Tallinn University

Institute of Informatics

Applying Gamification in an Online Course of Computer Hardware

Master Thesis

Author: Mehis Küla

Supervisors: MA Piret Lehiste

MSc Argo Ilves

Author: ……..……”……”……..2015

Supervisor: ……”……”……..2015

Supervisor: ……”……”……..2015

Head of the Institute:..……..……”……”……..2015

Tallinn, Spring 2015

Author's Declaration

I declare that, apart from work whose authors are clearly acknowledged, this document is the result of my own and original work.

This work has not and is not being submitted for any other comparable academic degree.

Thesis has been supervised by MA Piret Lehiste and MSc Argo Ilves.

Author

Mehis Küla

…… (Date)

…… (Signature)

Abstract

This master thesis aims to design a blueprint for the Computer Hardware 1 course in Tallinn University Haapsalu College with the help of gamification methods. The research strategy used is the design research.

In the first part of the thesis gamification is explained in depth as well as other methods based on games are brought out. Different elements used in gamification are explained. Insight into user types and different kinds of motivation for gamers are brought out. One gamification framework is explained. Given are two examples of successful gamification in the commercial world and two higher education cases where gamification was used.

In the second part of the thesis a blueprint of the Computer Hardware course is developed based on the framework previously described. The objectives for this course were identified, test personas described and different parts of the course created. Different metrics were designed, to measure the success of both students and the system itself. Badges were added for the course to bring in more fun. Three semi-structured interviews were conducted.

As a result of this thesis, a blueprint for the Computer Hardware course was designed and it can be used to create a gamified Computer Hardware course for cyclical studies.

Keywords: gamification, game design, game based methods, higher education, online course

Table of Contents

List of figures

List of tables

INTRODUCTION

The current thesis explores how to use gamification techniques to support an online course about computer hardware. In 2015 Haapsalu College of Tallinn University's Applied Computer Science curriculum is going over from full time studies to cyclical studies. This means that instead of having to go to college for 5 days in a week new students are going to be in the college only for 3 days every other week. Because the study load is still 180 ECTS, students will need to be much more independent with their learning and courses should be created so that theory could be studied by students in their own time and auditorial work would be only for putting those theories into practice. There are some courses where this is more difficult to do so, but there are also courses that mainly consist of theory. For those kinds of courses it is easier to make contact lessons scarce so to give more time for classes with more practical subjects that cannot be well learnt independently. One of those courses is Computer Hardware 1 that the author of this thesis has been teaching for three years. Gamification in this course is needed to help students stay motivated even when they do not have any contact sessions. Another argument for choosing gamification as the main topic for this thesis is the Horizon Report: 2014 Higher Education Edition that states "Although more nascent than in military or industry settings, the gamification of education is gaining support among educators who recognize that effectively designed games can stimulate large gains in productivity and creativity among learners." (Johnson, Adams, Becker, Estrada & Freeman, 2014).

The aim of the present thesis is to design a blueprint on what it would be possible to later on develop the gamified Computer Hardware course.

The thesis aims to find answers to the following research questions:

- What are the main aspects to keep in mind while developing a gamified system?
- What should the blueprint for Computer Hardware 1 course be like?

Gamification was chosen as the main topic of this course because according to Entertainment Software Association an average gamer today is at university age — about

30 years old and 68% of all gamers are over 18. That makes a university course an excellent material to gamify (Johnson, Adams, Estrada & Freeman, 2014).

The current thesis can be considered as a design research. Andrew Maier (2010) defines design research as following: “Design research describes any number of investigative techniques used to add context and insight to the design process.” He describes it as a process that is both iterative and cyclical. For this master thesis the author has chosen to observe what has been learned in the field of gamification and based on that knowledge to design a blueprint for the course and get feedback in the form of interviews from the sample representing the target groups. This blueprint with the data from the interviews would be the output of this thesis that can be used later on to design a gamified Computer Hardware course.

The first method chosen is literature review, as it is important to learn from theory behind gamification and frameworks that others have created. The second method used is interview with the target group for understanding how they perceive the solution.

Currently the course of Computer Hardware 1 consists of theory lessons, a practice session, presentation session and exam. Theory lessons each have a main topic on which the teacher gives a presentation where he explains the topic. The presentation sometimes contains terms and facts and sometimes some video material, but the teacher explains those terms and brings examples. Depending on the subject, the teacher might also show some components of current or older computer hardware. In addition to that students are encouraged to ask questions during the presentation and it is not rare for the presentation to turn into a discussion for some time. Usually the presentation ends with some questions or topics (4-5) that the teacher did not explain in depth. The class is then divided into groups by random methods, so no one knows beforehand which group they will be in. This helps students to get to know each other better and later on to improve their ability to do group work with their group mates. It is important because Computer Hardware is one of the first courses of computer science students in the college. In these groups they have to prepare a short presentation on the topic or question that their group was assigned to.

There are six of such theory lessons in the course. After all the theory lessons there is a practice session. Students are divided into groups of two or three and they are given a working computer and some tools. They need to dismantle the computer completely and identify all the components of that computer. After that they need to put the computers back together and make sure that they work. If there are some problems and the computer does not work anymore, they have to debug the problem and fix it. After that volunteers have a chance to dismantle a MacBook, Mac Pro and some PC laptop. Unfortunately there are not enough of those for everybody, so others will have to just watch and assist. In the next lesson there is a presentation session where students have to present a topic that they choose from a list of topics made by the teacher. There are about two times more topics than students who have enrolled in that class. Students can do the presentation either individually or in pairs. They have 7 minutes to present their topic and then there is a short round of questions where the teacher and other students can ask about the topic. The presentations are graded by the teacher and peers. A positive grade for the presentation is a prerequisite for registering to the exam. After all the previously mentioned classes there is an exam. This is done individually and students are allowed to use their own materials and the internet. The exam is graded in points and considering how many points from the total the student has got, the grade is calculated. That means, if a student has got more than 90% of points, he/she is graded with an A, between 80% and 91% will give the student a B and so forth.

The present thesis consists of two parts. The first part gives an overview of literature on gamification and game-based methods. The second part describes the development of the blueprint for gamified Computer Hardware 1 course and the conducted interviews.

1. Literature review

1.1. Different methods based on games

There are many different methods to use game concepts as educational, marketing or informative tools. Andrzej Marczewski, who is the author of "Gamification: A Simple Introduction & a Bit More", defines four methodologies related to games: gameful design, gamification, serious gaming and simulations (Marczewski, 2013). The latter two are closely related to each other. Marczewski's table below shows well how different methods compare to each other and to games in general (Table 1).

Table 1. Game-related methods (Marczewski, 2013)

	Game Thinking	Game Elements	Game Play	Just for Fun
Gameful Design	**X**			
Gamification	**X**	**X**		
Serious Game / Simulation	**X**	**X**	**X**	
Game	**X**	**X**	**X**	**X**

1.1.1. Gameful Design

Gameful design brings in game thinking. Penenberg (2013) illustrates this idea with an example from a well-known book called "Adventures of Tom Sawyer" by Mark Twain. There is a scene in this book where Tom is tasked with whitewashing a fence as a punishment for playing hooky. Tom does not want to do this and so he tricks some other children to do it for him. In addition to doing his work for him the other children actually pay Tom to do it. This example shows how Tom used gameful design to show how fun

painting the fence is. If Tom had paid those children to do it, they might also have done it, but because of an external stimulus — money (or other payment). In the book children had internal stimuli and this means that they were likely to do it with greater care, considering they had to pay to do it in the first place.

