



UNIVERSITY OF BERGEN

MASTER THESIS

The use of gamification in learning applications

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Abstract

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The aim of this thesis was to investigate and identify the elements of gamification used in learning applications and how they affect user experience. The three main research questions were *“How are gamification elements used in learning applications?”*, *“Do the gamification elements create a good user experience?”* and *“Is there any evidence that learning is taking place?”* The research included desk work, literature survey, and field trial in order to attempt answering the research questions. With an analysis of different chosen games, a list over gamification elements was created, which became the base for the testing sessions with several participants. The data from the sessions was collected and analyzed before being used in a discussion with other theoretical work. The conclusion of the research was that the integration of gamification elements into learning applications has a positive outcome for most of the users, as it creates motivation. However, further research is required; both on gamification in general, and on its role in learning applications.

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Chapter 1

"In every job that must be done, there is an element of fun. You find the fun and SNAP! The job is a game." Mary Poppins.

1.1 Introduction

Having grown up with computers and games, I have seen how technology has been implemented in so many different aspects of our lives. We use Internet services, different smart technology and hardware. A fairly new concept in the technology world is gamification (Deterding, Khaled, et al. 2011), which basically means *"to use game elements in non-gaming contexts"* (Deterding, Dixon, O'Hara, et al. 2011). As I am an avid gamer this is a development I find very interesting. One of the fields where gamification has begun implementing is in learning applications. There are learning applications for all kinds of skills, such as learning how to cook and speak languages. The possibility of using computer games and learning at the same time would be the perfect combination for many students. Johnson et al. (2013) state:

"In higher education, when students are expected to think critically in order to solve problems, game-like simulations can be leveraged in any discipline to reinforce the real world applications of concepts".

From an early age, we learn through different types of play, whether it is playing with friends, playing a sport, card or board games, games engage and capture our attention (Oblinger 2006). There are several digital games where the players gain knowledge and if the game was not meant for educational purposes, the learning can happen without the player being aware of it. An example of this is the game The Sims 3. The player creates a Sim, who they follow through a lifecycle, which include baby, toddler, child, teenager, adult and elderly. The Sim is given personal traits, but they evolve to unique individuals through the players different choices. In order to survive and live, the Sim must get a job (in order to pay the bills) and satisfy their basic needs such as hunger, sleep, bladder, hygiene, social interactions and having fun. So the player learns about decision making, social aspects, prioritizing and basic everyday life. In school situations, the game can be used in economy classes; if given 20 000 simoleans (sim currency) how would they distribute the money? Is there a difference in their approach if the Sim is given a partner, baby or a dog? Different screenshots from the game can be used in creative writing and drama. So for a game not meant for learning, it still has some learning aspects to it. There has been conducted a one year study, which included The Sims 2 and how it could be used in education such as discussion, drama, foreign languages and real life simulations (Sandford et al. 2006). Also, there has been developed a website, which uses The

Sims 2 in the process of becoming a better writer (Wann 2007).

As technology is taking more and more space in our everyday lives, implementing technology for learning in a school context will probably become more and more common. Richard Van Eck (2006) finds games suitable for educational purposes because besides being fun, they are also

- Immersive
- Includes socialization
- Have clear goals
- Requires the player to go through a frequent process of hypothesis formulation, testing and revision
- Adapts individually to the player

However, there are several people who do not like computer games. How would they feel if gaming was implemented in school? And the parents of the older generation, would they be able to keep up with the learning techniques used with the games? Not to mention the teachers. Would they be able to create a curriculum with enough structure to implement games in class? It would be easy to lose control of 30 students gaming in class, which would mean the teacher would have to rely on the students to follow the lecture plan and not just play for pastime. Gamification puts gaming elements into the learning applications, but does it teach? Do gamification encourage learning and motivate. These questions are the motivation for this research. Finding out whether or not gamification elements are found interesting and motivating for the users, and if the elements are able to motivate and improve the learning outcome.

1.1 Learning applications

Learning applications might be confused with the term e-learning, but the e-learning revolves more around using technology in teaching, such as having powerpoints in lectures. This relates more to the field of technology enhanced learning which will be presented later in the thesis. In this context, learning application means the different applications developed for digital platforms meant for learning purposes. After the smartphones were developed, appstore (for IOS) and google Play (for Android) offers almost limitless of different applications to download. In appstore, one of the search categories is "Education". Here, anything you want to learn has an application. It can be anything from cooking, languages, music to anatomy and dictionaries.

1.2 Gamification and experience

This together forms the background for my thesis, finding out more about how gamification has been

applied in with learning applications and how the user interacts with both elements. When someone is playing a game, they have a user experience. It revolves around creating a positive experience for the player in order to motivate and encourage the playing and hopefully, learning.

1.3 Research questions

In order to investigate the role of gamification in learning applications and its impact and consequences, the following research questions have been formed:

RQ1: How are gamification elements used in learning applications?

RQ1a: What are gamification elements?

RQ1b: How is gamification elements used in existing learning applications and games?

RQ2: Do the gamification elements create a good user experience?

RQ2a: What is a good user experience?

RQ2b: Do the gamification elements work for or against their purpose?

RQ3: Is there any evidence that learning is taking place?

1.4 Motivation

The motivation for this research is my own observations and interest in games. I would have loved the opportunity of using games and more e-learning in school, but there is a need for more research on this area showing results in order for the school/teachers to take this into consideration. Although some teachers has tried the concept and are open to it, the Norwegian curriculum does not include this yet.

1.5 Goals

The goal with this research is to raise some awareness to using game elements in learning applications and the results they provide. One other main goal is to examine the user experience and whether or not gamification can help create a good user experience. Hopefully the research will be a helpful contribution to raise the awareness of games and gamification for learning applications for learning.

1.6 Organization of thesis

Chapter 2 presents a literature survey and discusses gamification and related fields. Chapter 3 describes the research methodology used in this thesis. Chapter 4 presents the games and an analysis of the games. A field trial with the games is presented in Chapter 5, which includes the findings. The thesis concludes with Chapter 6.

Chapter 2 Literature Survey

This chapter provides the background and reviews the relevant literature for this research. First the chapter situates gamification in relation to the different research fields. Then gamification, the focus of this research, is discussed and previous research related to gamification is surveyed. The chapter ends with a presentation of gamification elements with illustrations.

2.1 Defining the research area

Research on gamification and learning applications are connected to several other research fields. The main areas that form the core of gamification are technology, games and learning, see figure 1. At the interaction of these three areas are digital games, serious games, and technology enhanced learning, the center intersection that these elements form together is gamification.

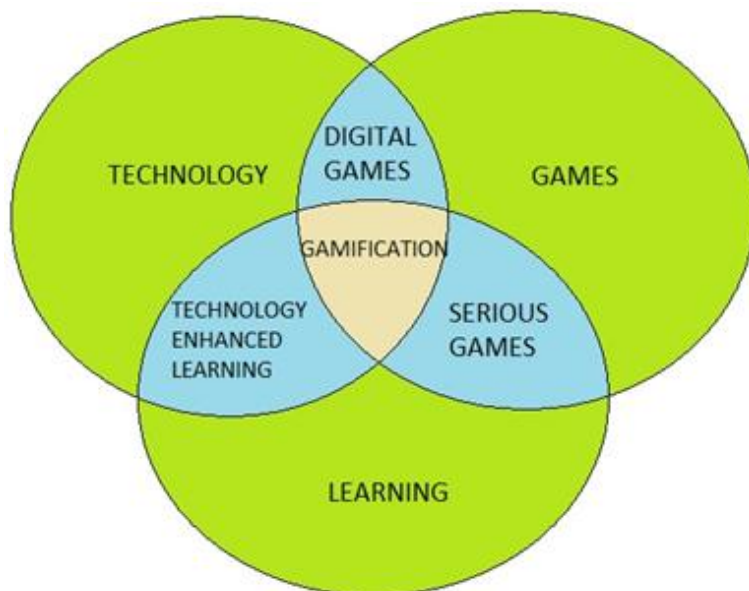


Figure 1: Related fields

The following section describes the different areas shown in figure 1.

2.1.1 Technology

Technology plays a huge role in people's everyday life, whether it is through smart phones, cars, tablets, or computers. Researcher Marc Prensky defined the youth today as the "digital natives", being used to the technology and living with it, while the older generation who are learning and adopting new technology are the "digital immigrants" (Prensky 2001). Examples of the technology available today are smartphones, pc, tablets, cars, digital watches, microwaves, etc. Today most Norwegian high schools offer students computers to loan or lease (with an option to buy after 3 years). It is almost a given that the students have computers available when in class. What about the

books, will they be switched out with pdf and e-books? Does this development open for games as well in the field of learning?

2.1.2 Learning

Learning is knowledge acquired through study, experience, or being taught (University Press 2013a). Learning can be achieved in various ways such as reading, listening, observing, and writing, playing or experience. There are several different learning theories such as informal, non-formal and social learning theory, but this is a field too wide to elaborate in this research so for more on this field, see Schunk (2011). Jesper Juul writes that "games are learning experiences" and the player improves certain skills through playing in order to beat the challenges given (Juul 2005, p. 57).

2.1.3 Games

Finding a suitable definition for games is a challenge (i.e. (Costikyan 2002; Salen & Zimmerman 2004)) as it can be everything from board games, card games, to outdoor games and dice games. Games are meant for pastime and enjoyment for all ages, which is up to each individual what they find entertaining and fun. Bernard Suits defines games as the following:

"To play a game is to engage in activity directed towards bringing about a specific state of affairs, using only means permitted by rules, where the rules prohibit more efficient in favor of less efficient means, and where such rules are accepted just because they make possible such activity" (quoted in Juul 2005, p. 30).

2.1.4 Digital games

Definitions of digital games varies from only including video games and computer games, when it can be made more universal and include arcade machines, consoles, mobile games and PC (Kerr 2006). Digital games has become a part of modern culture where nearly all children play games and continue to do so into their adulthood (Oblinger 2006), a statement confirmed by Entertainment software association (ESA who has created an overview for facts about computer and video games industry in the US, stating that the average player is 30 years old (Entertainment Software Association 2008). Digital games have an enormous market and audience, which forms the base of success for gamification. Using game elements in learning application will appeal to those interesting in both education and gamers.

