefulness (average of points 3,2), and the ability of the prototype to motivate, engage and its effectiveness (average of points: 3,1).

The second-last question was about the problems that emerged during the test and whether there were some problems with navigation. Four participants affirmed that they did not find any issue during the usage of the application. A student replied that the text present in the readings must be relevant to the questions posted inside the other screens, there should be some photos and some scroll button so that it is easier to navigate. A participant declared that the application is quite cluttered because of the large number of menus, options, and sub-menus, there should be a streamlined focus on the features that could be important for the students.

Another student answered that the application is hard to navigate, there should not be a relationship with the word mistake within their level of progress and the button for deleting the account should not be easy to find. One student replied that there is a word in the application which is not clear.

Another student declared that is not clear when a match ends and there no bookmarks in the application. Instead, a learner declared that there should be more colors and pictures to get the full idea of the application. Another learner declared that there should be symbols in the badge area to display progress. The last question asked for overall feedback about the application.

The answers were various: one student replied with *useful*, and another two replied with *good*.









Another participant said the prototype is excellent, another one said that the application is easy and funny. Another answer affirmed that the idea is positive, but it needs navigation improvements.




Another user declared that the students should log in or sign up with their student IDs instead of

their email addresses or social media. The application is fine, and it can be used as a tool to stimulate the teaching of a specific subject.

#### 4.4 Gamification Mechanics

The third part of the research is to improve the design of the first version of the prototype, thanks to the feedback collected with the second survey. The next phase is to get the evaluation of the gamification mechanics to answer the second research question. For achieving the goal, a third survey was developed to obtain qualitative data, from the participants. The questionnaire contained eight open-ended questions (see Appendix C), one for each gamification mechanics. The participants tried the second version of the prototype and then answered the queries.

Gamification mechanics	Evaluation
1. Memory challenge	
2. Trivial challenge	
3. Matching mechanic	
4. Completing mechanic	
5. Ranking system	
6. Levelling system	
7. Badges system	
8. Competition system	

Positive
Need to Improve
Negative

*Figure 9 The results about gamification mechanics' evaluation*

Figure 9 shows a summary of how the participants evaluated the gamification mechanics (third survey and interview). This synthesis is the outcome of a meta-aggregation which assembles results from qualitative study (third survey and interview), categorizes those results into three groups (positive, need to improve, negative) on the basis of analogy of the evaluations (absence of critical issues, presence of improvement suggestions, presence of critical issues), and aggregates these to create some series of declarations in the discussion (see Chapter 6) that properly represent that aggregation.

The first question focused on the memory challenges, and the majority of the answers were positive. Memory challenges were perceived as an effective procedure to improve the motivation, engagement, and cognitive ability for studying. However, one student replied that the effectiveness of the mechanic depends on what kind of memory challenge is suggested. Another student replied that the mechanism it is not useful for what he or she is currently studying. The second question was about the trivial challenges. Some students responded that the mechanic could be helpful and improve the reactivity of the students in giving answers. Nonetheless, another student did not understand the meaning of trivial challenges. Other participants replied that the mechanics could become tedious, demotivating and useless because there is no logical reasoning. The third question focused on matching challenges. Most of the students answered that the mechanic could be successful and useful for improving engagement, motivation, and attention to detail. Anyway, one student declared that the mechanic can become boring after some repetitions. The fourth question was about the completing mechanic. Some students stated that the mechanic can be useful for capturing the player attention and stimulates the player to choose the right answer. Besides, the mechanic can challenge the knowledge of the player. Another student replied that the matching mechanic is less useful than the other mechanics. The fifth question covered the ranking system. The majority of the students revealed that the mechanic can improve their motivation, cooperation, and competition. The sixth question focused on the levelling system proposed in the prototype. The students answered that the mechanic is useful and motivating because it adapts different learning

levels so that it is possible to improve the knowledge step-by-step. The seventh question was about the badges system. The majority of the answers were positive because the mechanic was perceived as useful motivating and engaging. The participants declared that the badges mechanic is the correct reward for the player; it stimulates coming back and the awareness of the learning process.

However, one student replied that the mechanic it is not motivating and another one revealed that the badges are not the best rewards for a real learning process. The eighth question focused on the competition system of the prototype. All answers were positive. The competition system according to the students it can improve the motivation and the engagement because of the comparison between different students.

The questions of the survey were also used during a semi-structured interview (see Appendix C) with a student of Media Technology. The author focused on a single interview because the interviewed already dropped out in a previous university experience. For this reason and the quality of the data collected, the relevance of this interview is similar to the third survey. For the interview was used the same method of codification of the third survey. The answers were clustered into three groups based on the type of evaluation, also to create some series of statements.

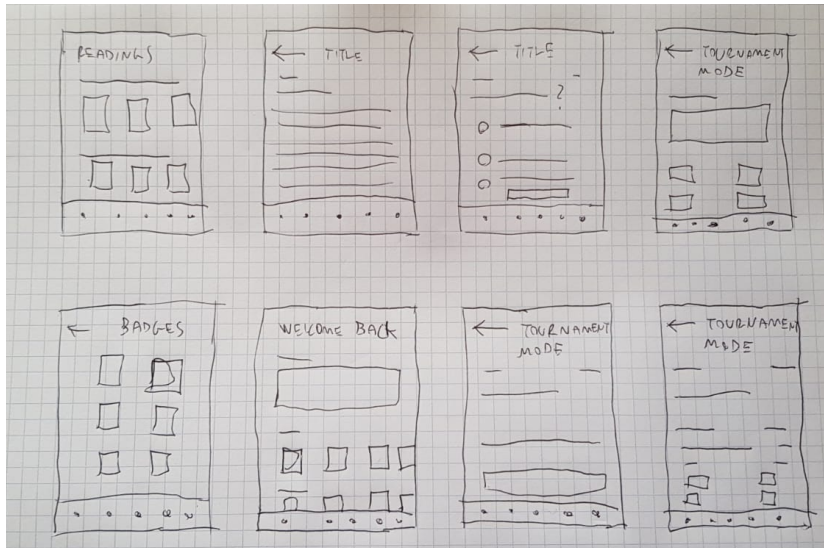
The student interviewed answered the questions after testing the second version of the prototype. In the first question, he found the memory challenges as an engaging alternative to the language of the readings, which can be hard to understand. For the second question, the participant declared that the trivial challenges are effective because even if the user fails, then he or she will remember the correct answer. In the third question, the participant declared that the matching mechanic is efficient because it is a visual process. For the fourth question, the student replied that the completing challenge it is useful to focus on the concepts. In the fifth question, the answer was positive toward the ranking system, which allows the user to be more motivated. For the sixth question, the student answered that levelling is another incentive and motivation. In the seventh question, the participant said that the badge system is not effective, but he suggested implementing a value that represents

the knowledge learned, instead of simple acknowledgments. In the last question, the student declared that the competition process is reliable because it is a motivation to be better than others.