1.1.2. Serious Games

On Marczewski's table serious games and simulations are on the same level. Those two terms are often used as synonyms, but there are some differences. Marczewski (2013) himself also recognizes these differences. Penenberg (2013) defines serious games as follows: "A game designed for purpose beyond simple entertainment". That means, although entertainment is not the main purpose of the serious game, it still is a part of it. These games usually try to educate the user about some issue, for example: health, history or political propaganda. For example Re-Mission 2: Fight Cancer is a game by the nonprofit organization called HopeLab and it tries to teach adolescents and young adults about cancer and how different treatments deal with cancer. This is shown through a 2D platformer game, where the player takes the role of different treatments in fighting cancer. Level names also reflect what treatment is being introduced — for example Stem Cell Defender. HopeLab believes that seeing how these treatments can be successful, patients are more likely to stick to their treatments and have more positive expectations for the treatment. Positive attitude is important because fighting a difficult sickness such as cancer, depression can heavily impede the treatment. HopeLab conducted two studies to see how Re-Mission 2 impacts patients and the results of both studies have been published (HopeLab, s.a.).

Another kind of serious games are political propaganda games. A good example of those is called Darfur is Dying developed by mtvU (Figure 1). The game tries to inform about the situation in Darfur by making the player forage for water while being chased by local militia, rebuild the village and rebuild the village after an attack by the militia. The main part of the game resembles a typical management game, like Farmville. This game does not only inform about the situation in Darfur, but it actually makes the player write to

President Obama (Figure 2). From time to time there is a message that states that an attack is imminent and to do something about it the player could write to Obama in real life, collect money or find another way to get involved (mtvU, s.a.).

Figure 1. Screenshot from the game "Darfur is Dying"

Figure 2. Screenshot of "Take action" screen from the game "Darfur is Dying"

1.1.3. Simulations

Simulations on the other hand do not have to have any entertainment at all in them. One definition for simulations is that "simulation is a realistic, controlled-risk environment where learners can practice behaviors and experience the impacts of decisions" (Kapp et al. 2014). To further explain this definition Kapp (2014) breaks it down into four elements:

- Realistic — simulations try to be fairly realistic, but this is not always needed to simulate the situation. For example, flight simulators should be fairly realistic to help pilots to learn, but simulations for medicine do not have to be so realistic. When a real person plays the patient, he does not have to really have symptoms, but the doctor could ask for example what his throat looks like and where it hurts and give a diagnosis based on that information, that is given verbally instead of inspecting the patient himself.
- Controlled risk — simulations provide controlled risks, because the environment is simulated. For example, soldiers in the United States Army train to call in missile strikes in a controlled environment, so that there would be no risk of "friendly fire" or civilian casualties during their exercises (Figure 3).

Figure 3. U.S. Army soldier using a simulator (AMSO, s.a.)

- Practice behaviors — a person using the simulation can experience different kinds of situations that might otherwise be difficult to learn. For example, a pilot can use a simulation to train to handle different kinds of technical malfunctioning of the airplane.

These situations rarely happen in reality, but pilots should still be prepared for those situations. Using a real airplane is not possible in these kind of situations, as often the best course of action is an emergency landing that possibly damages the airplane.

- Experience the impacts of decisions — a person using the simulator can experience what the possible outcomes of his decisions are. For example, militaries use different simulations for platoon leaders to understand how to use tactics in their advantage. The user can understand what are the results of simple tactics (just charging towards the enemy) and what are the results in more complex tactics (flanking, using fire support, etc).

Simulations can also be more like games. For example a game called X-Plane 10 is sold mainly as a flight simulator for entertainment purposes, but it has also been certified by Federal Aviation Administration (FAA), so that pilots can actually use it to log simulation hours required by the law. X-Plane 10 is an interesting case because it is a commercially successful video game and at the same time it is a professional simulator (Laminar Research, s.a.).

X-Plane 10 is not the only example of professional simulation being commercially successful as a video game. Bohemia Interactive developed a first person shooter called Operation Flashpoint. In 2001 they developed a simulation called Virtual Battlespace Systems 1 (VBS1) on the game engine of Operation Flashpoint. VBS1 is only sold to governments, armies and other governmental structures that need military tactics. VBS2 used the video game Arma 2 as its base (Kable, s.a.). The current version of VBS is 3 (Bohemia Interactive Simulations, s.a.).

The last thing in Marczewski's table is the game itself. Most people know games and have played them, but to define games is not an easy task, considering how many different types of games there are.

Sid Meier, a well-known game developer who has been developing games for 33 years, defines games as "series of interesting choices" (Marczewski, 2012). Philosopher Bernard

Suits states that “playing a game is the voluntary attempt to overcome unnecessary obstacles” (McGonigal, 2011). To better illustrate what Bernard Suits meant, one can think about the game of golf. The golfer has a goal to get a small ball into a small hole. The easiest way to achieve this is to take the ball and walk up to the hole and drop the ball in it. There are several obstacles that would not be necessary for a golfer’s objective if this was not a game — the golfer could only move the ball by hitting it with a club.

So to conclude those definitions, a game consists of interesting choices that should be done voluntarily to overcome some obstacle that is not actually important. People play games to have fun.

1.2. Gamification

The term gamification was first used by a British game developer and IT expert Nick Pelling in 2002 / 2003, when he started his consulting company that tried to gamify hardware solutions. It was not a common term until the year 2010 (Pappas, s.a.; Werbach & Hunter, 2012). This does not mean that gamification principles were not used before 2002, but before that time there was not a common name for gamification principles.

There is no one definition for gamification. Karl Kapp et al (2014) write that “gamification is using game-based mechanics, aesthetics, and game-thinking to engage people, motivate action, promote learning, and solve problems.” Werbach & Hunter (2012) have a bit shorter and simpler definition: “The use of game elements and game-design techniques in non-game contexts.” When combining the definitions about games and gamification, we can say that gamification aims to bring fun into non-game activities.

So combining definitions about games and gamification, we can say, that gamification aims to bring fun into non-game activities.

1.3. Gamification techniques

Gamification has three main elements (Werbach & Hunter, 2012):

- points,
- badges,
- leaderboards.

Marczewski (2012) adds two more;

- rules,
- levels.

1.3.1. Points

Points are a simple numeric value that are increased (or decreased) if a player does something. Points themselves can be motivation for people who like to collect things and to show off to peers with their accomplishments. In the gamification context points can have six different uses:

1. Points keep score — in typical games and gamification systems points tell how much some user has invested in this system. Bigger differences in points show which players have played more and which ones less. In addition to that points can determine player levels. For example 500 points is level 1, 1500 points is level 2 and so forth.
2. Points can determine the win state of the process — in case there is a possibility to win the game (for example win a prize), when a player has collected a certain amount of points, he/she can be declared a winner.
3. Points connect player progression in the game with extrinsic rewards — in case the game has some external prizes (usually in case of commercial gamification systems), players' points can be converted into real life rewards. For example, one of the biggest banks in Estonia, Swedbank, has a customer loyalty program, where customers collect points and for those points they can have either a free bank service for some time, gifts (for example wine classes, set of knives, etc) or gift cards (for car wash, massages, etc).

4. Points give feedback — clear and frequent feedback is an important element of good game design. Points provide a good way to give instant feedback. This feedback tells the user that he/she is doing well and progressing in the game.
5. Points can be an external display of progress — in the system where fellow players can see each others' scores, points could be a significant marker of status.
6. Points give data for game designers — points that players earn can be tracked to allow developers to analyze important aspects of the game. For example, how fast users are progressing, are there certain bottlenecks for the users, etc (Werbach & Hunter, 2012).

Points have their issues — they do not reflect what the user has done to get those points. That is why points should be used together with badges (Werbach & Hunter, 2012).

1.3.2. Badges

A badge is a visual representation of some achievement within the gamified system. Within gamified systems, terms 'achievements' and 'badges' are often used as synonyms. Some badges show a certain level of points. For example Nike+ gives badges based on how many kilometers in total have you run. Other badges can be given to show some completed activities. For example, Foursquare, a service that helps to find interesting places around you, gives badges on different occasions, such as the first check-in at military base, three check-ins within a week in the same place, etc. Researchers Judd Antin and Elizabeth Churchill bring out five motivational characteristics for a well-designed badge system (Werbach & Hunter, 2012):

1. Badges give players goals to strive towards, which has been proved to give positive motivation.
2. Badges give users an idea about what is possible in the system, thus getting users more engaged with it.
3. Badges show what users care about because users often try to acquire certain badges to show what they are capable of.
4. Badges are like virtual status symbols and a log of users' experiences through the gamified system.