2.1.5 Technology enhanced learning

Technology Enhanced Learning (TEL) is a research field where information and communication technologies are used to support learning. Goodyear and Retalis (2010) define TEL as *"all those circumstances where technology plays a significant role in making learning more effective, efficient or*

enjoyable.” Researchers in TEL are carrying out research on learning through technology, for example Skype-lectures, intelligent tutoring systems and collaborative learning (Anderson et al. 1985; Stahl et al. 2006; Laurillard et al. 2009) TEL also includes learning applications considering they can address any field, from learning languages, cooking and school subjects. There have been several studies investigating the use of "regular" games in learning context; In a one year study called “Teaching with games”, three commercial off-the-shelf games was implemented into the school and teaching (Sandford et al. 2006). One of the key findings was that 82% of the students played computer games outside lessons, while only 28% of the teachers did. Locally, a Norwegian teacher, Magnus Sandberg also created a teaching plan with the game Minecraft used in mathematics and arts and crafts (Sandberg 2013). Although there are no official reports on the results of this teaching plan, the teacher himself has in several articles stated that the children are highly motivated when using this game.

2.1.6 Serious games

Serious games is closely related to gamification as the main purpose of the serious games are to shine light in a serious matter through a game. Susi et al. (2007) define serious games as *"Games used for purposes other than mere entertainment"*. Clark Abt (1987) was the first to define the term in his book “Serious Games” and although his explanation was meant for card and board games, it can be used in a digital game context as well:

“Reduced to its formal essence, a game is an activity among two or more independent decision-makers seeking to achieve their objectives in some limiting context. A more conventional definition would say that a game is a context with rules among adversaries trying to win objectives. We are concerned with serious games in the sense that these games have an explicit and carefully thought-out educational purpose and are not intended to be played primarily for amusement” (Abt 1987).

Examples of different topics are global warming (Clim'Way), health issues (Pulse!!) or the challenges of developing countries (Darfur is dying). Serious games can also be confused with edutainment, which is the two words education and entertainment merged together. It is hard to tell the difference between the two, but as written on Wikipedia:

“The difference between serious games and other gaming genres like edutainment may be that the former has some built-in serious purpose, whereas the latter becomes serious when the user decides to assign such a purpose to it”.

Serious games are developed with a serious matter in mind, while edutainment are games meant for educational purposes, but with the element of entertainment.

2.2 Gamification

It is claimed that the term gamification was first used in 2008, but was not widely known until 2010 (Deterding 2011). There are several definitions on the term:

1. *"Gamification is the use of gameplay mechanics for non-game applications."* (Raymer 2011)
2. *"Gamification is an informal umbrella term for the use of video game elements in non-gaming systems to improve user experience (UX) and user engagement."* (Deterding, Dixon, O'Hara, et al. 2011)
3. *"Gamification is using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems."* (Kapp 2012)

Implied from these 3 definitions, gamification involves using game based elements in a non-game application. This can also be said about the term serious games, however they differ because serious games bases itself on being a game, but with a serious purpose such as global warming awareness (see section 2.1.6). Although these definitions are similar, number 2 is the most appropriate in the context of applying gamification in the learning applications and to the research questions as they include the aspect of user experience.

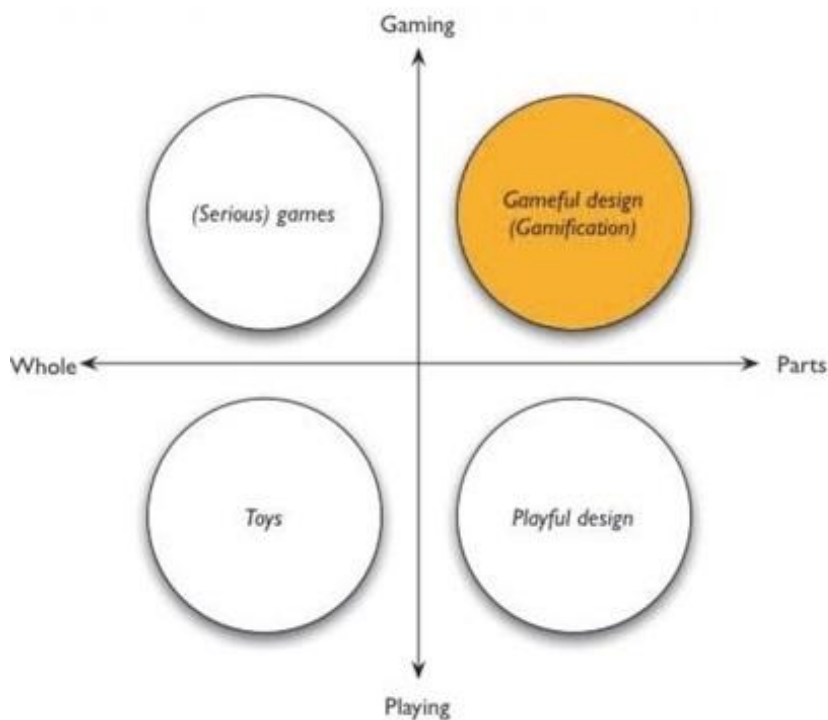


Figure 2: Gamification VS games

Figure 2 shows how gamification is placed in relation to serious games, toys and playful design (Deterding, Dixon, Khaled, et al. 2011). Serious games have the whole gaming experience, while gamification only has parts of the gaming. Gamification is not about playing where toys and playful design lies. Playful design can be related to user experience, which is another central field in this research, however, it is a field of study not being included in this research.

2.3 User Experience

Another important and central field in this thesis is the concept of user experience (UX). User experience can be interpreted in many ways, but the term bases itself on how humans experience interaction with something or someone. McNamara and Kirakowski (2006) define the UX as *“The user experience considers the wider relationship between the product and the user in order to investigate the individual’s personal experience of using it”*. User experience is individual thus is different for everyone. Two individuals playing a game will have two different opinions about the experience of playing. Perhaps one will find it entertaining, wanting to repeat while the other might find it tedious.

When developing a learning application, one of the main goals for the developer should be for the users to have a good user experience. Finding the game meaningful, valuable, fun and useful is an important factor for the application to succeed. The same goes for games, if they are not well received by the end users, the game has failed and will probably not sell. If the learning application provides a solid and good user experience the users will be positive, motivated and hopefully learn faster by using the application more. Using gamification as a tool to achieve a positive user experience is therefore one of the approaches this research is looking into. Games in different forms are created to entertain different target groups, so if taking these different elements the games has in common; implementing them into the learning application will perhaps create a good experience for a wide range of users. The user experience will be one of the main focuses in the field trial presented later in the thesis.

2.4 Previous work

Several researchers have written about gamification. In this section, a selection of researchers and previous work has been chosen to give a wide range and understanding of the field.

Jon Guerrero is an American blogger who conducted an experiment called *“How to gamify your life: An experiment”* in 2012, trying to gamify his life by using an application called *“Level me up!”* (Guerrera, 2012). This application lets the user add different abilities you want to improve. The more time spent on these abilities, the higher level you will achieve. The abilities can be everything from guitar playing, programming, jogging etc. The results of his experiment were posted in 4 separate

posts on his blog, all positive. He does write about the pitfalls and challenges around the experiment. but in the end he got positive results. This experiment was one of the key inspirations for the research questions as he did to a certain degree; succeed to apply gamification to his life. If it is possible in real life, it should be possible to apply gamification to other aspects.

Another key inspiration for the work with gamification is game designer **Jane McGonigal**. She states in her book "Reality is broken" (McGonigal 2011) that the world should be more like a videogame. She believes the world and peoples everyday life can be greatly improved by implementing games and game elements into it and has therefore become a front figure for gamification. One of her dreams is having a game developer nominated for Nobel Peace prize before 2023. She also co-developed Gameful, a website for game developers and people in general wanting to make the world a better place by using games. She writes about how games make work satisfying and the two things it always starts with; a clear goal and actionable steps to achieve this goal. Games can also be used to encourage and motivate according to her book, which is some of the aspects that are looked upon in this research. She wants to have games in the everyday life, and one way to achieve that is to implement gamification.

Marc Prensky is a speaker in learning and education and author of the book "Don't Bother Me Mom — I'm Learning", which focuses on what children can learn from games (Prensky 2006). He is also the one who defined the "digital natives" and "digital immigrants" explained in section 2.1.1. In the article "Digital Natives, Digital Immigrants" he criticizes the American school system, not taking into consideration that today's students are not the same as before, growing up with all this new technology, backing up the starting point for this thesis, learning through games and technology is becoming more and more applicable.

Websites has also been developed for gamification and one of the bigger ones are gCO, which claims to be the leading source for gamification news and information (Zichermann et al. 2013) with **Gabe Zichermann** as the front figure. He is another gamification front figure, known for his books on the topic and for his GSummit where gamification is the main topic in how to solve problems on different areas. His theoretical work is highly relevant for this research and motivation. Along with Gamification Wiki (GamificationWiki 2010) these two websites have been the main Internet source to articles and information in the research.

Karl Kapp is a knowledge broker, professor, speaker and author on the topic of gamification and e-learning. His definition on gamification was presented earlier in the thesis (see section 2.2). In the article "Once Again, Games Can and Do Teach!" he argues an article written by Ruth Clark about

games not having the ability to teach (Kapp 2013). As this research focuses on the learning outcome, his argumentations and articles were found relevant.

Kurt Squire is a teacher, author and game researcher. He is also one of the founders for Games , Learning, & Society Initiative, which is faculties and students who focuses on game based learning (Squire et al. 2013). Along with **Henry Jenkins** who is a professor in communication, journalism, and cinematic arts, their theoretical work both together and separate has been relevant and useful for this research. Jenkins is also actively working for the usage of computer games in educational purposes. Squire and Jenkins (2003) believes that *"much of the learning occurs through participation in gaming communities, as the most gifted players pass along what they have learned to the other players"*.

"Gamification of education" (Pavoordt 2012) is a thesis which looks at why games should be used in education. The paper is written based on a group project where the author developed a serious game to teach geography feeling the general knowledge among the group and others were too low. Using games in education could be the solution to engaging students to obtain knowledge according to the author which analysis different games in order to see how they could be a part of educational curriculum. Even though this research revolves around games as a whole in educational situations, the base for the research is the same. The analysis of the different games are helpful in seeing what educational purposes the games have, the paper also points out some issues with games in education, which also is an important aspect for this research.

2.5 Gamification elements

In this section, a number of gamification elements are presented. The list consists of elements gathered from Enterprise Gamification (Bunchball 2012), Gamification Wiki (2010), and personal findings during the playing and research. Each element will be illustrated with a screenshot or logo from a game, which will not be numbered.