## **5 THE PROTOTYPE**

The final step of the research is to create the prototype of a mobile application for stimulating student engagement and motivation. So, to design a usable application the end-users must be included in the design process (Rosenzweig, 2015). This process is iterative and focuses on some qualitative and quantitative aspects of the experience. The evaluation is tested on the users' perspective (Tullis & Albert, 2013). The final prototype is changed and designed based on the opinion of the end-users, whether they are satisfied with the overall experience and whether it can solve the problem stated in this research. The metrics for evaluating the prototype are adapted from Tullis et al. (2013).

After the first survey for establishing the needs of the students, the next part was to create a prototype based on those requirements. The participants were involved into the evaluation of the design of the prototype and also into the evaluation of the gamification mechanics through several user test followed by surveys to collect data. At the beginning, the students tried to use the first prototype, to verify the usability, the clarity and also the effectiveness of the prototype. After the test the participants shared their experience with the author, by giving useful feedback to improve the first version of the prototype. Then the students evaluated the gamification mechanics of the second version of the prototype to assess the identified mechanics, with a survey and an interview.

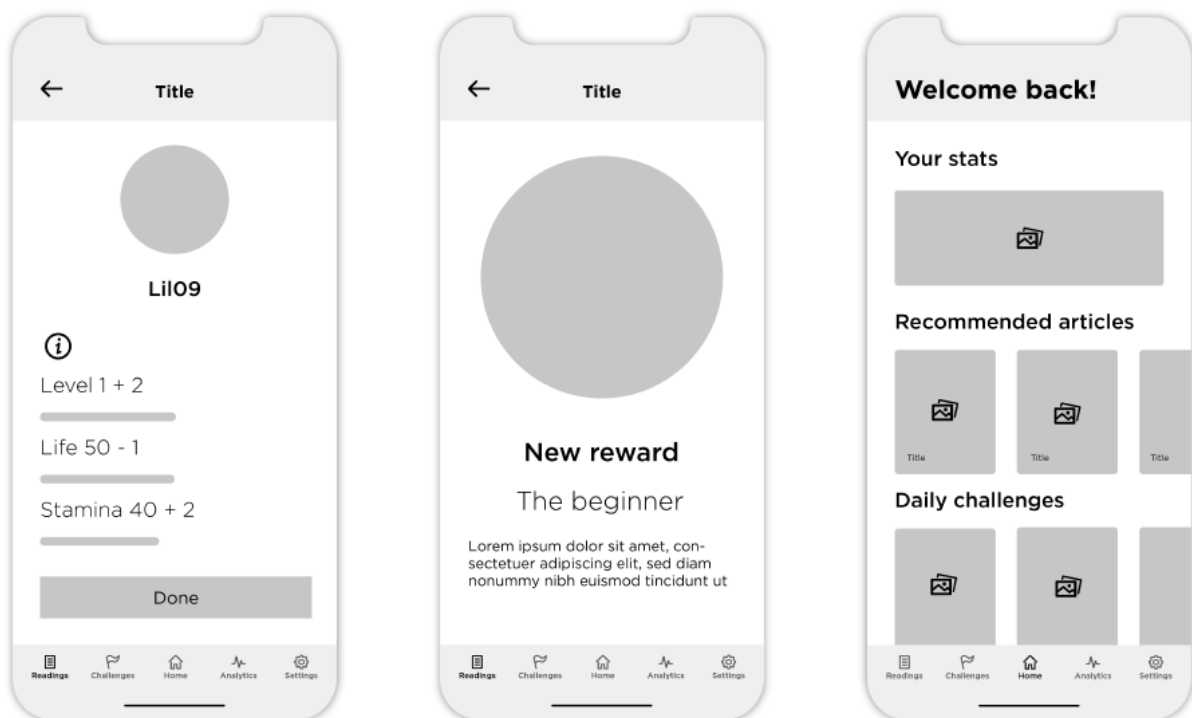


*Figure 10 First sketches of the prototype*

The design process is adapted from the user experience methods of Rosenzweig (2015). The first step of the process was to know better the needs of the end-user of the prototype. After the analysis of the first survey and the literature review the author started to design the prototype. The first phase was to decide the layout of the prototype, so several sketches were made before the high-fidelity prototype. In the Figure 10 are represented the first sketches and ideas of the layout of the prototype. During this part the author chose the gamification mechanics and features to include in the final prototype. According to the model of the persuasive design of Fogg (2009) a person, to perform a target behavior, has to be adequately motivated, have the capacity to behave and be triggered to act. In the development of the gamified prototype, also these elements were used to identify what gamification mechanics can act as a facilitator to behave. The gamification mechanics chosen for the first prototype are easy, entertaining and fast to perform, besides the type of challenge can be a trigger to perform a target behavior. The choice of the gamification mechanics was influenced by the level and the type of motivation (extrinsic and intrinsic) and the grade of engagement. The most suitable gamification mechanics were chosen to improve the engagement and the intrinsic motivation of the participants. For the layout the author was influenced by the