5. Badges work as tribal markers. Users with the same badge feel a sense of identity as a group and good gamification design could use badges with a system of group-based identification.

A good thing about badges is that they can be awarded for anything the developer can imagine. This allows the system to be more diverse than a point system by itself could be. Different players could have completely different sets of badges although they are playing the same game. This allows players with different interests to be interested in the same game (Werbach & Hunter, 2012).

1.3.3. Leaderboards

Leaderboards show a user where they are within the gamified system compared to other users. Leaderboards can be shown based on points, the number of badges or some other criteria and there can be more than one criterion used on the leaderboard. Leaderboards can be individual (seen by one player and depending on the information of the user) or universal. An example of an individual leaderboard is used in Foursquare, where users are compared only against their friends' list. This means that on person A's leaderboard, he/she might be second, surpassed only by person B and on person B's leaderboard, B might be the 4th. This helps to motivate players as they are not playing against total strangers, who might have thousands of points more than the player, but they are playing against their friends (Marczewski, 2012; Werbach & Hunter, 2012).

Leaderboards themselves can be grouped as absolute and relative leaderboards. Absolute leaderboards display top X players on the leaderboard. This could be both good and bad. For people, who are at the top of this list it gives a feeling of achievement and status. This could also be beneficial for others who want to see who is the best at some criterion. The downside is that for the people who are at the bottom of the leaderboard, or even below it, this could be very demoralizing. This is especially true if a player at the bottom has just started playing the game and a player at the top has been playing for years. For some this

might seem as an impossible goal and they will just quit. For others this might be a source of motivation to try to also get from zero to top (Marczewski, 2012).

Relative leaderboards try to avoid these problems by only letting users to compare themselves to similar players. If a player is ranked 400th among 450 players, he/she would be shown only the 10 players above and below him/her. This helps to prevent the issue where the player feels inadequate and just quits. This method also has some downsides. Firstly, this is technically difficult to achieve. Secondly, this feedback might be seen meaningless by the players, because comparing equal players is not a challenge. A solution might be to show players both leaderboards, so they can choose for themselves, which one they like more (Marczewski, 2012).

1.3.4. Rules

Rules are a vital part of games. Even when the game has an open world, like in Minecraft for example, it still has some rules. In Minecraft you have rules of physics (although not exactly the same as in real life), there are rules on how the character can move and what will happen if he loses all his / her health.

People invent rules by nature, to gauge each others' skills and pick a winner. Watching children play often looks like a chaotic thing, but at a closer look it turns out that they are constantly inventing new rules and informing each other about these.

In gamification it is also important to have a set of rules. For example, some actions give that many points, more complex actions give more points and if a player has a certain amount of points, he/she will get a badge that is required to get to the top of the leaderboard and how many times can one answer a question. Changing rules can create very negative feelings for players, especially if this has a negative effect on their status in the game. If you need to change the rules, let people know it well in advance. Explain why it has to be done and how it can help the game (Marczewski, 2012).

1.3.5. Levels

Many games have implemented levels. A player starts at Level 1 and has to progress through increasingly challenging stages to progress. Reaching a new level is known as "leveling up". Leveling up signifies the process and gives an opportunity to give positive feedback. Former Apple CEO John Scully has said that this turns the journey itself into reward. Without levels, players might lose interest in the game because they have no real sense of progress. Even sandbox games that have no predefined objectives need dynamics and growth in either the world or players' mastery of the objectives. Without levels the game quickly becomes static and boring. "Games are process, not outcome" (Werbach & Hunter, 2012).

1.4. Game elements in gamification

Following are the game elements used in gamification systems.

1.4.1. Dynamics

Most important game dynamics are:

1. constraints (limitations or forced trade-offs);
2. emotions (happiness, competitiveness, etc);
3. narrative (consistent storyline behind the game);
4. progression (player's development during the game);
5. relationships (social interaction generating feelings of belonging, status, etc) (Werbach & Hunter, 2012).

Dynamics are big-picture aspects of a gamified system that should be considered and managed, but can't be directly inserted into the game (Werbach & Hunter, 2012).

1.4.2. Mechanics

Mechanics are basic processes that generate player engagement. Mechanics are:

1. challenges (some tasks that require effort to solve (for example puzzles);
2. chance (elements of randomness);
3. competition (when there is a chance for one team to win and another to lose);
4. cooperation (players need to cooperate to achieve a common goal);
5. feedback (information for a player on how well he / she is doing);
6. resource acquisition (obtaining some useful or collectible items);
7. rewards (benefits from some action of achievement);
8. transactions (trading between players);
9. turns (sequential participation by alternative players);
10. win states (objectives that make one player of the group the winner; draw or lose states are related to that) (Werbach & Hunter, 2012).

Each of those mechanics is a way to achieve one or more of the dynamics mentioned above. For example, a random event, such as an award, that pops out without warning, can stimulate players' sense of fun. This might also be a way to get new players hooked (on-boarding) and to keep older players involved(Werbach & Hunter, 2012).

1.4.3. Components

Components are more specific than dynamics or mechanics. Components are:

1. achievements (defined objectives);
2. avatars (a visual representation of player's character);
3. badges (a visual representation of achievements);
4. boss fights (harder challenges than normal at the culmination of a level);
5. collections (sets of items or badges to accumulate);
6. combat (a defined battle that is usually short);
7. content unlocking (certain aspects of a game that are available only when a player reaches certain objectives);

8. gifting (an opportunity for a player to share his / her resources with other players);
9. leaderboards (a visual representation of a player's progression and achievements);
10. levels (defined and increasingly more difficult steps in player progress);
11. points (a numerical representation of game progress);
12. quests (predefined challenges with objectives and rewards);
13. social graphs (a representation of a player's social network within the game);
14. teams (a defined group of players working together for a common goal);
15. virtual goods (game assets with perceived or real monetary value)(Werbach & Hunter, 2012).

1.5. Motivation

To create a better game, developers must have an understanding on how players would be motivated to play this game. There are three states of person's motivation — amotivated, intrinsic and extrinsic. According to psychologists amotivated means not having a desire to do something. Intrinsic motivation is when the person wants to do something because he/she feels like it. Extrinsic motivation is something that motivates the person to do something because he/she feels the need to do it either because of the social pressure or for some other reason (Werbach & Hunter, 2012).

Behaviorist thinking suggests that extrinsic motivation is the best way to make a person do something. This means that systematically applied rewards or punishments would condition and reinforce responses for anticipation for further rewards or punishments. This could be observed in the motivation methods of some businesses: rewards are an increased salary and bonuses and punishments are demotion of firing (Werbach & Hunter, 2012).

There are many cognitivist theories that oppose the behaviorist approach. One of the most influential among them is the Self-Determination Theory by Edward Deci, Richard Ryan and their collaborators. They suggest that humans are inherently proactive and with a strong internal desire for growth, but their external environment must support this because otherwise internal motivators could not work. Self-Determination Theory focuses on what

humans need to allow their innate growth and well-being tendencies to flourish. The theory suggests that these needs fall into three categories: competence, relatedness and autonomy. Games illustrate the Self-Determination Theory very well. For example, Sudoku activates intrinsic needs for autonomy (which puzzle to solve and how to do it is up to the player), competence (if the player is able to solve the puzzle) and relatedness (if the player completes the game, he/she can feel related to his/her friends who have also completed the game) (Werbach & Hunter, 2012).

1.5.1. Mastery

Video games usually have a similar pattern on player progression — at first the game helps the player and shows different features of the game. This is called on-boarding. When the player gets better, he/she is given new and increasingly more difficult challenges to overcome. In games we can see little moments of mastery — each completed boss fight (Marczewski, 2012).

1.5.2. Autonomy

People do not like the feeling of being controlled. They want to feel that they can choose what they want to do. Google has seen this as a value and created its 80/20 rule — their employees need to spend at least 80% of their work hours to do tasks that are given to them and they are encouraged to spend 20% of their work hours to work on their own projects. This is how some of the biggest projects of Google were created — Gmail and Google News to name a few (Marczewski, 2012).