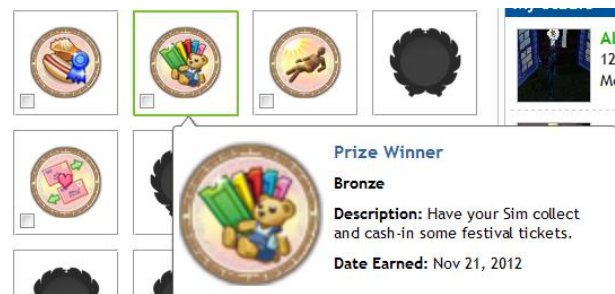
Achievements, when a goal or task is completed, you get an item (physical or virtual) to prove it with. An example of this is in games like Super Mario where the player can earn special coins to unlock bonus houses. On the right upper corner the amount of earned coins are shown. Each level has 3 hidden coins for the player to find. The mushroom house just beneath it requires 5 coins to unlock which the player now has.

Appointments, when the player needs to log in or participate in the game at a certain time or place to get an award or positive outcome. In the Ipad/Iphone game Hay Day the player has a farm and produces different goods. On the right screenshot the player has the task to fill a boat with different goods before time runs out. The player needs to produce and harvest the goods in time before the boat leaves. The player can only make 2 popcorn cans at the time (standard setting), which takes 30 minutes per can, so it is required to participate in the game so that the player is able to produce the right amount in time before the boat leaves.

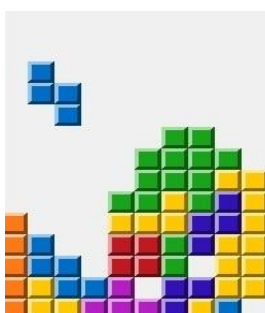


Avatar/Mascot, is an element found in several games. This is a representation of the player, or a character for the player to relate to. For instance in tutorials or the narrative part of a game, the player is often presented with a story with different characters. Often the characters "speak" to the player in order to form a relationship. An avatar can also be a non-active representation of the player. On the left picture, which is taken from Dragonbox, the player has to choose an avatar to represent their profile they have created.

Badges are one of the most common elements looking at the different applications. Badges are a form for reward or achievement. The Sims 3 rewards the players with badges when having completed an achievement (having planted 50 plants and so on). The game is connected to



Internet so the badges are posted on the players profile as they are achieved. On the screenshot, the one marked is the "Prize Winner" where the player gets a description of the badge and date it is earned. The badges available, but not earned is shown in dark gray.



Behavioral Momentum "is the tendency of players to keep doing what they have been doing". This citation is taken from Gamification Wiki and explains the element as the contingency in the playing. One game that keeps the same actions over and

over again without getting old is the classical game, Tetris. The rules of Tetris are fairly simple as the goal is to stack the blocks to form a line. This line is then eliminated and the player gets points. If the blocks reach the top of the screen before being eliminated the game is over. On the screenshot, if the blue block in the air is placed in the gap furthest down, two lines will be eliminated. Another example of a game with behavioral momentum is the card game solitaire.

Blissful Productivity means the game makes it easier to work hard, because it also makes you happy when doing so. In training applications you get encouragement by working out, so it becomes more fun. Blissful productivity can be encouraged by rewards, badges and bonuses. It is individual for each player what makes them happy and into the state of blissful productivity.



Bonuses are achieved by completing several tasks in a row or in a short amount of time. Bonuses are often given when the player has done a task in a specific way or order. In time management games a bonus is given the player if the level is completed in time and often has different bonuses, for example one bonus for time left on the clock, one for combos and one for hint-use. The screenshot

shows a level summary in the time management game Youda Jewel Shop, which is based on the player owning a jewel shop and has to make different types of jewelry to customers. There is a bonus given if the player completes the level with all customers happy (if waiting too long, they lose their patience and leaves angry).

Cascading Information Theory is the “theory that information should be released in the minimum possible snippets to gain the appropriate level of understanding at each point during a game narrative”

(GamificationWiki 2010). On the screenshot taken from Starcraft II the green squares are the buildings the player already built, while the light areas are where the player has explored the land. The dark spots are unknown territory with unknown resources, enemies, characters and such. The player will not get this information unless the land is explored and therefore the player is given minimal information at a time.



Cartoonish graphics are used in many games in order to make it more game like and fun. Pretty graphics can

also make the game more appealing. The game becomes less "serious" and less realistic when using drawn graphics and characters. The screenshot is taken from the game The Cave where the player is the farmer standing in the middle, solving puzzles in a cave. The graphics are drawn 3D and with bright colors.

Combos carry out a number of actions as a result of a player's actions. This often gives a reward in form of a bonus or points. In fighting games the player often get combos by managing to press the different buttons on the console in a specific order. In the screenshot from Tekken 5 on the left side, there has been completed a combination move as seen in the red circle.



Community Collaboration is an element where an entire community has to participate to solve a problem, mission or task. In 2013 Bergens Tidende, the local newspaper of Bergen, released a company contest called Pust, to improve the air in Bergen. Companies could participate and it lasted from 4th of February until 22nd of March. The idea was to get people to use public transport instead of driving.

Countdown is when the player has a certain amount of time to complete a task. In the game Candy Crush Saga, the player is given different tasks to the different levels. One of the tasks is to achieve a certain amount of points in a given time. On the one shown in the screenshot the main goal is 100 000 points in 90 seconds. When the player starts the level the clock in the upper left corner shows the time left.



Discovery is the element of exploration and discovery of new things. In games, when the player discovers something new, like an item or new land, they often get a reward. In gamification this can be used to motivate. Unlocking different levels and items are part of the discovery element.

Epic Meaning is when the players are motivated because they believe that what they are working for is something so big, awesome, incredible, something bigger than themselves.

Free Lunch is the gamification wiki's word for when a player feels like they are getting something for free where others have done the work. An example of this is if a player gets a free pass, bonus or

benefit because another player already completed the work beforehand. As seen in the Super Mario screenshot, some of the levels are open. This could be another player which means the current player is allowed to continue without completing those levels already cleared.



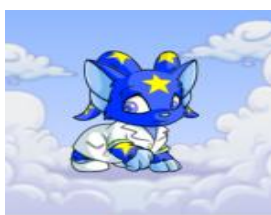
Goal setting is when there is a long term goal. In the building game Pharaoh the player is given a long term goal such as "Have 15 houses with high status" and "Population of 3000", but in order to reach these goals, the player needs to fulfill several other quests for the main goals to be completed; for example, in order to get the population to 3000, houses must be built, the city must be good to live in to avoid emigration.

Hint is given when a player is stuck and gets some sort of help from the game. In the screenshot taken from Big City Adventures: Paris, which is a hidden object game, the cursor is held over the "single object hint" which if used, will show one of the items the player is looking for.



Infinite Gameplay is when the game doesn't have an ending, but keeps getting updates with new tasks and assignments, or the game has so many levels that getting to the last one is so to speak impossible. Games like Hay Day or Tetris just keeps on going, no matter how much time the player spend on the game. It expands with more tasks, more levels and more quests so it never stops.

Levels are another well-known and well used concept in games. Levels show the improvement of the player, whether it is finishing a level or gathering enough points that is required. In The Sims, each playable character gets different skills, where they need to practice it to reach a higher level. In games like Angry Birds you have several different levels with one separate goal per level. In the screenshot from Juice Cubes the player has completed several levels as shown in the screenshot.



» Customise
Species: Acara
Health: 95 / 95
Mood: delighted!
Hunger: dying
Age: 3,571 days
Level: 47

Loss Aversion is when the player ties emotional bonds to the game and sees it as a real situation. An example is in health care games when the player imagines the patients as real. In the screenshot taken from Neopets, which is a site where the player owns several neopets, which needs to be fed, played with and cared for. The neopet in the screenshot has the mood of delighted, but is dying of hunger

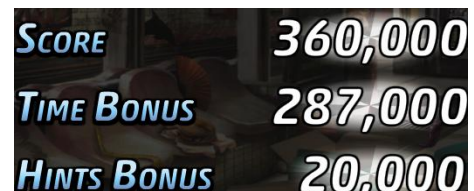
and therefore has a sad face. Because this is the player's animal, the player feels the need to care for the pet and provide it with food in order to make it happy again. If the mood switches to bad, the player must pay attention to the pet through toys and books in order to make it happy again.

Lottery is when something in the game is decided with luck or by chance. Rock, paper, scissors are a good example of this element. Other games which have this element are slot machines such as the one seen in the screenshot and scratch cards. The slot machine on the screenshot is taken from the Neopets site, and is basically a slot machine where the player can win Neopets-currency. Never knowing the outcome, it represents the lottery element.



Ownership is when the players attach themselves to the game emotionally. Tamagotchies is an electronic toy where the player cares for a little animal or egg in order for it to grow and be happy. It includes giving medicine if sick, cleaning up after it, feeding and playing with it. If the tamagotchi is not cared for, the pet will die and the player must start over with a new pet.

Points are an element used in many settings. In games, you get points for completing a level, quest or challenge, for picking up items (like coins or diamonds) etc. Often, players get a bonus if finishing the level or task without using hints or being quick. In the screenshot from Criminal Case, a hidden object Facebook game, the player has finished a stage and received points for the stage in general, for having time left on the clock and for not using any hints.



Progression is an element often shown by using a progression bar. It can be based on different foundations like gathering points, completing tasks, being active on a website, log into applications and so on. This is used in quite many applications, for example the game Mega Run. The points the player collect "feeds" the progression bar and when it is full, you go to next level.

Quests are different types of challenges, tasks and problems given during the game, which the player needs to do. When a quest is completed, it is normal to get some sort of reward whether it is money, experience, more story or unlock something. In Learn Spanish the players receives several quests during the playing, see figure 10 (c). When the quests are completed the player is rewarded with experience points.

Real-time feedback is given when doing a task, the game gives you constant feedback on how you are doing. Games like Guitar Hero and Sing Star gives the player a flow of feedback when playing, if they need to be more accurate or they are doing well. In the screenshot taken from Sing Star the player has managed to hit a note and hold it for as long needed and gotten the feedback "Cool" in green.



Reward Schedules is the delivery board where rewards (points, prizes, level ups) are given. According to gamification wiki there are three main parts in a reward schedule; contingency, response and reinforce (2010). When the player logs in, the reward schedule will show the latest event, which has happened on the game since last time the player was active.

Status is the rank or the level a player is at. This also relates to envy considering most players want to have the top status. In the screenshot from High School Story, the player can level different types of students such as jocks, nerds and cheerleaders. When the player level the students they get outfits to show their rank. Other examples of this is in building games such as Caesar III where the player starts off as a low rank citizen and ends up as Caesar after completing several missions.





Transparency is when the player is able to see the score and progress at any time they want. Platform games are often transparent and you keep track of the points, time, and health at all times. In the screenshot from Mega Run, the amount of coins and diamonds and points earned, special stars and pause button is visible at all times.

Urgent Optimism, when you believe you can win and defeat the challenge. This is often created by motivating game play.