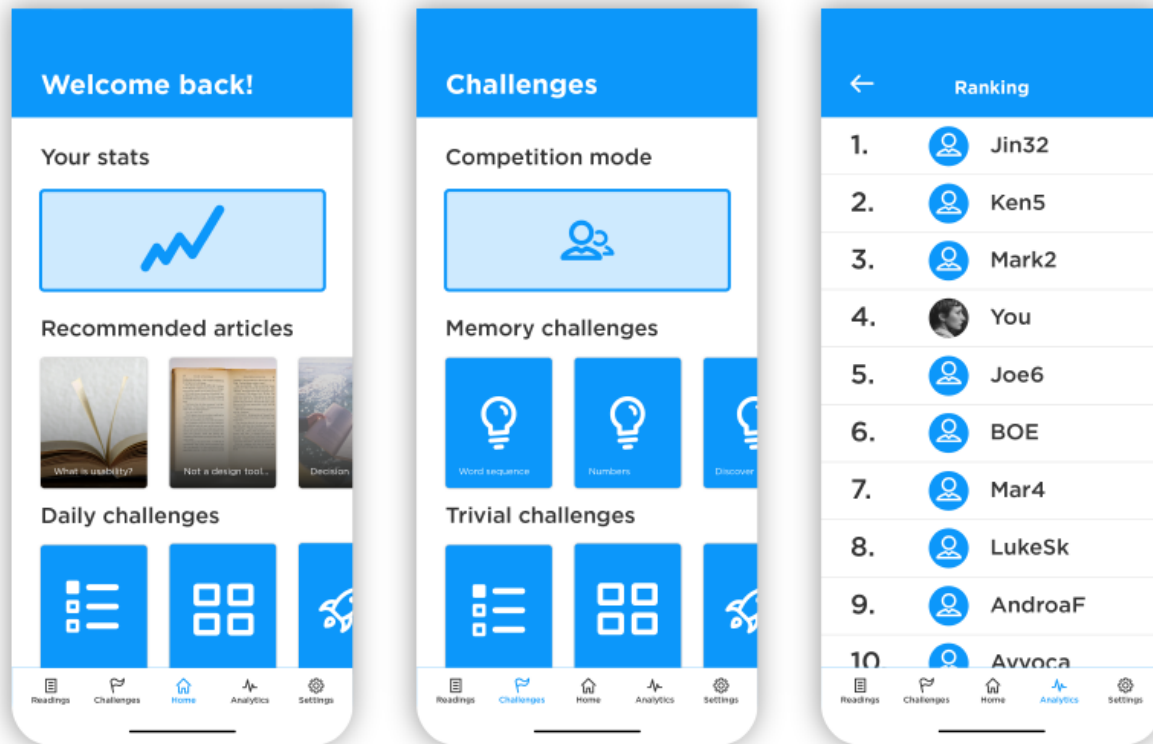
guidelines of iOS environment. Afterwards the sketches were transformed into the high-fidelity wireframes.

The prototype was designed in two versions. The first version is used to get the evaluation of its design from the university students. Meanwhile, the second version is customized according to the feedback of the testers and used to obtain the evaluation of the gamification mechanics. The first version of the prototype (see Figure 11) was a set of high-fidelity wireframes of a mobile application. The screens are interactive, so it is possible to navigate through the whole application and see every detail.



*Figure 11 First version of the prototype*

The second version was the evolution of the first prototype (see Figure 12). The wireframes become interactive mock-ups. The design is improved according to the data collected by the second survey.



*Figure 12 Second version of the prototype*

The second version has fewer screens than the first one. Thus, the design is simpler and the navigation results are more fluid and functional than the first release. In the second prototype, some features are removed and others are added according to the feedback of the testers. In this version, some sub-menus are deleted as well as the button for removing the profile.

Both of the versions were created by using Illustrator, Invision, and Marvel to create interactive prototypes. The two prototypes (see links in Appendix D & E) were both tested by the students to obtain data and achieve the aim of this study. The two versions were tested by the participants in single sessions of testing. During the test, the participants tried to navigate through the screens with

the mouse or the keyboard, to see each function and feature. After the test, the participants answered some questions about the design and the gamification mechanics presented.

The final version of the prototype is designed following the guidelines of the iOS environment and the target device which is the iPhone X. In the first section, there are login and sign-up screens. The user can log in using their student-ID and a password or a Facebook profile. There is also the possibility to change the password if the user forgot it. On the sign-up screen, the user can use the student-ID and a password or Facebook to register himself. Then the user can start to create his profile by choosing a nickname, a profile photo, his university, his academic year, and his program's study. Then the user knows his level in the game and the statistics of his performance. The second section is composed of five menus that contain each feature. The first menu is the homepage. It is used as the central hub where the user can reach the other functions. The second menu is called reading, where the user can find a list of the eBooks or articles from the library related to his program's study. The user can select a reading and then answers to a simple question on the topic read. After completing every challenge, the user can receive positive or negative feedback. When the user achieves some goals and receives a badge, that supports his or her motivation or engagement. The performance of the user affects his level and statistics. The third section is dedicated to the challenges. There is a list of the different challenges: memory challenges, trivial questions, matching the concept, and completing the sentence. The memory challenges are used to increase the strength of the memory of a player. Trivial questions are simple questions based on the readings and knowledge of the program's study. For the matching mechanic, the student must match the image with a word that represents a concept. The last challenge is to complete a sentence with the correct words. In the challenges menu, there is also a competition mode whereby the player can challenge one or more player randomly, in a duel or tournament. The player that wins more challenges become the winner and improves his ranking. The fourth menu is

called analytics, where the player can see a diagram of his statistics over time. Furthermore, the user can observe his profile, his ranking, and every badge collected. The last menu is dedicated to the settings. There the player can report an issue or ask a question, manage notifications, and logout.

## 6 DISCUSSION

This research displays how gamification features can be used to raise the motivation and the engagement of university students, to not dropping out earlier. The first stage was to investigate more about the experience of the learners: how much they are motivated and if they can complete their tasks. Therefore, it was possible to know better which kind of gamification mechanics could be used to design a mobile application and answer to the first research question (see Chapter 1.3). The next step was to get feedback about the first version of the prototype so that the second research question could receive an answer. The final phase was to upgrade the first prototype using the analysis of the data gathered with the first user tests.

### 6.1 Motivation and Engagement

The results of the first survey show that is possible to delineate a particular profile of a student that appears more motivated than engaged.

In fact, some red flags that indicate a possible risk of an early dropout emerge from the data analysis:

- There is a small gap (6%) between the percentage of positive answers (points 3 & 4) of general motivation (66%) and the level of engagement (60%) (see Figures 2 & 7);
- There is a higher concentration of answers in the points 3 and 4 of general motivation (3,7) than in the same points of engagement (5) (see Figures 3 & 8);
- There is a remarkable difference (20%) between the percentage of positive answers (points 3 & 4) of extrinsic (74%) and intrinsic (54%) motivation (see Figure 4);

- There is the same concentration of answers in the points 3 and 4 of extrinsic and intrinsic motivation. But the average of extrinsic motivation (7,7) is higher than the average of intrinsic motivation (6,6) (see Figure 5).

From the data analysis emerges a red flag represented by the level of engagement which is slightly lower than the grade of motivation. This gap could represent a weak signal of a state of imbalance that predicts a probable risk of dropout.