1.5.3. Relatedness

People desire to be connected to others. This is what helps to keep a gamified system together. When badges and points have become boring for the player, the community that

he / she feels a part of is the reason why he / she stays. This is why social networks are so popular — they give new possibilities to connect to other people (Marczewski, 2012).

1.5.4. Purpose

Although not mentioned in the Self-Determination Theory, Marczewski adds purpose to the previous three needs. Players have a need for meaning for their actions. If a player does something, he / she wants to feel like there was a reason why he / she did this and that this was a part of something bigger. An example for this could be Wikipedia. There are millions of articles given freely for no other reason than to add a better understanding of the topic. Users' purpose and meaning is to add knowledge to the base of everyone else (Marczewski, 2012).

1.6. Criticism of gamification

There are many who argue that gamification is not as good as advertised. Ian Bogost is a game designer and theorist at Georgia Tech and a leading critic of gamification (Werbach & Hunter, 2012). Bogost sees gamification as a way companies make their workers do mundane things tricking them to think that this is fun or a way for marketers to trick customers to buy things that they do not even need or want. Bogost dislikes companies like Zynga who create social games. He describes them as "Wall Street hedge-fund guys of games". Zynga is most famous for the game called Farmville where players would have to return often to water plants and harvest crops. Bogost criticizes that these games do not have much depth, but what he finds even more enraging is the fact that Zynga does this only for money. He said on his blog, "friends aren't really friends; they are mere resources" and "not just resources for the player, but also for the game developer". The more players these games have, the more viral they go. If a player gets stuck, he / she can buy, with real money, his way to the next level. Bogost also states that "social games so covet our time that they abuse us while we are away from them, through obligation, worry and dread over missed opportunities". He wanted to prove how pointless these kind of games are by creating a mock game called Cow Clicker. It was a Facebook game, where

users needed to just click cows to earn points. When users connected with eight of their friends, they got more points. Users collected points called “Mooney” and for those they could buy different kinds of cows. There also was a micropayment system where players could get 125 mooneys for $1 USD. This allowed players to buy different cows. What Bogost did not expect was that this game became very popular. At one time Bogost ran a charity within his game and he raised more than $1125. What began as an ironic joke became a very real game. He also sold Cow Clicker merchandise — T-shirts, hoodies, mugs, etc. When he was ready to end his experiment, he made a countdown clock that showed how much time was left until he closed down the game. He added a Zynga-like twist: players could postpone the end of the game by paying $1 for one additional hour or $400 for an extra month. Eventually the timer got to zero and he removed cows from the game in a “rapture”, but he left the game running with now empty pastures, so one could still click the place where there used to be cows. This was actually the most successful game that Bogost has ever created. He was not sure how to interpret this data, but it shows that even the biggest critics to gamification cannot deny that it is powerful if done right (Penenberg, 2013).

1.7. Implementing gamification

There are several gamification frameworks out there. Werbach (2012) suggests a design framework that is customized for developing gamified systems. He divides this framework into six steps:

1. define business objectives;
2. delineate target behaviors;
3. describe your players;
4. devise activity cycles;
5. don’t forget the fun!;
6. deploy the appropriate tools.

1.7.1. Define business objectives

For effective gamification it is important to know specific goals for a gamified system to be, such as building brand loyalty or improving employee productivity. Without this step the project might get off the ground, but it will fail eventually. Each goal should be as precise as possible. There should be only goals, not means. For example, getting users to accumulate points is not a goal. After having written down all the goals, they should be ranked in terms of importance. If needed, lesser goals might be traded off for more significant ones. When this is done, another column should be added and into that, next to each objective an explanation on how you or your organization could benefit should be written. Throughout the process, this list should be revisited from time to time.

1.7.2. Delineate target behaviors

The next thing should be to write out what players should do and how to measure it. Behaviors and metrics should be considered together and as concretely and precisely as possible. For example:

- post comment on discussion board;
- exercise for at least 30 minutes;
- share information about your service on Twitter.

These behaviors should promote ultimate objectives defined in the first step, though relationship with these objectives may be indirect. As many behaviors as possible should be written down although the system should not become too complex or confusing. Still it is good to give users a range of activities and options to pursue based on their own personal preferences. After listing all desired behaviors, metrics to measure success should be developed. In gamification systems everything that the player does translates into numbers and those numbers generate feedback. Numbers might not be transparent to the player. Players might just see a popup saying that they have reached a new level or achievement, but in designing this system, developers need to know precisely what those mean (Werbach & Hunter, 2012).

Points are an easy way to measure and quantify any kind of progress. Whether or not a gamified system will present users with points, they probably are needed internally to define relative values of behaviors in the design process. The value of points should correspond to an estimated relative value of activities to developers' organization. For example, reading a discussion post gives 1 point, commenting on it gives 5 points and posting gives 10. Developers need to be ready to revise them when the system has been tested (Werbach & Hunter, 2012).

Another success metric is the "win state". Everyone likes to win, so it is logical to implement some sort of "win" for players. However, from the designers' perspective, winning is problematic. When some players have not won, it may discourage them and those that do win might not see any point to resume playing because usually 'win' means that the game is over. This can be a problem if the developer's goal is to make players return to the game. It is possible to find a middle ground by creating localized or temporary win states. For example, there is a new contest every week that players can win or "winning" just gives an achievement. Foursquare added levels to its badges when it realized that a single badge state created all-or-nothing dynamic rather than encouraging continued progression (Werbach & Hunter, 2012).

It is important to use analytics. Every online event can be tracked and measured. E-commerce and social game companies are using analytics to get data from large numbers of user actions to measure success of their service. Common analytics include ratio of daily to monthly active users (this shows how often users return), "vitality" (how much users share service to their friends) and total volume of points awarded. What to measure depends on the context (Werbach & Hunter, 2012).

1.7.3. Describe your players

It is important to understand who are going to be players and what are their relationships to developers: employers are not in the same situation as customers are. Another thing is to define as many possible motivations as you can. It is also important to think what

demotivates players. Because not all users are the same, developers might want to segment their players so that the system is appropriate for more than one subgroup. Game designers have different models of player types that they use as a starting point for segmentation. One such model was created by Richard Bartle in the late 1980s. Bartle distinguishes four player types: achievers, explorers, socializers and killers. Achievers love leveling up and earning badges, explorers want to find new content, socializers want to engage with their friends and killers want to impose their will on others, usually by defeating them. Everybody has elements of each of those archetypes, but proportions vary and over time players' primary motivation can shift. Good games should have something for each player. Even killers can be helpful to the system if they function as elite "power users" or if they galvanize everyone else in a positive way. Player modeling is a way to segment players to further guide the design process. Players should be divided into categories that seem appropriate and each group should be given an avatar of typical player with a name and story. An avatar is a virtual representation of someone, like a test persona. It is easier to think how "Michael" responds to a certain situation instead of "Player A". The last thing to consider is the player lifecycle. Everyone starts as a novice who needs some hand holding to learn different aspects of the game. Novices may need reinforcement so they can succeed. When a novice becomes a regular, he / she may need novelty to stick with the system. What was first new and challenging might become effortless for them. Finally players become experts. Experts need challenges that are sufficient to keep them engaged and they might also want explicit reinforcement of their status. All players will not be on the same stage at the same time, but the longer the system runs, the more experts there will be. There must be opportunities for players at all stages.

1.7.4. Devise activity cycles

Games always have a beginning and sometimes have an end, but along the way they operate through series of loops and branching trees. There may be a leveling system that is linear, but the overall gamification system behind the scenes is not so simple. The most useful way to model the action in a gamified system is through activity cycles. This concept is popular in social networking services and in social media. User action calls for

another action and so forth. For example, if in Facebook a user tags friends in a photo that he /she uploaded, the person tagged gets a notification and now if that friend comments on that photo, the photo poster gets a notification and so forth. There are two kinds of cycles: engagement loops and progression stairs. Engagement loops describe at micro level what players do, why they do it and how the system responds. Progression stairs give macro perspective on the player's journey (Werbach & Hunter, 2012).