Virality is when a game is better if several people are playing. In several Facebook games the player gains extra bonuses if inviting friends to play as seen in the screenshot of Criminal Case. On the left the player has the option of inviting friends. The friends can send the player bonuses in form of cards as seen at the bottom of the picture. Cards can later be exchanged to bonuses only available if having friends playing.



2.6 Summary

This chapter has defined which research areas gamification consists of, before looking at some previous work done on the field. A list of gamification elements are presented before summing up the chapter with an explanation of how the elements can be categorized into different levels of game principles.

Chapter 3

3.1 Methodology

The main goal of this research is to understand the use of gamification in learning applications by first carrying out a critical analysis of the use of gamification in existing applications, and second by carrying out an empirical study of users playing the gamified learning applications. The following research questions guided the research:

RQ1: How is gamification elements used in learning applications?

RQ1a: What are gamification elements?

RQ1b: How is gamification elements used in existing learning games?

RQ2: Do the gamification elements create a good user experience?

RQ2a: What is a good user experience?

RQ2b: Do the gamification elements work for or against their purpose?

RQ3: Is there any evidence that learning is taking place?

This chapter describes the research methodology followed to answer the research questions.

3.2 Research Methods

This section describes the research methods used in this thesis, which includes desk research, game analysis, and a field trial. The reasoning for the chosen methods is presented along with the method itself in the following sections.

3.2.1 Desk research

Desk research (also called secondary research) revolves around finding and analyzing already existing data (WebFinance 2013). By finding useful information sources an overview of existing research and results can be made. These results will inform further research carried out in this thesis.

In this work, interesting perspectives on the field of gamification and on games and learning were of interest. In particular the identification of gamification elements was central. Furthermore, relevant research related to user experience was reviewed. Desk research was chosen in order to create an overview for the already existing work. The literature survey conducted goes under this category and does therefore not stand by itself as an individual method.

3.2.2 Game Analysis

Game analysis included both selecting the games and analyzing them, according to the results found in the desk research. In particular, how gamification elements were used in the game was studied

(RQ1). Not having an overview for gamification elements, making a new one was necessary for the game analysis. The game analysis was chosen as a method because it was one of the fundamentals for this research, and it was necessary in order to create the element list and a proper description of the game play in each game.

3.2.3 Field Trial

In addition to the desk research and game analysis, a field trial (also called field experiment) was carried out in order to study the user experience of game play, with respect to gamification elements (RQ2). Data was also collected in order to say something about whether or not learning was taking place (RQ3).

Field trials are a common method in HCI research where novel technologies are given to a set of real users to use (Poulson, Ashby, Richardson, 1996; Brown, Reeves & Sherwood, 2011). Field trials are also known as “*field experiments, deployments, evaluations, field studies, and technical problems*” (Brown et al., 2011, p. 2).

In a field trial one aspect the researcher can explore is how users understand the system. During the field trial the participants played one of two the games that have been reviewed. The data collection methods used during the study included:

- questionnaires
- observations
- pre- and post-tests

3.3 Questionnaires

The participants were given several different questionnaires to answer. Questionnaires are defined by the Oxford dictionary (University Press 2013b) as “a set of printed or written questions with a choice of answers, devised for the purposes of a survey or statistical study”. There are different types of conducting a questionnaire and the method chosen for this research is the self-completion questionnaire, which is when the participant has to answer questions by completing it themselves (Bryman 2012, p.216).

3.4 Observation

Observation research comes in several major types:

- Structured observation/ Systematic observation
- Participant observation
- Non-participant observation

- Unstructured observation
- Simple observation/ Contrived observation

A systematic observation, also called structured observation is a technique where there are explicit formulated rules for the observation and recording of behavior. Participant and non-participant observation is observing a group of participants in different settings and how involved the researcher is in the study; unstructured observation has no schedule and has the goal to obtain as much detail as possible. Simple and contrived observation means that the researcher stays passive and "hidden" from the participants, having no influence over the situation observed (Bryman 2012, p. 257). The method used for this research is structured and participant observation.

3.5 Pre- and Post-Tests

The pre-and post-tests are made for the participants to take before and after the game playing. This is to see how the games influence the results of the tests. Making the participants go through pre- and post-tests are one of 3 steps described on the field of classical experimental design (Bryman 2012, p. 36-37). Classic experimental design includes some of the essentials for field trials. The other two steps are experimental treatment (the games) and timing (the time used to play).

3.6 Qualitative Data Analysis

The data from the testing sessions were compared and placed in charts and tables in order to see the results more clearly. The participants' results from pre-and post-tests were also compared in order to reveal improvement or stagnation.

3.7 Validity and reliability

Validity can be categorized into several branches, i.e.; construct validity, internal and external validity. For this research, construct validity is the most relevant considering it revolves around the relation between the phenomenon researched and the actual data. Reliability concerns how truthful the measured results are, how data is collected and processed (Johannessen et al. 2002). Measuring validity and reliability is a challenge because there are several issues to take into consideration. The validity has the issue of whether or not the participants changes their answers and behavior knowing they are being observed. If using family and friends, they most likely would like the research to succeed and answer what they think would be the most desirable for the research. It would have been most desirable to spend more time on the testing sessions, getting to measure the results over time, however due to time constraint, the testing sessions happened over one session per participant. Because of the strict set of rules set for the session, it was considered as an solid approach. The participants were given very little information about the session and the other

participants in order to keep the data as formal and strict as possible, not giving them the option of guessing which answers were more "correct".

3.8 Summary

In this chapter the different research methods are described and explaining the different elements used in the research, such as field trial, questionnaire, observation, pre-and post-test. The chapter also explains how the data analysis was processed before the chapter is summed up with a section about validity and reliability.

Chapter 4 Learning Games

This chapter introduces the games that have been analyzed in this thesis and gives the reasons why they were chosen. Then different types of categorization is presented before a more detailed structure of learning games development are given, and finally a detailed description of each game and their gamification elements.

4.1 Choosing the games

Three learning applications and 2 games were chosen to be analyzed and played through in order to find the different gamification elements listed earlier (see section 2.5). Table 2 lists the five games that were chosen for this research by name, category, learning goal, age group and developer. The games were chosen to give a variation in learning goals, target groups, and category. **Backpacker 3**¹, a PC game I had in my possession and which I knew was a game suitable for most ages, teaches geography and professions in addition to being a well-rounded game. This is a commercial game not meant for learning or educational purposes and was released in 1994. There are several games in this genre that were considered such as Quiz Academy and the Buzz!-series. The problem with a lot of the quiz type games is that they are meant for multiplayer and are pure question-answer games with more of a guessing perspective and no learning aspect. Backpacker 3 has the option of single player, which was practical for the evaluation and it has several elements which includes obtaining knowledge.

Josefine Kaos i Kommaby² is part of the Josefine and Sofie series of games, which address different learning goals for children. Kaos i Kommaby was a game I owned and it is for Nintendo DSi (a portable Nintendo) and not for computers, which is practical for those on the move and gives an opportunity to play anywhere. Being on a different console it also gives a new feel considering the screen is a lot smaller and the steering mechanisms are different than pc and iPhone/iPad. Some of the games are also made for iPhone or iPad such as Josefine - Skolehjelp and Josefine Skolebøker, but the reviews given on iTunes are mostly negative because of bugs in the game and a lot of extra purchases. If giving an iPhone/iPad to a child where you can gain bonuses and save time by purchasing items for real money, the child might not understand the consequences of spending real money by accident. Using the game for DSi, gives the entire game right away with no possibility for this kind of mishap.

¹ http://www.panvision.no/1/1.0.1.0/33/2/?item=prod_prod-s1/13227

² <http://www.kreagames.no/josefine/>

Learn Spanish³ is a learning application for iPhone/iPad and was one of several in a series of language games from MindSnacks. The other languages available at the time are Italian, French, Portuguese, German and Chinese. After playing through the Spanish version, I chose to try out one of the others to see if there was any difference, but the game aspect is the same with the different languages. The Spanish language was randomly chosen. In appstore there is a wide variation of language applications such as Duolingo, several languages from the developer 24/7 Tutor Inc and Brainscape. However, when choosing the games, design was highly evaluated and very few of the games available have the “game”-look with graphics. If they had, such as the language games from Studycat, it was meant for children only, which was not desirable. Learn Spanish also won the 2013 Readers’ Choice Award for Best iOS app for people learning Spanish, held by About.com by 45% of the votes, winning over among others Duolingo (About.com 2013).

Dragonbox⁴ is a learning application which was chosen based on the learning subject math, attention in media, and that it suits all ages from 8 up. It has been featured in newspapers and received a lot of positive feedback and response (Bjørkeng 2013; Shapiro 2013), however one of the reviewers of the game reflects on that even though there is little to no doubt that learning games has a positive effect, the skills of logical thinking is very individual, game or no game (Omdahl 2012). This game is supported on PC, Mac, Android and IOS and in this research it was bought for iPhone. When bought, it has no possibility of extra purchases and it was easy to bring. Dragonbox has also won several prizes including International Serious Play Awards 2012 and Best of show and Best serious game for home learning. In 2013 Dragonbox 12+ was released as a sequel to the successful original aiming for a higher age group.

Democracy 2⁵ is a strategy/simulation game for PC, which according to the website is very well suited for school purpose. The game revolves around politics, economy and solving different problem areas such as hunger and poverty. It is probably the most complicated one of the chosen games considering all the information and functions, which needs to be learned. This game was chosen based on the topic it revolves around and the impression of being a more serious and “grownup” game than the other games, but could be played by younger participants as well as older. Alternatives to this game were different strategy games such as Civilization V and SimCity Social, but both of these games were found to “open” in game play to analyze properly.

³ <http://www.mindsnacks.com/subjects/spanish>

⁴ <http://www.dragonboxapp.com/>

⁵ <http://positech.co.uk/democracy2/educational.html>

The target group for the games is from 5 years and up. Backpacker and Dragonbox can be played by interested adults. Having a large target group was important for this research because the learning goals and learning outcome might be different for the groups. Backpacker was also developed in early 90's, which means it was released before gamification was a concept. This is interesting and a strong argument to choose this game. The other games are fairly new while Backpacker is of the older generation.

4.3 Categorizing

Different researchers have different ways to categorize games. Kickmeier-Rust (2012) categorizes learning games into 5 categories:

- Mini games for the youngest
- Simulations
- Off-the-Shelf Games / Moddings
- Game-like enhancements
- Competitive Learning Games

The games chosen for analysis in this thesis have been grouped into these categories, as can be seen in table 2. The table also shows the learning goal, age group and the developers.