Furthermore, another red flag is that the students are motivated more by extrinsic factors (future job occupation, prestige, richness, career), than intrinsic factors (satisfaction, passion, self-esteem). In this situation is more probable that in a long period the students could have a decline of engagement that will influence their performance, causing possible dropouts. In particular, the fact that the majority of the students revealed that their main aim in the future is to get a degree to have a decent occupation and the right skill for their job (extrinsic factors) is not enough to prevent the risk of dropping out. On the contrary, the students that have a passion for their studies have more probabilities to complete their university path. Indeed, for instance, some participants (see Appendix A) attend university because they want to finish their program so that they will be ready for what they like to do. Other participants replied that attend university because they enjoy learning new and unknown information.

The other scholars focused more on the relationship between motivation and engagement with the learning process. Some studies (Hsieh, 2014; Xiang et al., 2017; Saeed et al., 2012) revealed that there are several aspects of intrinsic motivation in the behavior of the students. Saeed et al. discovered that students who have intrinsic motivation are more likely to learn better than the students that do not have intrinsic motivation.

While the author of this thesis explores the relationship between motivation, engagement and the risk of early abandonment. From the data analysis, the students appear to be motivated more by

extrinsic factors than intrinsic elements. This situation deserves attention because it could be predictive of a risk of dropout.

The behavior of the teachers is important in the learning environment because the students can perform better if the teachers are more sensitive (Christenson, Reschly, & Wylie, 2012). In the exploration of Christenson et al. (2012), there is a correlation between motivation engagement and the risk of dropout. In the study is reported that the students that are not motivated they have a lack of engagement. This absence may lead to the early abandonment of the studies. Self-regulation in the educational context is an important ability that is directly linked to academic accomplishment (Caruth, 2018). In the study, it is pointed out that mindfulness can also influence student achievement.

These authors identified the correlation between motivation engagement and the risk of dropout, but they did not evaluate the impact of the gamification mechanics on the prevention of this risk. Furthermore the fact that the students of this research appear to be more motivated than engaged could depend on the type of the motivation (prevalence of extrinsic factors).

## **6.2 Evaluation of the Design of the Prototype and Gamification Mechanics**

The profile emerged from the sample was used to design the first version of the prototype. The aim of the first prototype was to balance the relationship between extrinsic and intrinsic motivation and improve engagement. The first release of the prototype was quite successful, and the participants appreciated the design of the mobile application (usability, usefulness). After the test, the prototype was further customized according to the feedback of the students. In particular, the clarity was improved and the wideness was simplified. The second version of the prototype was used to collect data of the gamification mechanics. In the last survey and the qualitative interview, the students gave their evaluation of the gamification mechanics. In general, the mechanics were valued by the participants that revealed that the active gamification mechanics (memory challenges, matching,

completing) have a minor success and need further investigation, probably because these challenges require attention, concentration, and engagement. This outcome is coherent with the difficulty of concentration emerged in the engagement survey (see Appendix A). On the contrary, some passive gamification mechanics (competition, ranking, levelling) were appreciated probably because enhance the intrinsic motivation and the spirit of emulation. The passive gamification mechanics can stimulate a virtuous circle. For instance, if the student sees the best results of his or her peers, then he or she can be stimulated to become a *pacesetter*, improving his or her motivation and engagement.

Furthermore, the only exception to the passive mechanics is the badge system, which has been criticized, perhaps, because it is not an adequate reward system for the sample of the study.

In the research of Botha-Ravyse et al. (2018), the researchers developed a mobile application by introducing some gamification principles to help the students to be organized to tackle their examinations. In the conclusions of their study, it is specified that the gamified mobile application was both a success and a failure. A success because the application was simple to use and understand. A failure because the application is also not enough useful. Furthermore, some features needed more analysis, for instance, the different type of questions.

Bartel et al. (2014) also explored the possibility of gamification in the university context with a gamified mobile system for learning. In the discussion chapter, the author reveals that there are some limitations with gamification in the motivation and engagement background. For instance, the reward system cannot have an effect on long periods, and the motivation levels of students differ, so the usage of the application may become useless to some students.

From an examination of the literature review emerges that the majority of the studies is focused on the correlation between gamification and the learning process, but not to prevent dropout. The novelty of this study is that the field of investigation is the relationship between gamification and

the improvement of motivation and engagement to promote the fulfillment of the university studies, through a mixed methodology. Another important strength is the involvement of the students in the research process. The eventual limit of the sample size is compensated by a mixed methodology which involved the participants in several steps (see Figure 1 & Table 2) to create a more solid research.

In particular the students were involved for establishing the needs to identify and select the most suitable gamification mechanics. Then the participants were involved in the test of the design of the first prototype, to improve the critical aspects of the prototype. In the end the learners were involved in the evaluation of the gamification mechanics, to grade the most effective gamification elements.

Another innovation is the examination of the connection of motivation and engagement, and the exploration of extrinsic and intrinsic motivation. The last new consideration is the relevance of the possible impacts of passive and active gamification mechanics. This research methodology could be used in other settings, in other education systems, other study departments, workplaces, and sports clubs, for instance. However, the study has limitations. For this research, the socio-economic and educational background was not included in the investigation to create a deeper profile of the students. The study was limited to double test sessions. The prototype of the mobile application should be used over a long period, to understand the effects during the studies. Besides, this research focused on only two aspects, the motivation and engagement of students. This research involved only the students of Malmö University of Media Technology and it did not include teaching figures that could be helpful.



## 7 CONCLUSION

The aim of this study is to identify the gamification mechanics that can be used in a mobile application to improve the motivation and the engagement of university students, to contrast the phenomenon of dropout. The investigation tried to answer two research questions:

- *What are the gamification mechanics that can be used in a mobile application to improve the motivation and the engagement of university students?*
- *How can these gamification mechanics be evaluated by university students?*

According to the analysis of the results of the students' profile, the most suitable mechanics to improve the intrinsic motivation and engagement are a reward system (badges), a ranking classification of the users with a progression scheme (levelling), specific trivial questions, matching mechanics, memory challenges, completing mechanics, and matchmaking encounters.

The first version of the prototype was developed inserting these features to test the application and get the evaluation from the students. The majority of the students evaluated in a positive way some passive gamification mechanics (ranking system, competition, levelling). Active gamification mechanics (trivial questions, matching mechanic, memory challenges, completing mechanic) are not appreciated in a relevant way by the participants and need more investigation. Furthermore, the badge system is the most criticized gamification mechanic.