In engagement loops player actions are a result of motivation and in turn produce feedback from the system (like badges of points) (Figure 4). This in turn should motivate users to take further actions and so forth. A key element is feedback — this is what makes games so effective as motivators. Almost all game components can be seen as forms of feedback — points, leaderboards and achievements display feedback about the performance. Engagement loops are the basic process of the gamified system, but it does not capture player progression. If experience is exactly the same on Day 100 as it was on Day 1, most players get bored. That is why progression stairs help to keep the game interesting. They reflect the fact that game experience changes as the player moves through it. In video games such as World of Warcraft, going from Level 1 to Level 2 takes far less time than going from Level 41 to Level 42. The same could be implemented in gamified systems. Developers should map out a player journey in the gamified system as a collection of short-term missions and long-term goals, which play out as rolling series of progressions.

Figure 4. Engagement loop (Werbach & Hunter, 2012)

Though escalating difficulty is the general theme of progression, this process should not be linear. That is why it is called progression stairs. The very first stair, called onboarding, needs to be simple and guided, so it draws players into the game. When the player is through that, difficulty should increase at variable rates, along what are called interest curves. The model used in most games involves steadily increasing difficulty, followed by a period of relative ease, followed by a major challenge at the end of each segment (Figure 5). Those ease periods allow players to catch their breath and let them experience the satisfaction of mastery — the feeling that they have become an expert at some part of the game. There are often series of small cycles like this. The final challenge of a level, known in games as a boss fight, provides a different experience of mastery. The most difficult challenges that players can barely manage produce the explosion of positive emotions. In gamified systems there probably is no "boss" villain at the end of the level, but an equivalent could be a major challenge that taxes the player sufficiently to feel a sense of pride when they reach the next level. It is also important to incorporate some measure of randomness. Studies show that human brains prefer a small, random chance of a big reward to a certain modest reward (Werbach & Hunter, 2012).

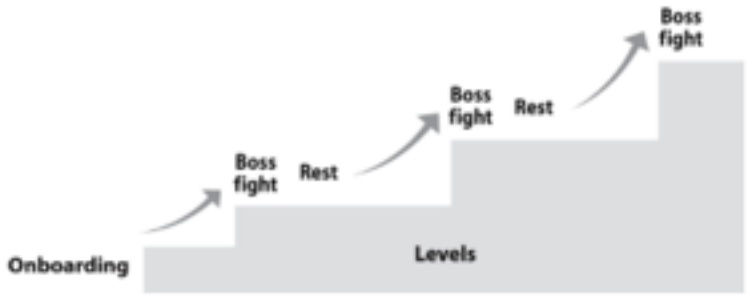

Figure 5. Progression stairs (Werbach & Hunter, 2012)

1.7.5. Don't forget the fun!

Before starting to develop gamified systems, developers should ask a simple question: is it fun? Putting together complexities of players, goals, rules and motivation, it is easy to lose sight of fun. If users perceive the gamified system as fun, they are more likely to return. Developers should ask themselves: Would players participate in it voluntarily? If there weren't any extrinsic rewards offered, would players still play it?

There are many dimensions of fun. Game designer and consultant Nicole Lazzaro, who is an expert of emotional aspects of games, has found four distinct kinds of fun in studying a group of game players. “Hard fun” is a challenge or puzzle, that is fun because of the pleasure of solving it. “Easy fun” is casual enjoyment, a way to relax without overly draining oneself. “Altered states” is an experimental fun — enjoyment of trying out new personas and new experiences. The last type is “the people factor” that is essential in social fun — fun that depends on interaction with other people, even if it is competitive. What kind of fun should the gamified system provide depends on the context. Best games offer broad spectrum of fun. Fun is not an easy thing to predict. That is why game companies sometimes spend millions of dollars in developing a game that is not a successful one. The best way to say if a system is fun is to build it, test it and constantly improve on it (Werbach & Hunter, 2012).

1.7.6. Deploy the appropriate tools

The last stage is the implementation stage. Engagement loops created in previous steps should give the skeleton of the system. It is important to test and iterate and learn as the project goes on. Gamification does not require technology any more than games do. However, it lends itself perfectly to online systems. There are two basic options for technical implementation of gamified systems — build a custom implementation or use one of the software-as-a-service offerings. (Werbach & Hunter, 2012).

1.8. Examples of gamification

There are many different success stories in using gamification. Following are two well known examples, of implementing gamification successfully in the commercial world.

1.8.1. Waze

Waze is a crowd-sourced GPS and traffic app developed by Waze Mobile Limited. It has all the main gamification features. Users get points for just driving around using Waze, for social activities, like inviting friends or doing something for community, like making corrections to the map or notifying others about hazards on the road. Points determine what level players are on. Levels depend on how high on the leaderboard the player is in his/her country or area. The first level is for new users, the second level can be achieved when the player has driven more than 100 miles, the third level can be achieved when the player is in top 10% of the players, the fourth level for being in top 4% and the fifth level for being in top 1%. This means that if the player reaches a certain level, but does not get any points from that moment on, he/she could soon lose this level as the average point score of the region increases. This makes players use Waze more often, in order not to lose their levels. In addition, Waze also has badges for forum users and map editors (Waze, s.a.).

Waze was started in 2007 and has grown very quickly. In June 2013 it had nearly 50 million users and only 8 months before that it had 30 million users. Waze has raised $67 million USD from outside fundings from many of prominent Silicon Valley firms. In 2013 Waze was acquired by Google for around $1.1 to $1.3 billion dollars (Empson, 2013).

1.8.2. Nike+

Nike+ is a service released by Nike, Inc in 2006. It was created in cooperation with Apple and originally it was only for iPods. It consisted of a sensor in a running shoe, a wireless receiver attached to an iPod and an app pre-installed by Apple onto the iPod. The sensor is a small compact device, which consists of an accelerometer, wireless transmitter operating at bluetooth frequency and a battery. It needed to be calibrated for users, by running a defined distance with it and after that it could calculate users' run distances automatically. Because at this time Apple had not develop its smartphone — iPhone, it was designed for iPods. Later on this sensor worked also with iPhones. Before going to run, the sensor had to be put into the sole of the shoe. During the run the iPod / iPhone could give spoken and written feedback on the current run: the distance traveled, pace, calories burned and time.

After completing the workout, the user was asked to mark on what terrain he/she ran, how he/she felt and how was the weather. This data was stored in the device, but syncing the device with the computer uploaded it to Nike+ cloud. iPhones with cellular data of wifi would do it automatically (Mcclusky, 2009).

Because Nike's customers do not only run, but do also other kinds of sports, Nike created a new kind of product to capture all of their users daily activities, called Nike+ FuelBand. This also has a built-in accelerometer, but it does not count steps, like the previous sensor, but rather movements made by the whole body. This helps to track users' daily activity during almost all kinds of sports (except for swimming, because FuelBand is not waterproof) and also activities made while not actively sporting, like climbing the stairs, riding a bicycle to work or just taking a walk (Ruffino, 2014). To measure the activities equally between all users, Nike created NikeFuel — a point system that takes into account users' age, gender and fitness level. This means that an older woman has to do lighter workout than a younger fit male to receive the same amount of NikeFuel points (Nike, s.a.).

In Nike+ users can visually track their progress, compare themselves with friends and others in their age group, receive real time encouragements from their Facebook, Path or Twitter friends, challenge each other to go fastest or farthest and set themselves challenges like working out at least three times a week or running 100 km total in one month. It helps users to improve on their workouts and keeps track of users' shoes, so when they need to be replaced, users would buy a new pair of Nike shoes (Werbach & Hunter, 2012).

Nike+ has enjoyed huge success — in 2007 they had 50000 users, in 2009 1.3 million users, in 2011 5 million users and in 2013 11 million users. This also has reflected on their market share of running shoes. In 2006 Nike sold 47% of all running shoes sold in United States. In 2007 this number was 57% and in 2009 it was 61%. Until today Nike has a controlling portion of running shoe market (Ferriman, 2014).