Table 1: The games

Name	Category	Learning goal	Age group	Developer
Josefine Kaos i Kommaby	Mini games for the youngest	Norwegian writing	5-12 years	Krea Media
Backpacker 3	Competitive Learning Games	Geography and general knowledge about different profession	Not given, but out of own experience, 12+ years	Pan Studios
Learn Spanish	Competitive Learning Games	Spanish language	All ages, but require reading skills and basic understanding, so I would say 12+ years	MindSnacks
Dragonbox	Competitive Learning Games	Math	8 + years	We want to know
Democracy 2	Strategy / simulation game	Politics and economics	12+	Positech Games

Table 2: The elements category

Gamification element	Category
Achievements	Look and feel
Appointments	Feedback
Avatar/Mascot	Look and feel
Badges	Look and feel
Behavioral Momentum	Emotional
Blissful Productivity	Emotional
Bonuses	Look and feel
Cartoonish graphics	Look and feel
Cascading Information Theory	Discovery/Scaffolding
Combos	Look and feel
Community Collaboration	Emotional
Countdown	Feedback
Discovery	Discovery
Epic Meaning	Emotional
Free Lunch	Serendipity
Goal setting	Feedback
Hint	Scaffolding
Infinite Gameplay	Discovery
Levels	Feedback
Loss aversion	Emotional
Lottery	Serendipity
Ownership	Emotional
Points	Look and feel
Progression	Feedback
Quests	Discovery
Real-time feedback	Feedback
Reward Schedules	Feedback
Status	Feedback
Transparency	Feedback
Urgent Optimism	Emotional
Virality	Emotional

A second type of categorizing which was developed during the research involves the characteristics:

- Look and feel
- Feedback
- Emotional
- Discovery
- Scaffolding
- Serendipity

The different categories of characteristics are based on how the elements appeal to the user. Do they play on the feedback they give, or the emotions they create? In table 4 each gamification element has been categorized according to these characteristics. Learning applications need to have the element of fun in order for people to play and find it entertaining as well as educational. Hunicke et al. (2004) identifies 8 categories that make a game fun:

- Sensation, Game as sense-pleasure
- Fantasy, Game as make-believe
- Narrative, Game as drama
- Challenge, Game as obstacle course
- Fellowship, Game as social framework
- Discovery, Game as uncharted territory
- Expression, Game as self-discovery
- Submission, Game as pastime

The games have been categorized according to the fun list, as can be seen in table 3.

Table 3: Categories of fun

Game	Josefine Kaos i Kommaby	Backpacker 3	Learn Spanish	Dragonbox	Democracy 2
Categories of fun	Challenge Narrative Fantasy Discovery Submission	Challenge Narrative Fantasy Discovery Fellowship Expression Submission	Challenge Discovery	Challenge Discovery Expression	Challenge Narrative Fantasy Discovery

There are several areas where gamification can be implemented, whether it is in the mechanics of the game or in the design principles. Table 4 is based on the article "From Game Design Elements to Gamefulness: Defining "Gamification" and has been merged together with "What the user experience is" (Deterding, Dixon, Khaled, et al. 2011). The table displays how the element list is categorized into different levels of game principles. To see how it applies to this research, all the elements from table 1 have been added to show how the elements fit into the framework.

Table 4: Gamification elements categorized

			Gamification elements
Level	Description	Example	User Experience
Game interface design patterns	Common, successful interaction design components and design solutions for a known problem in a context , including prototypical implementation	Badges, leaderboard, level	Badges, level, status, reward schedules, progression, transparency, bonuses, combos, points
Game design patterns and mechanics	Commonly reoccurring parts of the design of a game that concern gameplay	Time constraint, limited resources, turns	Countdown, discovery, cascading information theory, hint, appointment, real time feedback
Game design principles and heuristics	Evaluative guidelines to approach a design problem or analyze a given design solution	Enduring play, clear goals, variety of game styles	Virality, achievements, goal setting, quests, infinite gameplay, epic meaning, community collaboration, lottery
Game models	Conceptual models of the components of games or game experience	MDA; challenge, fantasy, curiosity; game design atoms; CEGE	Behavioral momentum, blissful productivity, ownership, loss aversion, free lunch, urgent optimism
Game design methods	Game design-specific practices and processes	Playtesting, playcentric design, value conscious game design	Cartoonish graphics, points, avatar/mascot,

4.4 Evaluation of the games

This section presents each game and its evaluation. First each game is described and then the gamification elements that were found during game play are described. In order to evaluate the games each game was played several times. During the game play gamification elements were noted down and screenshots were taken.

4.4.1 Josefine: Kaos i Kommaby

Josefine:Kaos i Kommaby is one of many games in the Josefine-series for Nintendo DSi. It is a Norwegian game featuring the yellow bunny Josefine. Each game has one learning goal, and in this game the focus is to teach children about the Norwegian language. This is a learning game focused on children from the ages 5-10 and it is assumed that the player knows the difference between vowels and consonants and listens to instructions.

About the game

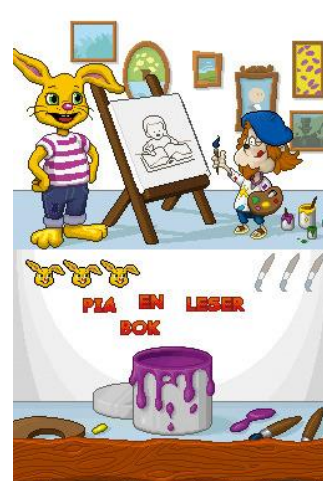
The players goal is to help Mrs.Ordglad to gather golden letters so she can complete a book for the other citizens in Kommaby to read. Kommaby consists of 3 Islands where Josefine can walk around, visit citizens and do different tasks for them, solve riddles and gather golden letters. The golden letters can be found while walking around on the island or can be obtained by doing tasks for the citizens. For each task, the player earns some golden letters and it's unlimited how many times a player can repeat the task. To finish the game, 7 sentences need to be written from a set of letters (for the first sentence the player needs to get 10 golden letters, then the second is 15, and so the number of letters needed keep increasing).



(a) Helping the baker



(b) Helping with the rhymes

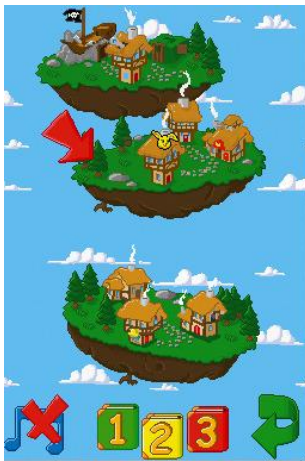


(c) Helping the painter

Figure 3: Josefine: Kaos i Kommaby

Each of the screenshots in figure 3 show examples of the different tasks the player needs to do in order to receive golden letters. Figure 3(a) shows the task where the player needs to know what a vowel is. The baker has made pies with letters on, but whenever a pie with a vowel is in front of him, the player is supposed to yell "Now" or blow into the microphone on the DSi in order for the baker to remove the pie. Figure 3(b) is a task where the player needs to make the sentences rhyme by choosing one of the alternatives on the right page after listening to the poem on the left side. Everything is read to the player so all that needs to be done, is to listen to the words. However, it does require reading skills from the player. Figure 3(c) is another task where the player hears a sentence in Norwegian and the words are given to the player, although not in the right order. The player hears the sentence and has to drop the words in the right order in the paint bucket. All of the tasks need to be completed correctly several times in order to receive the golden letters. If the player fails to do the tasks correctly more than 3 times during a game, they will have to start over.

Gamification elements in the game



(a) The Islands and difficulty
Figure 4: Josefine: Kaos i Kommaby



(b) Lettercounting



(c) Mrs.Ordglad

This game is (initially) intended for children and has the *cartoonish graphics* to back it up with colorful characters and background. Mrs.Ordglad keeps a book where the amount of letters she needs is shown (see figure 4(c)). When she receives the right amount of letters, she can complete a sentence on her blackboard. The *goal setting* is to finish all the 7 sentences she has room for. In figure 4 (c), the book is blank because a sentence has just been written and the amount for the new sentence has not been given. The book displays the amount of letters needed in order to finish the current sentence. The little blackboard on the upper right corner is how many letters the player has left to give. The player can deliver the letters at any time of the game, even if the amount is too low. The book and the little blackboard act as a *progression bar* and a *countdown*. All of the small tasks shown in figure 3(a), (b) and (c) are minor *quests*. By finishing these quests, the sense of *achievement*

is accomplished because the player receives a *bonus* in form of letters. Josefine always has the count on how many golden letters the player has collected, see figure 4(b). This gives a constant feedback on how many letters the player has collected which gives a sense of *transparency*. The letters also works as *points*.

As the player wants to finish the sentences and reach the main goal, a *behavioral momentum* is created that keeps the player playing the same tasks over again until all the letters are collected. Walking around on the island and meeting all the citizens is a way of *discovering* the game, in addition when certain tasks are completed, the player gets access to new places. When the sentences are written and the book is complete, the player can either start the game over or continue to play the task and exploring the Islands which creates *an infinite gameplay*. There are 3 *levels* of difficulty (figure 4(a), the books at the bottom) which can be altered anytime during the game. Throughout the game, Josefine talks to the player as a friend and thus represents a *mascot/avatar* for the player to relate to.

4.4.2 Backpacker 3

Backpacker 3 is a game developed by PAN Vision and has no age limitation. It is a quiz and travel simulator game where the concept is to travel the world and answer different questions about the cities you visit, and different professions. You also need to take different jobs to earn money for your journey and it is here the questions about the professions enter. This is a game where learning about geography and the different professions is in focus. The jobs are given to you if you answer correctly on the minimum required amount of questions. You also need to read facts about the cities you visit in order to answer the questions correctly. It is listed as a family quiz game on the developers' webpage. The game is for PC and Mac which later had 3 expansion packs released, but only the main game has been considered in this research.

There are 3 types of player options; single player, multiplayer 2-4 and online player 2-8 versions. In this research, single player was chosen. When choosing single player, two choices are given; Jorden rundt or Reiseeventyr (i.e. Around the world or Travel Adventure). Around the world is when the player wishes to travel freely and explore, while Travel Adventure is when the player chooses one of three missions to complete. These missions involve travelling to specific places in order to complete the given mission.