The main findings of this research are divided into three parts:

### *A. Motivation and engagement*

From the study of the sample emerges that there is a remarkable difference between the level of extrinsic and intrinsic motivation. Besides, there is a small gap between the level of general motivation and the level of engagement. These results confirm that the students of the sample could risk dropout;

### *B. Prototype design*

The first release of the prototype was quite successful, and the participants appreciated the design of the mobile application (usability, usefulness), furthermore the students understood how the gamification mechanics works;

### *C. Evaluation of gamification mechanics*

The passive gamification mechanics (ranking, levelling, competition) seem to be more effective for the sample of the students than the active gamification mechanics (trivial questions, completing mechanic, matching mechanic, memory challenges).

This study expands the limits of the previous research because is focused on the relationship between gamification and the improvement of motivation and engagement to prevent early dropout. Furthermore, another strength is the involvement of the students in the design process which has allowed the creation of a customized prototype. Another new aspect is the consideration of the possible impacts of passive and active gamification mechanics.

The methodology presented in this study can be replicated to conduct another research in a different environment. The prototype was just the design of a mobile application. Thus, in the future, the prototype can be developed and improved so that the application becomes a digital software, available to use during studying. The mobile application can also be improved by including into the research the students of other faculties and universities as well as the professors, to have a deeper knowledge of university studying. Furthermore, in the future, the research can also evolve its boundaries by investigating also the learning part. Hence, gamification can be used to advance the learning skills of university students. Furthermore, it can be included in the future other gamification mechanics, for instance, a cooperative system that allows the support between the students, even outside the digital use of the application. The results of this study can become the

origin for future researchers to get a deeper knowledge of how gamification works in the university environment by enlightening the talents of the students.

## REFERENCES

- Akpolat, B. S., & Slany, W. (2014). *Enhancing software engineering student team engagement in a high-intensity extreme programming course using gamification*. Proceedings of 27th IEEE Conference on Software Engineering Education and Training.
- Anderson, S., Gilardi, J., Sennett, M., Westerhaus, J., & O'Rourke, J. S. (2017). *Motorola, Inc.: Smartphones and the Android OS*. SAGE Publications Ltd.
- Andersson, C., Johnsson, K. O., Berglund, M., & Jehagen, A. Ö. (2009). *Stress and hazardous alcohol use: Associations with early dropout from university*. Scandinavian Journal of Public Health.
- Barata, G., Gama, S., Jorge, J., & Gonçalves, D. (2013). *Improving participation and learning with gamification*. Gamification '13 Proceedings of the First International Conference on Gameful Design, Research, and Applications Pages 10-17 .
- Bartel, A., & Hagel, G. (2014). *Engaging students with a mobile game-based learning system in university education*. IEEE Global Engineering Education Conference (EDUCON).
- Basten, D. (2017). *Gamification*. IEEE Software Volume: 34 , Issue: 5 .
- Botha-Ravyse, C., Lennox, A., & Jordaan, D. (2018). *LESSONS LEARNED FROM GAMIFICATION OF A LEARNING EXPERIENCE: A CASE STUDY*. South African Journal for Research in Sport, Physical Education and Recreation, 40(2): 23 - 40.
- Buckley, P., & Doyle, E. (2014). *Gamification and student motivation*. Interactive Learning Environments.
- Buckley, P., Doyle, E., & Doyle, S. (2017). *Game On! Students' Perceptions of Gamified Learning*. Educational Technology & Society, 20 (3), 1–10.
- Caruth, G. (2018). *Student Engagement, Retention, and Motivation: Assessing Academic Success in Today's College Students*. Participatory Educational Research (PER) Vol. 5(1), pp. 17-30.
- Casanova, J. R., Cervero, A., Núñez, J. C., Almeida, L. S., & Bernardo, A. (2018). *Factors that determine the persistence and dropout of university students*. Psicothema 2018, Vol. 30, No. 4, 408-414.
- Christenson, S., Reschly, A., & Wylie, C. (2012). *Handbook of Research on Student Engagement*. Springer.
- Clark, V., & Ivankova, N. (2016). *Why a Guide to the Field of Mixed Methods Research?: Introducing a Conceptual Framework of the Field*. CA: SAGE Publications.
- Clarke, G., Kehoe, J., & Broin, D. O. (2017). *The Effects of Gamification on the Formation of a Habit of Studying in Tertiary Level Students*. Proceedings of the European Conference on Games Based Learning.
- Cooper, A., Reimann, R., & Cronin, a. D. (2007). *About Face 3: The Essentials of Interaction Design*.
- Daul, S. (2014). *Game Design For Learning*. atd Learning Technologies .
- Deterding, S., Sicart, M., Nacke, L., O'Hara, K., & Dixon, D. (2011). *Gamification. using game-design elements in non-gaming contexts*. Proceedings of CHI Extended Abstracts.
- Domínguez, A., Saenz-de-Navarrete, J., De-Marcos, L., Fernández-Sanz, L., Pagés, C., & Martínez-Herráiz, J. J. (2013). *Gamifying learning experiences: Practical implications and outcomes*. Computers & Education, 63, 380–392.
- Edwards, R., & Holland, J. (2013). *What is Qualitative Interviewing?* A&C Black.
- Eurostat. (2016). Retrieved from <https://ec.europa.eu/eurostat/documents/2995521/7771139/9-20122016-BP-EN.pdf>
- Eurostat. (2016). *Work beats study for 25% of university drop-outs*. Retrieved from <https://ec.europa.eu/eurostat/en/web/products-eurostat-news/-/DDN-20180404-1>