1.9. Research done in higher education.

Horizon Report (2014 Higher Education Edition) gives an example of Kaplan University in the USA that gamified their entire IT degree program after running a successful pilot in their Fundamentals of Programming course. Kaplan uses gamification software that can be embedded into web applications, such as LMS. Kaplan's results for their pilot were positive — 9% improvement in students' grades and 16% decrease in the number of students who failed the course (Johnson,Adams Becker, Estrada, Freeman, 2014).

In 2014 Martin Sillaots published an article where he described how he gamified a Research Methods course in Estonia. He designed this course as a game and later he got feedback from students on their feelings towards the course and different elements in it. What he found out was that students did not care about avatars and they disliked the random generator that he had used to randomly choose students to answer. On the positive side, his course achieved some level of immersion and provided a possibility for active involvement. Unfortunately he had to admit that some students do not want to play, even if it is for educational reasons.

2. Developing strategy for the course

2.1. Using framework

For developing a strategy for creating the Computer Hardware course, Werbach's framework (2012) will be used. Following are the six steps in his framework.

2.1.1. Define (business) objectives

Table 2. Objectives for Computer Hardware course

Objective	Explanation
Teach students about computer hardware	The main idea of the course is to teach students about computer hardware.
Grade students based on what they learned	Giving fair grades to students will motivate them and their peers and keeps the reputation of the college high.
Grade students based on their engagement	This helps to motivate students to participate in the lessons and through that learn more.
Online course with as few contact sessions as possible	Because in cyclical studies students do not go to school often, it is important to use that time as well as possible.

2.1.2. Delineate target behaviors

Following is a list of hoped target behaviors:

- acquiring new information from lecturer's materials;
- finding new information about computer hardware individually;
- finding new information about computer hardware in groups;
- presenting found information to the group;
- solving individual exercises about different aspects of computer hardware;
- getting enough knowledge in computer hardware to pass the exam.

Metrics of success for behaviors:

The main metrics to measure students' performance will be points. Students will get instant feedback where possible (if a lecturer needs to read the papers presented by students and give points manually, points may come with fed day delay). Points will determine the level that the student is on. The level determines the final grade — the higher the level, the higher the grade. Because topics in the course are changing, the course should not get progressively more difficult because new topics should not let it get boring by repeating over and over again. But still there will be "boss fights". Different topics of the course are divided into stages. Each stage contains certain activities and a progress bar shows how many stages are completed and how many are still ahead. In terms of point value, levels should be spaced equally. More points should be awarded for more difficult tasks. In addition to points and levels, badges are going to be implemented. Badges will not have an impact on the points of the level, but are rather for reinforcing the student and to give students something to compare each other with other than points. Badges should be given for certain activities. Some of those activities can be known for students, but there could also be badges that are awarded unexpectedly for some activities (for example one time badge for being the first one to deliver homework). In the background of the gamified solution, all pages have analytics code embedded, to gather usage statistics to better understand what users are doing and how long they are using different parts of the solution.

2.1.3. Describe your players

The target audience for this course are the people who will start to learn Applied Computer Science in Haapsalu College of Tallinn University in September 2015. Because the current students are in full time studies and this course should be created for the students in cyclical studies, it is difficult to say exactly what characteristics will define these students. Still, some estimations can be done based on the current students. Currently there are exactly 50 students learning Applied Computer Science on all three courses. Out of those 50 students 40 are male and 10 are female. Last year 18 new students started as first-year students and their average age was 20.9 year. Most of these first-year students did not have

any background in computer science (there were still some who had studied it before or worked on a position related to informatics). However, these statistics will probably not be true for the new students, because the reason why studies were changed from full time studies to cyclical studies was to attract a new profile of students. The current students usually come to study straight after they have finished high school. New students are expected to be a bit older and already working, preferably in the field of informatics, but not necessarily. Unfortunately it is difficult to say for sure what are the characteristics of new students, other than their interest in computer science (otherwise they would not apply for it).

Probable users can be divided into following groups:

1. people who are currently working in the field of IT and want to get a diploma;
2. people who are currently working, but not in the field of IT, and want to learn a new profession;
3. people who have just finished high school and decide to study Computer Science.

Following are the test personas (or avatars, like Werbach (2012) says) for each of those groups:

1. Michael is a 27-year-old man, who started to study Computer Science when he finished high school, but on the second year he got a good offer to work for a big IT company. Since then he has changed his employer and now has decided to get himself a diploma to improve his options in the job market. He currently works as system administrator, but he is interested in improving his developer skills, to be able to create his own software that would help him in his job. According to Bartle's player types, he is an achiever — he want's to be the best and not because of what others think, but for himself.
2. Ashley is a 25-year-old woman who studied graphical design in a college and now is working as an illustrator for books. She has decided to study Computer Science to be able to work as a web developer, because she feels that it would be a better challenge for her. She uses a computer every day, but does not have any special computer skills.

According to Bartle's player types, she is an explorer — she likes to try new things and to explore new options.

3. Walter is 20 years old and has recently finished high school and wants to go to college. He has always liked playing video games and he dreams about becoming a game developer himself. That is why he wants to study Applied Computer Science. According to Bartle's player types, he is a socializer — he actively uses social media and he loves to play online multiplayer games with his friends.

2.1.4. Devise activity cycles

The game will be divided into stages. Each stage corresponds to a certain topic of the course. Topics are taken from the current Computer Hardware course because the author of this thesis has taught the course for three years and during that time he has already made some improvements in it, so this division of topics works for full time studies (Table 3.).

Table 3. Topics of Computer Hardware 1 course in full time studies

Topic	Translated into english
Õppekorraldus ja tutvustus arvutite kohta	Introduction into the course and about computer hardware
Protsessorid	Processors
Mälud	Memories
Andmekandjad	Storage media
Videokaardid	Graphics cards
Emaplaadid	Motherboards
Välisseadmed	External devices
Praktiline harjutus laboris	Practice in the lab
Eksam	Exam

When the first online course is over, different metrics of this course will be analyzed and if need be, improvements will be made. Lecturer's materials are going to be short videos about the topic, or external reading materials. All stages have equal value in terms of available points. After every second stage, there will be a "boss fight" (Table 4). Only one stage at the time is opened for students and stages are open generally for a week. This helps to create deadlines for individual work. Because the course starts on a certain day and ends on a certain day, there will not be a problem that players are in different stages during the game.

Table 4. Structure of gamified Computer Hardware course with point values.

Stages	Points
Introduction into the course and about computer hardware	800
Processors	800
Boss fight — logic gates	400
Memories	800
Storage media	800
Boss fight — binary calculations	400
Graphics cards	800
Motherboards	800
Boss fight — virtual computer building	400
External devices	800
Practice in the lab	800
Exam	2400
Total	**10 000**

General stage build (Table 5):

1. Introduction into the stage and topic — a short description about what is going to be learned at the current stage and what tasks need to be done
2. Lecturer's materials — lecture materials can be both short videos or some reading materials. Viewing the materials gives a small amount of points. The quantity of materials may vary, but the general volume should be about the same for all stages.
3. Small quizzes between the materials to see how well the materials are understood — between videos or reading assignments there are quizzes to help to measure how much of the material is learned. As those are automatic, they will give instant feedback.
4. Individual or group assignments, depending on the topic — depending on the topic there will be an individual or group assignment. Feedback for individual assignments will be given at the end of the stage.
5. Conclusion, feedback and end of the stage — at the end of the stage, students will get feedback about their individual or group assignments.
6. In case there is a "boss fight", this will be after the conclusion and will have its own instant feedback. "Boss fights" are real mini-games, rather than quizzes.

Table 5. Parts of stage and it's corresponding point value

Part of stage	Points
Introduction into stage and topic	25
Lecturers materials	50
Small quizzes between materials	250
Individual or group assignment	450
Conclusion, feedback and end of stage	25
Total	**800**

Because students in Computer Hardware course need to be graded, the "win state" equals passing the course. For every activity students are given points and based on those points

students reach different levels. Each level corresponds to a certain grade as can be seen in the table below.