About the game

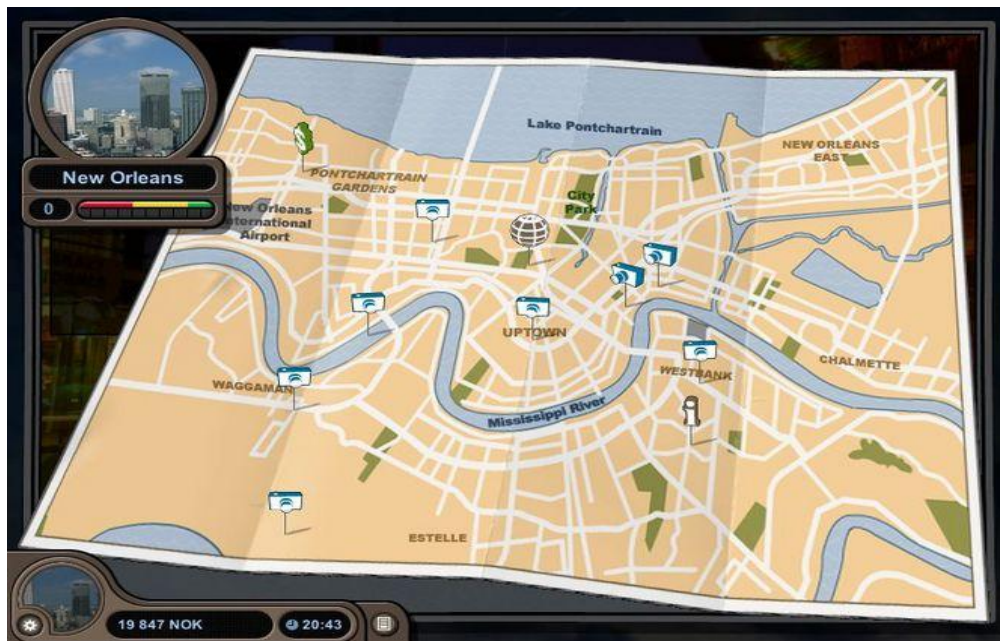


Figure 5: Backpacker 3, Destination, New Orleans

The player decides the starting city before the traveling starts. In figure 5 shows that the player has arrived New Orleans and is presented with a map of the city. The different icons represent different actions and events:

- The cameras represent information boxes. By clicking on the camera, one of the options is that the player will see a photo of for example a building and some information about it, which can be important later. The player will also get a question about the city, not related to the information given. You only get one chance to read the information and answer before the icon disappears.
- The dollar sign represent a job; these pop up randomly
- The "i" is basic information about the city, population, language, etc.
- The globe is the travel agency, where the player can choose to travel to different cities by boat, bus or plane.
- The bar in the left upper corner shows how much the player knows about the city, based on how many "cameras" they answer correctly.
- In addition, there is a "hand-shake" logo, where the player can get bonuses by answering a question or completing a minigame. The reward can be half price on tickets or more knowledge about the city.



Figure 6: Backpacker 3, Profession Pilot

In figure 6, the player has applied for a job as a pilot. Five questions related to this profession will be given and to get the job (and paycheck) the player has to get a minimum of 3 answers correct. The screenshot in figure 6 shows the easy mode, which has a bit simpler questions and lower demands than the hard mode. The easy mode, however, can have difficult questions such as "When did Knut Hamsun receive the Nobel Literature Prize?". However, you only receive the money and no further job or task if the amount of correct answers is correct.

Gamification elements

At all times, the player can choose to see which professions they have held and in which city in addition to which type of questions is answered correctly the most. The globe is a map for the player to see the different cities. The calendar shows how many days have been spent in the different cities, while the star is information about the mission in the Travel Adventure mode. This mode is a *goal setting* element, because the player is given one head mission, divided into several smaller tasks or *quests*, which also gives *achievements* when the quest is completed. The different bars shown in

figure 7 are *progression bars*.



Figure 7: Backpacker 3, Summary of the journey

If a player gets more than 2 questions right on a job "interview", a *bonus* is given based on how many right answers the player gives in the form of money. When applying for a job, there are 3 levels within the profession. When the easy one is passed, the second becomes available and then the third. This is a form of *discovery* because the player receives a new job offer if the previous is passed. The travelling to the new places also represents the discovery element, new information, new places and new people. The different levels of professions are a form of *status* and *level element*. This game can also be played again and again, and in the Around the world mode, the player can keep travelling without end, creating *infinite game play*.

In the Travel Adventure mode, the player is given only a little information at the time, making the player solving the mission little by little, functioning as *cascading information theory*. The game also encourages *behavioral momentum* and *blissful productivity*. Behavioral momentum is created based on the cities being different (with new information and jobs), but the tasks are the same, which enables the player to do the same actions in the different cities. The circle of "completing" a city is also the same: Read and answer the questions, apply the available jobs and if given a bonus (the handshake-icon), answer this as well before traveling to a new destination. The player is awarded with money and the opportunity to continue the traveling if successful, which gives the player blissful productivity. The game also gives positive feedback when answering questions correctly or getting a paycheck. The graphics are mixed between *cartoonish* and real life pictures. In some occasions, the player will get the handshake icon, getting the chance to win different prizes. Although the prize is

decided by the amount of money, how well you scored on the city questions and general results, it does create a *lottery* feeling.

4.4.3 Learn Spanish

Learn Spanish is part of a series of iPhone learning applications developed by MindSnacks, for those who want to learn a foreign language. The application is made for everyone who wants to learn the language, both beginners and intermediates. I chose to try out Spanish and Italian, but they were so similar it was only necessary to evaluate one of them. For the evaluation, the Spanish application was chosen because it is a language I have no knowledge about and I thought it would be good to start at a beginners point.

About the game

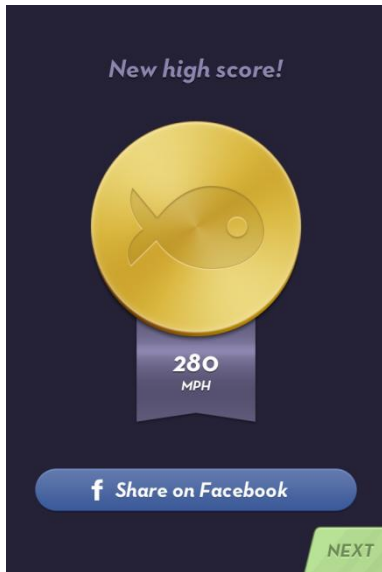
The player is to learn the Spanish language through a selection of lessons and minigames. The goal is to master the words and numbers given to you. The player can listen to the pronunciation as many times as needed (via the book icon in the upper right corner) while playing this game. At the beginning of the game the player must choose their level of difficulty based on how much they already know, see figure 9 (b). Two of the nine different minigames are unlocked when starting to play and the rest will be available when you reach higher levels. In the first minigame Swell seen in figure 8 (a) and (b), the player receives a word written on the screen and quickly needs to figure out what alternative is correct and tap on it before the time runs out. As the game goes on, the time limit is shortened. In the end the player will have lost all the lives (figure 8(b) in the upper right corner) and will receive a final score (figure 9 (a)).



(a) Menu screen
Figure 8: Learn Spanish



(b) Swell assignment

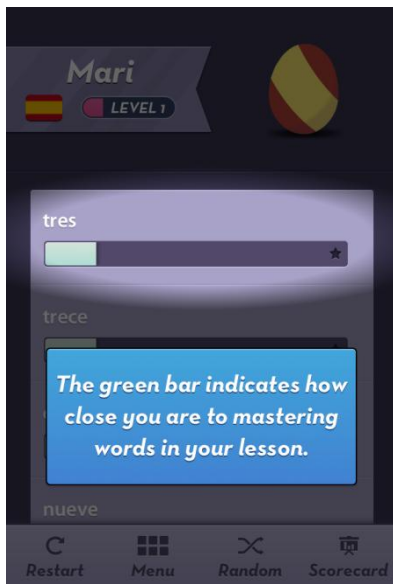


(a) High score
Figure 9: Dragonbox

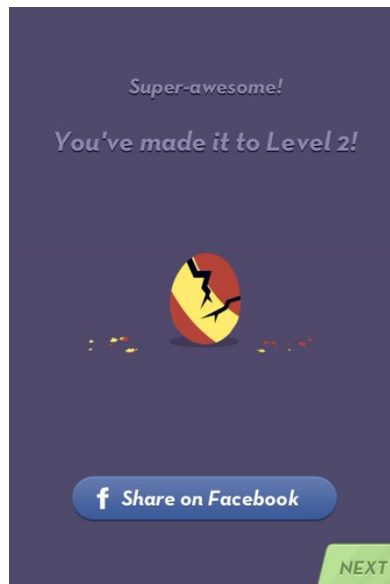


(b) Level of difficulty

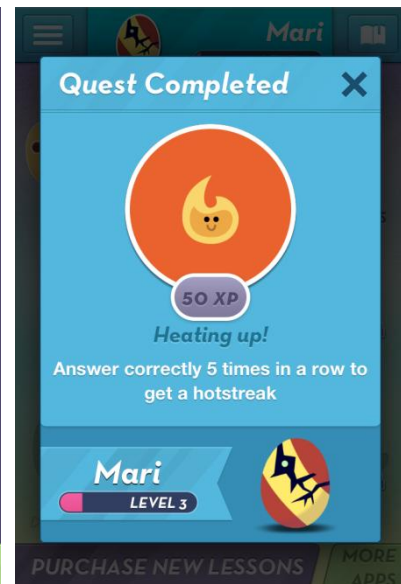
The score is transformed into experience points (XP) and when a player has gotten enough XP, they level up (see figure 10 (b)). When a player has finished a game, the game track which words/numbers the player answered correctly with the help of progression bars (see figure 10 (a)). When a progression bar is full, the game considers the word/number as mastered and shown less frequently. The player sees the progression bars after each game so it is easy to keep track of which numbers need more practice.



(a) Progression bar
Figure 10: Learn Spanish



(b) Level up



(c) Quests

Gamification elements

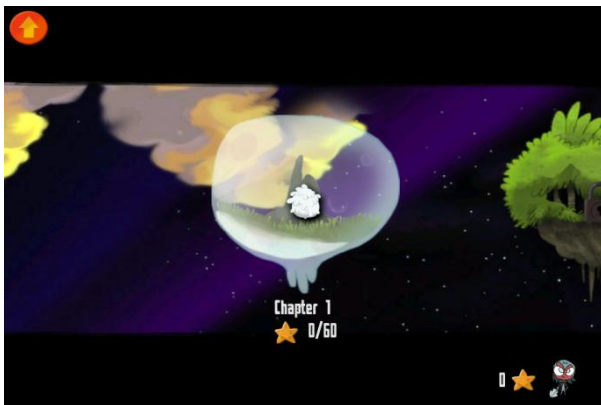
This application has a lot of elements, starting with the graphics. The game uses a lot of bright colors and cartoonish graphics. As seen on figure 8 (a) and 10 (a), there is a *progression bar* along with the *level* counter. The *points* made in the games are what "feed" the progression bars. There are 9 different minigames to learn from and the *goal setting* is to master every lesson the player is given and over all improve the Spanish language. When *achieving* higher levels (as seen on figure 10 (b)), the different minigames unlock. While playing these different minigames, the player receives different *quests* (figure 10 (c)) with *badges* to picture the different quests. The game gives a lot of encouragement to keep on playing the same minigames over and over again, which creates *behavioral momentum* and *blissful productivity*. The tasks are time limited and have a *countdown*. There is also a form for *discovery* in unlocking the new games and the little egg *mascot* (in figure 10 (b)) who becomes more and more visible per level, gives the player *ownership*, because the mascot grows as the player earns experience points and gaining higher levels. Seeing the development of the egg makes the player attach to it. The game also creates *urgent optimism* for the player because conquering a task gives the feeling of mastery and the ability to conquer this language challenge.