- Ferro, L., Walz, S., & Greuter, S. (2013). *Towards personalised, gamified systems: an investigation into game design, personality and player typologies*. In Proceedings of the 9th Australasian Conference on Interactive Entertainment Matters of Life and Death – IE'13.
- Fogg, B. (2009). *A behavior model for persuasive design*. Proceedings of the 4th International Conference on Persuasive Technology.
- Freitas, S. A., Lacerda, A. R., Calado, P. M., Lima, T. S., & Canedo, E. D. (2017). *Gamification in education: A methodology to identify student's profile*. 2017 IEEE Frontiers in Education Conference (FIE).
- Fullerton, R., Swain, C., & Hoffman, S. S. (2008). *GAME DESIGN WORKSHOP A Playcentric Approach to Creating Innovative Games*. Morgan Kaufmann Publishers.
- Google. (2012). *The New Multi-screen World: Understanding Cross-Platform Consumer Behavior*.
- Hällsten, M. (2017). *Is Education a Risky Investment? The Scarring Effect of University Dropout in Sweden*. European Sociological Review, Volume 33, Issue 2.
- Hamari, J. (2013). *Transforming Homo Economicus into Homo Ludens: A Field Experiment on Gamification in a Utilitarian Peer-To-Peer Trading Service*. Electronic Commerce Research and Applications, 12(4), pp. 236-245.
- Hamari, J., & Hamari, J. (2011). *Perspectives from behavioral economics to analyzing game design patterns: loss aversion in social games*. CHI 2011 Social Games Workshop.
- Hamari, J., Koivisto, J., & Sarsa, H. (2014). *Does Gamification Work? -- A Literature Review of Empirical Studies on Gamification*. 47th Hawaii International Conference on System Sciences.
- Hew, K., Huang, B., Chu, W. S., & Chiu, D. K. (2016). *Engaging Asian students through game mechanics: Findings from two experiment studies*. Computers & Education.
- Holt, A., & Huang, C.-Y. (2018). *Embedded Operating Systems: A Practical Approach*. Springer International Publishing .
- Hsieh, T. (2014). *Motivation matters? The relationship among different types of learning motivation, engagement behaviors and learning outcomes of undergraduate students in Taiwan* . Springer Science+Business Media Dordrecht.
- Huotari, K., & Hamari, J. (2012). *Defining gamification: a service marketing perspective*. 16th International Academic MindTrek Conference.
- Kapp, K. M. (2012). *The Gamification of Learning and Instruction: Game-based Methods and Strategies for Training and Education*. Hoboken: Wiley.
- Kocadere, S. A., & Çağlar, S. (2017). *Gamification from Player Type Perspective: A Case Study*. Educational Technology & Society, 21.
- Maher, R., Maher, M., Mann, S., & McAlpine, C. (2018). *Integrating design thinking with sustainability science: a Research through Design approach*. Springer.
- Marcus, A., & Wang, W. (2017). *Design, User Experience, and Usability Understanding Users and Contexts*. 6th International Conference, DUXU 2017 Held as Part of HCI International.
- McClean, P., Saini-eidukat, B., Schwert, D., Slator, B., & White, A. (2001). *Virtual worlds in large enrollment science classes significantly improve authentic learning*. Proc. of the 12th International Conference on College Teaching and Learning, 111–118.
- Mendoza, A. (2013). *Mobile User Experience : Patterns to Make Sense of It All*. Morgan Kaufmann.
- Moreno, J. (2012). *Digital competition game to improve programming skills*. Educational Technology & Society.
- Muntean, C. I. (2011). *Raising engagement in e-learning through gamification*. The 6th International Conference on Virtual Learning ICVL .
- Narayanan, A. (2014). *Gamification for Employee Engagement*. Impackt Publishing.
- Nicholson, S. (2012). *A User-centered theoretical framework for meaningful gamification*. Games+Learning+Society 8.0.

- OECD. (2019). *Population with tertiary education*. Retrieved from doi: 10.1787/0b8f90e9-en
- Perry, B. (2015). *Gamifying French Language Learning: a case study examining a quest-based, augmented reality mobile learning-tool*. *Procedia – Social and Behavioral Sciences*, 174.
- Purdy, J. G. (2012). *Smartphones: New User Paradigms and Behaviors MLA (Modern Language Assoc.) Mind Commerce. Smartphones : New User Paradigms and Behaviors. Mind Commerce, 2012. APA (American Psychological Assoc.) Mind Commerce. (2012). Smartphones : New User Paradigms an. Mind Commerce Publishing.*
- Resmini, A. (2014). *Reframing Information Architecture*. Springer.
- Rosenzweig, E. (2015). *Successful User Experience : Strategy and Roadmaps*. Elsevier Science & Technology.
- Saeed, S., & Zyngier, D. (2012). *How Motivation Influences Student Engagement: A Qualitative Case Study*. *Journal of Education and Learning*; Vol. 1, No. 2.
- Salen, K., & Zimmerman, E. (2004). *Rules of play: Games design fundamentals*. MA: MIT Press.
- Schnepf, S. V. (2014). *Do Tertiary Dropout Students Really Not Succeed in European Labour Markets? IZA*.
- Seaborn, K., & Fels, D. (2015). *Gamification in theory and action: A survey*. *International Journal of Human-computer Studies*, 74, pp. 14-31.
- Sharples, M., McAndrew, P., Weller, M., Ferguson, R., FitzGerald, E., & Hirst, T. (2013). *Innovating pedagogy 2013: Open university innovation report 2. Milton keynes*. The Open University.
- Tugce, A., Berkan, C., & Goknur, K. (2018). *A qualitative investigation of student perceptions of game elements in a gamified course*. *Computers in Human Behavior Volume 78*, Pages 235-254 .
- Tullis, T., & Albert, B. (2013). *Measuring the user experience*. Morgan Kaufmann.
- van Staden, S. (2017). *Survey Research in Action: A South African Example of the Progress in International Reading Literacy Study*. SAGE Research Methods Cases Part 2.
- Werbach, K., & Hunter, D. (2012). *For the win: How game thinking can revolutionize your business*. Wharton Digital Press.
- Xiang, P., Ag bug ă, B., Liu, J., & McBride, R. (2017). *Relatedness Need Satisfaction, Intrinsic Motivation, and Engagement in Secondary School Physical Education*. *Journal of Teaching in Physical Education*, 36, 340 -352.
- Ymran, F., Akeem, O., & Yi, S. (2017). *Gamification Design in a History E-Learning Context*. 2017 International Conference on Information, Communication and Engineering (ICICE).
- Zichermann, G., & Cunningham, C. (2011). *Gamification by design: Implementing game mechanics in web and mobile apps*. O'Reilly Media.