Table 6. Points, levels and corresponding grades.

Number of points required	Level	Grade
9000	**10**	**A**
8000	**9**	**B**
7000	**8**	**C**
6000	**7**	**D**
5000	**6**	**E**
4000	5	F
3000	4	F
2000	3	F
1000	2	F
0	1	F

2.1.5. Don’t forget the fun!

For the system to be fun, it should be like a game. McGonigal (2011) has said: “When you strip away the genre differences and the technological complexities, all games share four defining traits: a goal, rules, a feedback system, and voluntary participation”. the first three can be achieved in the Computer Hardware course and have been described earlier in this chapter, but the fourth one, voluntary participation, is something that is a little less clear. Although studying in the college is voluntary, the same cannot be said about this course, because it is compulsory for students studying Applied Computer Science. Still three out of four requirements are being filled by this course, so this should not be a problem.

To add additional fun aspects to the gamified system, it will also include badges. Those will be awarded for different actions and students will not be told when and for what they will be awarded. These badges will have references to pop culture related to ICT. These kind of badges will likely provide fun for three out of four of Bartle's player types — achievers, explorers and socializers. Achievers would like to get as many achievements as possible, explorers will like to discover how to get those badges and socializers would like to show off their badges. Badges would not not give any additional points, but they would be visible to other students. Below are three examples of badges: "Shall we play a game?" (Figure 6) will be awarded on first logging into the course. This is a reference to 1983 movie called WarGames, where an AI called Joshua is asking a protagonist this quote. "Over 9000" (Figure 7) is a popular internet meme based on the Japanese manga anime series Dragon Ball Z. This will be awarded to a player who has collected more than 9000 points. "10 types" (Figure 8) is a badge that reads "There are 10 types of people in this world: those who understand binary and those who don't". This is a joke about number 2 in decimal system being written as 10 in binary. This badge will be awarded on completing the second "boss fight" — binary calculations.

Figure 6. Badge "Shall we play a game?".

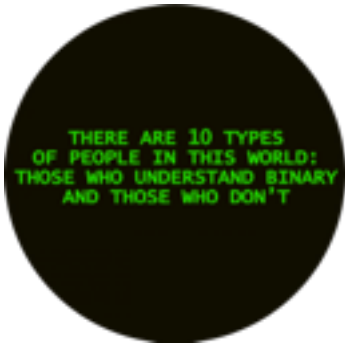

Figure 7. Badge "10 types".

Figure 8. Badge "Over 9000".

2.1.6. Deploy the appropriate tools

There are several options to create a gamified system. The aim of this thesis is not to create a working solution, but to create a blueprint for later on creating a working solution. Nevertheless, some of the things to consider will be brought out in here. There are many commercial online learning management systems (LMS) that also provide gamification for education like Brightspace or Blackboard and there are also free ones like Chamillo LMS, Moodle and Canvas. The latter one is actually commercial software, but it is open source and the source code is freely available, so it can be installed on your own server. Another option is to create an in-house solution and use this. That would be more difficult than using an existing solution, but benefits are that all necessary functions can be implemented without the need to find compromises in the course requirements. Choosing an LMS for a single course is probably not as efficient as choosing one for the whole college to use. That is why this decision should be done so that it will satisfy the need of this course, but also other possible courses that may be created in the future.

2.2. Interviews with representatives of target group

Interviews were conducted with three people in April 2015. The sample of interviewees was formed based on the target groups described in paragraph 2.1.3. Each target group is represented by one person. As stated before, currently there are about five male students to every female student and considering that two out of three persons interviewed were male

and one was female. Below is a table of interviewees in the same order as the target groups mentioned in 2.1.3. that they represent (Table 7).

Table 7. Interviewees.

No.	Age	Sex	Field of occupation
1	26	Male	System administrator
2	25	Female	Florist and freelance designer
3	21	Male	Unemployed

Interviews were carried out in an semi-structured format. Two interviews were conducted face-to-face and one was done over Skype. The interview lasted for thirty minutes on average. At the beginning of the interview the general idea of the course was introduced and some examples were made by using current full time studies materials and explaining the processes within one stage.

All interviewees were asked to talk about three topics:

- How do you feel about this course?
- What do you suggest in order to improve the idea?
- Given a choice, would you take part in this course? Why? Why not?

Before those questions were asked, interviewees were asked to confirm that they understood the idea presented to them and if need be ask for clarification before the interviewer started to ask questions.

All of the interviewees confirmed that they understood how this course is planned and they all believed that it would be interesting to try it out in real life. Following are the main points that were brought out during the interviews.

One interviewee said that it reminds him of Codeacademy in the sense that Codeacademy too has points and badges and he admitted that those do not motivate him that much, but

added that if there was a competitive aspect to Codeacademy, he would probably be much more interested in taking courses from there.

The second interviewee believed that she would love this system because she is also a keen Foursquare and Nike+ user, which both have somewhat similar mechanics. She stated that there should be some built-in way to communicate with the group. She pointed out that everybody does not use Skype or Facebook, but groups should be able to have a group chat board or message board of sorts. This idea will be implemented, as it would make sense to have a messaging system within the system, to inform about changes and to let student create groups of themselves, without the need to be physically in the same room.

The third interviewee admitted that this solution does not remind him of a game that much and he doubted that it would be very much fun, but he added that for him this would still be more fun than traditional lessons in the classroom. He pointed out that his favorite things are the badges because he is a gamer and very well familiar with that kind of pop culture.

In conclusion it can be said that the current blueprint for Computer Hardware course seems interesting for the interviewees and they would all be willing to try it out. They each noticed some different aspects of it. An improvement idea that came from the interviews is that a message board or some other kind of group communication method is necessary in the system. This will help both students to do group assignments and if some student gets stuck, he / she can ask others for help. The message board or some other kind of group communication system will be added to the requirements for the system.

CONCLUSION

The main focus of this thesis was to implement gamification in a Computer Hardware course. In the introduction research problems were identified and the current situation was explained. Also the reason why the topic of this thesis is current and research methods were brought out. This thesis can be described as a design research.

The first part of the thesis concentrated on defining what is gamification and to define that the concept of a game itself needed to be understood. Different methods that are using game elements were brought out and compared. What motivates players to play games was investigated and different types of players were identified. A deeper insight into what elements of games gamification uses was provided. Also negative sides of gamification were brought out to be more objective on the subject. Two examples of successful implementation of gamification were brought out: overview of Nike+ and Waze. One gamification framework was thoroughly explained. In addition to that results from a study where gamification was used in Estonian higher education context were analyzed and the most important aspects were presented. This part of the thesis also answers the first research question — what are the main aspects to keep in mind while developing a gamified system.

Based on all of the data on the first part of the thesis, the second part aimed to develop a blueprint for Computer Hardware 1 course. This also gives an answer to the second research question. The framework described by Werbach & Hunter (2012) was taken as a template onto which the blueprint was built. Objectives were described and metrics for measuring players' success and measuring the success of the gamification system itself were defined. The target behavior was described and target groups defined. Based on these target groups three test personas, or avatars, were created. Those test personas were also classified according to Bartle's player types. After that activity cycles and different stages in the gamified course were designed. Every part of the gamified system was assigned a point value, location of "boss fights" within the course and overall order of

topics was determined. The leveling system was designed and linked with students' final grades. For fun aspects, of course, badges were introduced. It was decided that badges would be assigned without prior "warning" to add the element of positive surprise. Badges are going to be designed with ICT pop culture in mind, so students can have a feeling of recognition and discovery. Short introduction into possibilities of deploying this course was made.

Three semi-structured interviews were conducted with people from each of the target group. Overall feedback to the idea of gamified Computer Hardware course was positive. There was one suggestion that will be taken into final design — a message board or some other kind of messaging within the students.

The aim of this thesis was to design a blueprint on which it would be possible to later on develop the gamified Computer Hardware course. This was achieved and in the second chapter of this thesis a blueprint for development was designed. Further development on the basis of this thesis should be now to develop a prototype and to use it in the course, to receive students' feedback as well as analytics to further improve this solution.