4.4.4 Dragonbox

Dragonbox is developed by We Want To Know, a Norwegian-French company. According to their website the game is meant for ages 8 and up, but they also state that this game is for everyone wanting to learn algebra. Dragonbox is a math game, which aims to encourage and teach algebra in an easy and fun way. Dragonbox has also been featured in several news reports because of the game's success. It has been tried out in different schools settings as well.

About the game

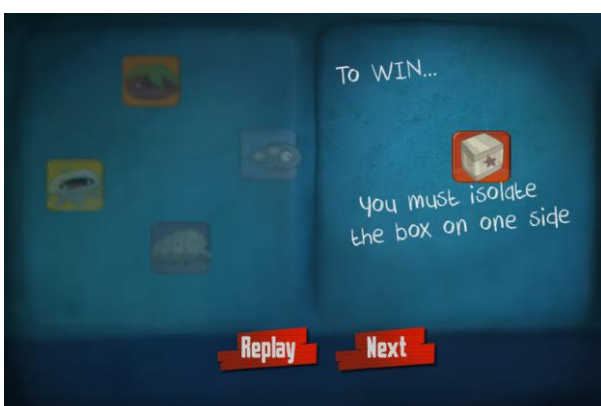
The game begins with the player choosing an avatar and creating a user. It is divided into different chapters or worlds as seen in figure 11 (a). In order to unlock the next chapter, a certain amount of stars must be achieved. The player is given a tutorial along the way with all the game mechanics and different possibilities in the game. Figure 11 (b) and 12 (a) shows the main goal of each level.



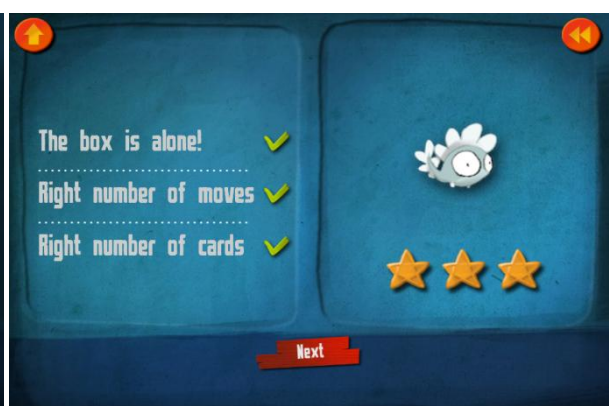
(a) Chapter 1
Figure 11: Dragonbox



(b) Tutorial part one)



(a) Tutorial part two
Figure 12: Dragonbox



(b) Level completed

The player is given a selection of cards at the beginning of each level. These cards are the starting point for eliminating the other cards from the two sides. For each card the player adds to one of the

sides, the opposite side must also have the same card added. The player has to isolate the box, by eliminating the other cards on the box's side. At every level, the player has a number of maximum required moves in order to solve the level. When the box is isolated the player receives points as seen in figure 12 (b). In order to get the maximum score of 3 stars, the player needs to isolate the box on one side, use the right amount of moves and cards.

For each chapter the player starts with an egg or similar small creature, who grows as the levels are cleared (the little creature in figure 12 (b)). When all the levels are completed in a chapter, the player will have "grown" a monster as the one seen in figure 13 (b). When all the chapters have been completed the player will have grown 6 monsters and become the "Algebra master".

Gamification elements

The game starts with the player choosing an *avatar* creating a user profile; however, we do not see this avatar in any other context than choosing which player you are when starting the game. In the game, a small creature is shown at the end of each level (see figure 12 (b)) and this becomes the *mascot*. The *cartoonish graphics* also makes this appealing to children in addition to adults. The *goal setting* is to finish the chapters and unlocking all the levels and become the algebra master. The chapters are divided into 20 *levels* as seen in figure 13 (a) and in order for the player to unlock the next chapter, this is *achieved* by earning at least one star in every level at the current chapter.



(a) Levels in chapter 1
Figure 13: Dragonbox



(b) Chapter 1 finished)

Blissful productivity and *behavioral momentum* are two elements that are created in this game, behavioral momentum as the player has to conduct the same set of actions in order to complete a level; isolate the box by using the correct number of cards and moves and blissful productivity as the player is rewarded with stars and growth of the monster at the end of each level. The stars represent a form for *bonus* and the checks combine them into a *combo*. The stars also work as *points* and the different levels and chapters unlocking are the *progression* of the player. This is also a game where

community collaboration is present as the game allows several people to play together and help each other; it is a game where logic and thinking together can be an advantage. If a child is struggling with math, the family can get together and play with this child, in a small form of community collaboration. The given number of maximum moves is a form of *countdown*. The tutorial presented over several levels giving new information and options is *discovery* to the player. The element of *urgent optimism* is created by the player conquering the different levels and the basic knowledge of algebra.

4.4.5 Democracy 2

Democracy 2 is a strategy/simulation game developed by Positech Games for PC and Mac, and is a sequel to the original game Democracy. According to their website, the original game was used in schools:

*"The original 'Democracy' game was used in a number of different schools and colleges to get students interested in the normally 'dry' subjects of politics and economics. Terms like GDP and Manifesto don't *have* to be boring, and Democracy showed how they could be integrated into a game that students found fun and challenging, whilst also teaching them about political principles and systems"*

Unfortunately it doesn't say which schools. As the quote says, the game is developed for teaching politics and economics. Democracy 2 was chosen over the original because reviews given of the game pointed to the direction of the original being outshined by the new version. In October 2013 a new version, Democracy 3 was released. The target group for Democracy 2 is not stated, but after playing the game, it seems appropriate for the age group 12+.

About the game

In this game, the player assumes the role as prime minister/president in a country with different problem areas. In the demo only one mission is unlocked (as seen in figure 14), the mission named Malaganga.



Figure 14: Democracy 2, The different missions and countries

This fictional country has a lot of issues which is presented to the player at the beginning of the mission (e.g., homelessness, high crime rate, alcoholism and diseases). The goal for the mission is for the player to solve these issues through different actions. The game is turn-based, so when the player has conducted the desired tasks for one day, the turn is over and the player is given a new day with an overview of what happened based on the actions from the day before in addition to tasks needed to be done the following day such as choosing a new FN ambassador.

Gamification elements

After choosing a mission you get a welcome screen with information about the mission you just accepted. Beneath the mission briefing, the player is given the current situation in the country, including problem areas. In figure 15 (a), the cursor is held over the *badge* saying the country suffers from homelessness.



(a) Main screen for mission
Figure 15: Democracy 2



(b) Policy Dilemma

These problem areas can be considered as separate quests to solve and the main goal setting is to solve all of them. The game presents the player with real life issues which makes the player feel responsible for the consequences of the actions taken, creating loss aversion. Getting attached to the game also creates ownership. Democracy 2 is a political game, where the player has different ministers and such to "handle" and communicate with. These are represented by *avatar* pictures. The feedback given by the game on the issues and the solving of them creates *blissful productivity*. By playing in turn and doing a certain amount of tasks for each turn, the game itself repeats itself and creates *behavioral momentum*. The game also gives a descriptive tutorial and has a *hint*-function built in, as seen in figure 15 (b). In the screenshot, a choice is given to the player; which UN Ambassador to employ. Whatever the player chooses has consequences for later; however, the consequences are randomly chosen and therefore add a *lottery* aspect. The thought of solving all the problems for a country gives the game an *epic meaning*. The *progression* is shown through *transparency* in the game. The main screen (figure 15 (b)) always shows the money flow and when ending a turn, the player gets an update on the different problem areas. This gives a form of *discovery* for the player and the player is also given a sense of *urgent optimism* and a hope to actually solve these problems.

4.5 Summary of elements

All the elements found in the games are summarized in table 5.

Table 5: Summary of elements in the games

	Achievement	Avatar/Mascot	Badges	Behavioral momentum	Blissful productivity	Bonus	Cartoonish graphics	Cascading information theory	Combo	Community Collaboration	Countdown	Discovery	Epic Meaning	Goal setting	Hint	Infinite game play	Level	Loss aversion	Lottery	Ownership	Points	Progression	Quests	Status	Transparency	Urgent optimism
Josefine: Kaos i Kommaby		x		x			x				x	x		x		x	x					x	x		x	
Backpacker 3	x			x	x	x	x	x				x		x		x			x			x	x	x		
Learn Spanish	x	x	x	x	x		x				x			x			x		x			x	x			x
Dragonbox		x		x	x	x	x		x	x	x	x		x		x					x	x				x
Democracy 2		x	x	x	x							x	x	x	x			x	x	x		x	x		x	x

All the learning applications and games has a fair amount of elements including some in common; behavioral momentum, goal setting and progression.

4.6 Developing learning games

When developing learning games, the approach is different from making a regular commercial game. In learning games, user experience along with the learning goal is what should be in focus. Figure 16 was created by Daniel Schwarz (2013) and presented by Michael Kickmeier-Rust in the book "An Alien's Guide to multi-adaptive educational computer games" (Kickmeier-Rust 2012) where the intention is to show how to most effectively design a learning game. By taking a closer look to this model, hopefully it can show how the gamification elements are implemented during the development process.