## APPENDIX A: First Survey

### First survey

- Gender: Male/Female
- Age: —

<b>Motivation</b>	<b>11 Total Participants</b>
	1 - Do not agree 2 - Agree hardly  3 - Agree enough 4 - Agree exactly
1. Do you attend university because you want a title that allows you to work in the future?	<b>1(0%) - 2(9,1%) - 3(45,5%) - 4(45,5%)</b>
2. Do you attend university because you like to learn new things?	<b>1(0%) - 2(0%) - 3(36,4%) - 4(63,6%)</b>
3. Do you attend university because you want to finish the program so that you are more prepared for what you like to do?	<b>1(0%) - 2(0%) - 3(63,6%) - 4(36,4%)</b>
4. Do you attend university because you like attending university?	<b>1(9,1%) - 2(45,5%) - 3(27,3%) - 4(18,2%)</b>
5. Do you attend university because you like challenging yourself in studying?	<b>1(18,2%) - 2(27,3%) - 3(36,4%) - 4(18,2%)</b>
6. Do you attend university because you want to demonstrate yourself that you can get a degree?	<b>1(0%) - 2(45,5%) - 3(36,4%) - 4(18,2%)</b>
7. Do you attend university because you want to have a prestigious job in the future?	<b>1(0%) - 2(0%) - 3(36,4%) - 4(63,6%)</b>
8. Do you attend university because you like to discover unknown things?	<b>1(9,1%) - 2(9,1%) - 3(36,4%) - 4(45,5%)</b>
9. Do you attend university because you think that after graduating you will get a job in the field that you like?	<b>1(9,1%) - 2(9,1%) - 3(45,5%) - 4(36,4%)</b>
10. Do you attend university because you think that university is funny?	<b>1(18,2%) - 2(36,4%) - 3(45,5%) - 4(0%)</b>

11. Do you attend university because you find motivating surpassing your previous results of studying?	<b>1(18,2%) - 2(18,2%) - 3(45,5%) - 4(18,2%)</b>
12. Do you attend university because you feel important after getting positive results after studying?	<b>1(9,1%) - 2(18,2%) - 3(54,5%) - 4(18,2%)</b>
13. Do you attend university because you want to have a rich life?	<b>1(18,2%) - 2(9,1%) - 3(45,5%) - 4(27,3%)</b>
14. Do you attend university because you want to have a greater knowledge about your favorite subjects?	<b>1(0%) - 2(27,3%) - 3(45,5%) - 4(27,3%)</b>
15. Do you attend university because you think that ending the studies it will help you to know more about your future job?	<b>1(0%) - 2(36,4%) - 3(36,4%) - 4(27,3%)</b>
16. Do you attend university because you think it is funny to talk with the interesting teachers?	<b>1(54,55) - 2(18,2%) - 3(9,1%) - 4(18,2%)</b>
17. You attend university because you had reasons now you find it useless.	<b>1(18,2%) - 2(45,5%) - 3(18,2%) - 4(18,2%)</b>
18. Do you attend university because you have a high satisfaction after succeeding hard exams?	<b>1(9,1%) - 2(45,5%) - 3(27,3%) - 4(18,2%)</b>
19. Do you attend university because you want to demonstrate to yourself that you are smart?	<b>1(36,4%) - 2(18,2%) - 3(27,3%) - 4(18,2%)</b>
20. Do you attend university because you want to have a better salary in the future?	<b>1(0%) - 2(27,3%) - 3(45,5%) - 4(27,3%)</b>
21. You do not know why you are attending university and you do not care about it.	<b>1(81,8%) - 2(9,1%) - 3(9,1%) - 4(0%)</b>
22. Do you attend university because university allows you to continue studying the subjects that you like?	<b>1(0%) - 2(36,4%) - 3(54,5%) - 4(9,1%)</b>
23. Do you attend university because you think that completing the studies it will help me to have better skills for my professional growth?	<b>1(0%) - 2(9,1%) - 3(36,4%) - 4(54,5%)</b>
24. Do you attend university because you like reading things that you love?	<b>1(9,1%) - 2(54,5%) - 3(36,4%) - 4(0%)</b>
25. You do not know what you are doing in university.	<b>1(63,6%) - 2(27,3%) - 3(9,1%) - 4(0%)</b>
26. Do you attend university because you like when university allows you to give the best for studying?	<b>1(18,2%) - 2(36,4%) - 3(27,3%) - 4(18,2%)</b>

27. Do you attend university because you want to demonstrate yourself that can succeed in studying?	<b>1(0%) - 2(36,4%) - 3(36,4%) - 4(27,3%)</b>
28. You do not know why you are attending university and you think that is a waste of time.	<b>1(63,6%) - 2(27,3%) - 3(0%) - 4(9,1%)</b>

<b>Engagement</b>	<b>Total 11 participants</b>
	1 - No 2 - Not much 3 - Enough 4 - Highly
1. Are you able to study the entire program for an exam and pass?	<b>1(9,1%) - 2(18,2%) - 3(54,5%) - 4(18,2%)</b>
2. Are you able to commit for studying even if there are more interesting things to do?	<b>1(0%) - 2(27,3%) - 3(63,6%) - 4(9,1%)</b>
3. Are you able to focus on studying without being distracted (TV, messages, music, etc.)?	<b>1(9,1%) - 2(72,2%) - 3(9,1%) - 4(9,1%)</b>
4. Are you able to take exhaustive notes during the lectures?	<b>1(9,1%) - 2(18,2%) - 3(45,5%) - 4(27,3%)</b>
5. Are you able to research articles, books at home and in the library of the university?	<b>1(9,1%) - 2(54,5%) - 3(36,4%) - 4(0%)</b>
6. Are you able to plan your university activities (lectures, workshops, studying, exams)?	<b>1(0%) - 2(18,2%) - 3(54,5%) - 4(27,3%)</b>
7. Are you able to prepare for two exams at the same time?	<b>1(0%) - 2(45,5%) - 3(36,4%) - 4(18,2%)</b>
8. Are you able to cooperate with other students for group activities?	<b>1(9,1%) - 2(9,1%) - 3(54,5%) - 4(27,3%)</b>
9. Are you able to use the university resources (online services, library, etc.)?	<b>1(9,1%) - 2(27,3%) - 3(36,4%) - 4(27,3%)</b>

## **Improvement**

- Is there something that you would improve in the current university system?