KOKKUVÕTE (summary in Estonian)

Käesoleva magistritöö peamine fookus on mängustamise rakendamine Riistvara 1 kursusel Tallinna Ülikooli Haapsalu Kolledžis. Sissejuhatuses tuuakse välja uurimisprobleemid ja tutvustatakse hetkeolukorda. Lisaks põhjendatakse ka töö aktuaalsust. Käesolevat tööd võib iseloomustada kui arendusuurimust.

Esimene osa magistritööst keskendub mängustamise defineerimisele ning selgitatakse mängu enda kontseptsiooni. Tuuakse välja ja võrreldakse erinevaid meetodeid, mis kasutavad mängu elemente. Uuritakse, mis motiveerib mängijaid mängima ja tutvustatakse erinevaid mängija tüüpe. Süvitsi uuritakse, milliseid mängude elemente mängustamine kasutab. Objektiivsuse tagamiseks tuuakse välja ka mängustamise negatiivsed küljed. Esitatakse kaks näidet ja antakse ülevaade edukatest mängustamistest: Nike+ ja Waze. Lähemalt tutvustatakse ühte mängustamise raamistikku. Lisaks sellele tuuakse välja mõned kõrghariduses läbiviidud mängustamisega seotud uuringud ja nende tulemused. Magistritöö teoreetiline osa vastab ka esimesele uurimusküsimusele — mis on põhilised aspektid, mida jälgida, kui luua mängustamisega süsteemi.

Tuginedes magistritöö esimeses pooles välja toodud andmetele oli töö teise poole eesmärgiks luua plaan Riistvara 1 kursuse mängustamiseks. See on ka ühtlasi vastuseks teisele uurimisküsimusele. Plaani loomiseks kasutati Werbach & Hunter (2012) loodud mängustamise raamistikku. Kirjeldati eesmärke ja mõõdupuid, et mõõta mängijate ja süsteemi enda edukust. Kirjeldati kasutajate soovitavat käitumisviisi ja sihtgruppe. Nendele sihtgruppidele tuginedes loodi test-isikud. Test-isikute puhul toodi välja ka see, kuidas neid liigitada Bartle'i mängija tüüpide alusel. Peale seda kirjeldati tegevuste tsükleid ja erinevaid etappe mängustatud kursusel. Igale mängustatud kursuse osale määrati kindel punktide väärtus, kursuse teemade üldine järjekord pandi paika ja määrati "bossi võitlustele" asukohad. Kujundati tasemete süsteem ja seoti see üliõpilaste hinnetega. Kursusele lõbusama poole loomiseks lisati märkide süsteem. Iga selline märk antakse ilma eelneva hoiatuseta, et tekitada positiivset üllatust. Märgid kujundati IT-

teemalise popkultuuri ainetel, et üliõpilastel oleks äratundmise ja avastamise rõõmu. Tehti ka lühike kirjeldus, kuidas seda kursust rakendada.

Kolme sihtgrupi liikmega viidi läbi pool-struktrureeritud intervjuu. Nende poolne tagasiside oli üldiselt positiivne. Tehti üks soovitus, mis võetakse ka arvesse — lisada mingisugune teadete tahvel, kus saaksid üliõpilased omavahel suhelda.

Selle magistritöö eesmärgiks oli luua plaan, mille järgi oleks hiljem võimalik luua mängustatud Riistvara 1 kursus. See eesmärk saavutati ja töö teises peatükis loodi kava edasiarenduseks. Käesolevat tööd edasi arendades tuleks luua valmis prototüüp ja seda kasutada kursusel, et saada üliõpilaste poolset tagasisidet ja koguda süsteemi kasutamise kohta statistikat.

References

AMSO. (sine anno). *Army Modeling & Simulation Office. AMSO's Mission.* Retrieved 2015, 25. April from: http://www.ms.army.mil/

Bohemia Interactive Simulations. (sine anno). *VBS3: The Future Virtual Battlespace*. Retrieved 2015, 2. May from: https://www.bisimulations.com/virtual-battlespace-3

Empson, R. (2013, 11. June). *WTF Is Waze And Why Did Google Just Pay A Billion+ For It?* Retrieved 2015, 29. April from: http://techcrunch.com/2013/06/11/behind-the-maps-whats-in-a-waze-and-why-did-google-just-pay-a-billion-for-it/

Ferriman, J. (2014, 13. January). *Successful Gamification Case Studies.* Retrieved 2015, 29. April from: http://www.learndash.com/successful-gamification-case-studies/

HopeLab. (sine anno). *Re-Mission 2 Fact Sheet.* Retrieved 2015, 25. April from: http://www.re-mission2.org/wp-content/uploads/2013/03/Re-Mission2_FactSheet_FINAL2.pdf

Johnson, L., Adams Becker, S., Estrada, V., Freeman, A. (2014). *NMC Horizon Report: 2014 Higher Education Edition.* Austin, Texas: The New Media Consortium. Retrieved 2015, 2. May from: http://cdn.nmc.org/media/2014-nmc-horizon-report-he-EN-SC.pdf

Kable. (sine anno). *Bohemia Interactive Simulations - VBS2.* Retrieved 2015, 2. May from: http://www.army-technology.com/contractors/training/bohemia-interactive/

Kapp, K. M., Blair, L., Mesch, R. (2014). *The Gamification of Learning and Instruction Fieldbook.* San Francisco: Wiley.

Laminar Research. (sine anno). *FAA-Certified X-Plane: Using X-Plane to log some hours.* Retrieved 2015, 2. May from: http://www.x-plane.com/pro/certified/

Maier, A., (2010, 1. June). *Complete Beginner's Guide to Design Research.* Retrieved 2015, 2. May from: http://www.uxbooth.com/articles/complete-beginners-guide-to-design-research/

Marczewski, A. (2012). *Gamification: A Simple Introduction & a Bit More.* Lulu Press, Inc

Marczewski, A. (2013, 3. June). *What's the difference between Gamification and Serious Games?*. Gamasutra. Retrieved 2015, 2. May from: http://www.gamasutra.com/blogs/AndrzejMarczewski/20130311/188218/Whats_the_difference_between_Gamification_and_Serious_Games.php

Mcclusky, M. (2009, 22. June). *The Nike Experiment: How the Shoe Giant Unleashed the Power of Personal Metrics.* Retrieved 2015, 29. April from: http://archive.wired.com/medtech/health/magazine/17-07/lbnp_nike?currentPage=all

McGonigal, J. (2011). *Reality Is Broken Why Games Make Us Better and How They Can Change the World.* New York: The Penguin Press.

mtvU. (sine anno). *Darfur is dying: About the game.* Retrieved 2015, 25. April from: http://www.darfurisdying.com/aboutgame.html

Nike. (sine anno). *What is fuel.* Retrieved 2015, 29. April from: https://secure-nikeplus.nike.com/plus/what_is_fuel/

Pappas, C. (sine anno). *How Gamification Reshapes Learning: Introduction.* Retrieved 2015, 25. April from: http://elearningindustry.com/how-gamification-reshapes-learning#introduction

Penenberg, A. L. (2013). *Play at work How games inspire breakthrough thinking.* New York: The Penguin Press.

Ruffino, P. (2014, 02. January). *Nike+ FuelBand: movement is life.* Retrieved 2015, 2. May from: http://projects.digital-cultures.net/gamification/2014/01/02/nike-fuelband-movement-is-life-and-vice-versa/

Sillaots, M. (2014). *Gamification of Higher Education by the Example of Course of Research Methods.* Tallinn: Springer: Advances in web-based learning - ICWL 2014.

Waze. (sine anno). *Your Rank and Points.* Retrieved 2015, 28. April from: https://wiki.waze.com/wiki/Your_Rank_and_Points

Werbach, K., Hunter, D. (2012). *For the Win: How Game Thinking Can Revolutionize Your Business.* Philadelphia: Wharton Digital Press.