## APPENDIX B: Second Survey

### Second survey

Design of the prototype	Total 11 participants
1. How much is easy the application to use?	1 - Hard to use (0%) 2 - Enough hard (0%)  3 - Pretty easy (72,7%) 4 - Really easy (27,3%)
2. How much are clear the functions of the application?	1 - Not clear (0%) 2 - Enough ambiguous (27,3%)  3 - Pretty clear (36,4%) 4 - Really clear (36,4%)
3. Would you use this type of application?	1-No (0%) 2 - Sometimes (54,5%)  3 - Often (18,2%) 4 - Yes (27,3%)
4. How much is motivating the application?	1 - Not much (0%) 2 - Not enough (0%)  3 - Enough motivating (81,8%) 4-Motivating (18,2%)
5. How much is useful the application?	1-Useless (0%) 2 - Enough useless (9,1%)  3 - Enough useful (54,5%) 4-Useful (36,4%)
6. Are you satisfied by using the application?	1-No (0%) 2 - Not enough (0%)

	3 - Enough satisfied (63,3%) 4-Satisfied (36,4%)
7. Do you think that the application is effective?	1-No (0%) 2 - Not enough (18,2%) 3 - Enough effective (45,5%) 4-Effective (36,4%)
8. Do you think that the application could improve your engagement as university student?	1-No (0%) 2 - Not enough (18,2%) 3-Enough (45,5%) 4 - Yes (36,4%)

- What kind of problems did you find during the usage of the prototype?
- What is your overall feedback of the application?

## APPENDIX C: Third survey & Interview

### Third survey

- What do you think about memory challenges in a relationship with your engagement and motivation?
- What do you think about trivial challenges in a relationship with your engagement and motivation?
- What do you think about the matching mechanic in a relationship with your engagement and motivation?
- What do you think about the completing mechanic in a relationship with your engagement and motivation?
- What do you think about the ranking system in a relationship with your engagement and motivation?
- What do you think about the levelling system in a relationship with your engagement and motivation?
- What do you think about the badges system in a relationship with your engagement and motivation?
- What do you think about the competition system in a relationship with your engagement and motivation?

### Interview

- **(10.02) What do you think about memory challenges in a relationship with your engagement and motivation?**

Obviously, I think that the memory challenges can become essential to study because the writing of the readings are really difficult to memorize and so studying. Instead, with this new method I could easily memorize everything in a matter of minutes or at least, in hours. Besides this, memory challenges can be used to summarize the text of the books.

- **(10.07) What do you think about trivial challenges in a relationship with your engagement and motivation?**

I believe that those are useful because even if the answer is right or wrong, you can always remember what the correct answer is.

- **(10.11) What do you think about the matching mechanic in a relationship with your engagement and motivation?**

For me the matching mechanic can work really well for the engagement because the iconographic part can be helpful to increment the memory. I think that something visual is highly effective.

- **(10.15) What do you think about the completing mechanic in a relationship with your engagement and motivation?**

I believe this system is motivating because help to focus the concepts and improve the motivation for studying.

- **(10.21) What do you think about the ranking system in a relationship with your engagement and motivation?**

In a game, a ranking system motivates the player to reach new steps to arrive at the top of the ranking. So, your desire of be the first push yourself to the limit and go even further by breaking all the records. This is really motivating and engaging.

- **(10.33) What do you think about the levelling system in a relationship with your engagement and motivation?**

This system is interesting because transform your performance in something like a game. This make you feel to be in a real game, so you have this necessity, and satisfaction to improve your statistics and profile to make it catchier.

- **(10.40) What do you think about the badges system in a relationship with your engagement and motivation?**

When I think about the badges, I soon have in my mind Duolingo. However, I do not care so much about having more badges than before. I would like to know how much I have improved since the beginning of my game. Basically, I would like to know how much my knowledge have grown.

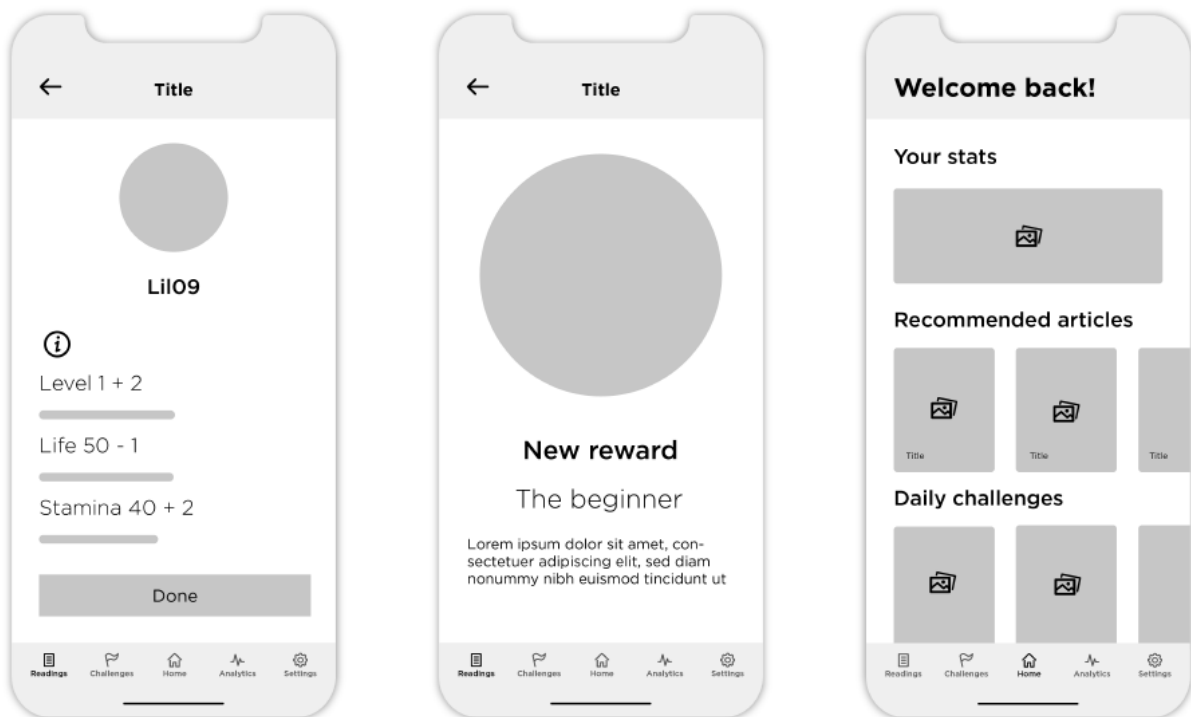
- **(10.45) What do you think about the competition system in a relationship with your engagement and motivation?**

I think, it is the correct choice because you want to know how much your friends know more than you do, this could improve my self-esteem.

## APPENDIX D: First prototype

First version of the prototype

<https://invis.io/XSREV6WMEVJ>



## APPENDIX E: Second prototype

Second version of the prototype

<https://marvelapp.com/bgj0d9h>