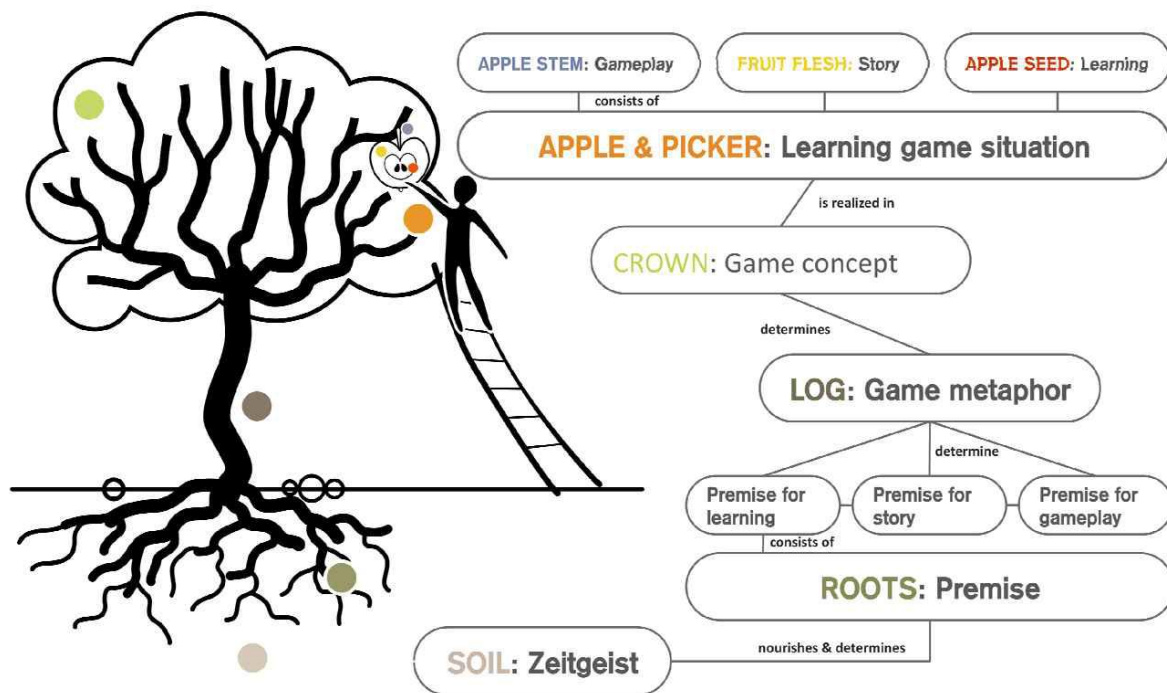


Figure 16: Apple tree and picker (Kickmeier-rust 2012)

It presents the Apple Tree and picker model for game design, how to develop a learning game and how the user benefits from it. To see how it applies, the figure will be tested with one of the games evaluated, Backpacker 3. My original plan was to describe Dragonbox with this model, but after talking with Daniel Schwarz (2013) it was concluded that the model best suits adventure games. Backpacker 3 was the closest to fit the adventure-genre and was therefore chosen over Dragonbox.

The tree figure starts with the zeitgeist, which represent the starting point and the basic knowledge to start with. It is here the main questions and goals are developed before moving up to the premise of the game. For Backpacker 3 the goals and questions revolve around geography and different professions. The premises leading up to the log sets the tone of the game and builds the foundation for the goals of the learning game. The article points out that there are two types of objectives in a learning game: educational and motivational (see figure 17). In Backpacker 3, the premises lines up for an adventure tone of the game with the music and the missions. The educational objectives of Backpacker 3 are:

- Basic understanding of geography (where the cities are on the globe)
- Basic understanding of different professions
- Good understanding of geography (the details to each city)

Educational objectives of the topic Geography in 80days	Motivational objectives	
	Main Motivational Means	
<ul style="list-style-type: none"> • Basic Geographic Instruments, use of maps and globes • Basic Knowledge of the Earth • Physical Geography Processes and Implications • Human and Economic Geography processes and Implications 	<ul style="list-style-type: none"> • Create suspense • Create curiosity • Create meaning • Create challenge 	Game play
	<ul style="list-style-type: none"> • Create emotion • Create affection • Create desire • Create immersion 	Storytelling

Figure 17: Objectives of Backpacker 3

The motivational objectives are what create the game play and storytelling. In table 6, the lists of gamification elements (recall table 4) are sorted into the motivational objectives. The only objective not met by the gamification elements is the desire-objective. Several of the elements could be placed in multiple objectives, however, to keep it simple, they are placed in the most suited one.

Table 6: Motivational objectives and element list

Suspense	Curiosity	Meaning	Challenge	Emotion	Affection	Desire	Immersion
Cascading information theory Countdown Hint	Badges Infinite gameplay	Community collaboration Epic meaning Free lunch Status	Achievement Bonuses Combos Goal setting Level Points Quest Virality	Behavioral momentum Blissful productivity Loss aversion Lottery Ownership Urgent optimism	Avatar/Mascot Cartoonish graphics Reward schedules	?	Appointment Discovery Progression Real-time feedback Transparency

The next step is the log, or the game metaphor. The game metaphor is used to help the player understand what the game is all about, understanding the goals, challenges, elements and the rules of the game. The metaphor in Backpacker 3 is that the player is taking a leap into the unknown, creating a path on the go. From the metaphor the figure moves up to the crown of the tree which

represents the game concept. The crown is based on three branches: the branch of goals, structure and content. The branch of goals consists of the learning, game play and story objectives, the structure branch revolve around the game concept while the content branch takes the skill list and the learning action categories for these skills. The goals have already been explained earlier this section, the structure of the game can be read in section 4.4.2, while the skill list and learning action categories address what skills the game teaches, and how they teach it. In Backpacker 3, one of the skills is learning geography. This can be learned through the tutorial, by observation and reading and by answering questions about the cities. Other skills are knowledge about the professions and knowledge about the cities. The last level of figure 15 is the apple and the picker. The apple represents the game play, learning and story, while the picker is the learning situation and the player.

The article also mentions the different challenges with developing learning games, which are finding a suitable game metaphor, creating a good game concept, transforming the factual knowledge to be learnt through action-oriented learning and creating a good story line. Talking to one of the two authors, it became clear that the figure could be more open for different types of learning games as it now is primarily for adventure genre. However, the model does also show how the gamification elements are early implemented in the process of developing learning applications.

4.7 Electing games for testing

Out of the 5 games analyzed, 2 of them were selected to use in the testing sessions. The reason for choosing not to test all the games is due to time constraints and the need for different research methods if choosing all 5. The two games chosen for the testing sessions are Learn Spanish and Dragonbox. Both games are suitable for all ages and they cover two completely different skills. The solving of problems is also different in the games with one having a “memorize and learn” approach while the other has a “learn by doing” approach. Josefine:Kaos i Kommaby is developed for younger children learning Norwegian grammar which, considering the age of the participants were not appropriate. Backpacker 3 would require a lot more time in the testing sessions and would perhaps demand a different research approach considering the broad range of the game and the randomization of job opportunities in the different cities (if travelling to the same places, they still would get different questions and choices). Democracy 2 is also a game of range and would need more time and a possibly another research approach. The game is also very complex and requires the participants to understand and handle the English political terms in addition to basic knowledge about politics in general.

4.8 Summary

Chapter 4 presents a game analysis and evaluation for the chosen games in the research. The chapter

also presents different types of game and element categorizations. Backpacker 3 was analyzed according to a game design model, created by Daniel Schwartz and presented in Kickmeier-Rust book (2012) before summing it up with the reasoning of choosing games for testing session.

Chapter 5 The Field Trials

This chapter presents the results of the field trials for each of the 2 games. The chapter begins, however, with a presentation of how the field trials were organized.

5.1 Field Trial Structure

In order to research on whether or not the gamification elements has an impact on the learning application and outcome, the participants were given no other information about the testing other than that they would be answering questions and playing a game. The field trial is structured in a way so the gathering of information covers both gamification elements and user experience.

5.1.1 Background Information

All of the participants were given the same information with minimal help, the questionnaires were made in advance and the participants were not given any information other than that each answer is good, whether it is “yes” or “no”. Considering the testing was kept as formal as possible and with no good purpose for lying, the data collected was therefore found valid and reliable.

5.1.2 Questionnaires

Together with some structured interviewing elements, these two methods form the base for the testing session appendices (see Appendix A, B, C). Three of the questionnaires has questions at the top which were given before playing the games, the first one was merely to get a basic understanding of their starting point on the topic, along with age, relationship to games in general, see Appendix A first half. The second was to understand their relationship to the topic (Spanish or algebra), see Appendix D and E first part. The third was given after playing the game based on the gamification elements found in the games. If they noticed the elements, found them motivating or irritating and if they felt some of the elements were more visible than others (see Appendix B and C). On this particular questionnaire, the participants were given the list of gamification elements in order to understand what the different elements revolved around. The last questionnaire revolved around how they felt the post-test was compared to the pre-test and if they found the game useful as a learning substitute (see Appendix A last part).

5.1.3 Observations

The decision to observe the participants was mainly to be able to observe the feelings and emotions expressed when playing the games. This was also a reason to why the participants were separated, so the main focus would be on the individual. There are different types of observation:

There are 7 major types of observation research (Bryman 2012, p.255-257):

- Structured observation/ Systematic observation

- Participant observation
- Non-participant observation
- Unstructured observation
- Simple observation/ Contrived observation

The two most relevant ones for this research are structured and participant research. Participant research involves observing the behavior of the participants, usually a group of people during an extended amount of time. The data gathering happens through listening, observation and interviews. This approach is also called ethnography and despite that it usually include several participants at the same time, this is the most appropriate for describing the approach in this research. Structured research involves implementing a set of rules for the observation and the behavior of observation. The participants are observed with the same set of rules, which is often articulated in a observation schedule. The schedule has the purpose of making sure the participants behavior is systematically recorded (Bryman 2012, p.257). The approach used in this research is a mix between the two types, considering all the participants followed a set of rules and layout of the testing, but they were not in a group during the sessions. Meeting the participants individually made the observer role visible and the participants were allowed to ask questions, although not guaranteed an answer. Using the structure of structured observation and the data gathering and observer role from participant observation became a solid approach for this research in order to get the data and environment wanted.

5.1.4 Pre-and post-tests

The pre- and post-tests were made to see the starting knowledge and the progress for each participant. Learn Spanish had 2 tasks, while Dragonbox had 10 tasks. Learn Spanish had one fairly simple task, translating the numbers 1-10 from English to Spanish and one where you had to draw a line between the correct English and Spanish words, see figure 18.

TEST 1:

Translate from English to Spanish:

One	
Two	
Three	
Four	
Five	
Six	
Seven	
Eight	
Nine	
Ten	

TEST 2:

Connect the right words together:

Toilet	La toalla
Sink	El lavaplatos
Shower	La estufa
Tub	El indoro
Towel	La tina
Stove	El jardin
Garden	La ducha
Dishwasher	La tasa
Table	El lavabo
Cup	La mesa

Figure 18: Learn Spanish tasks

Dragonbox had different algebra tasks with a variety of difficulty. In order to measure the progress (or the lack of it) it was important to make the tasks so that each participant was able to answer at least one task. This is also why the tasks had different difficulty level. A pilot testing session was conducted before running the real testing sessions and then analyzing the findings, answering the research questions.

5.1.5 Issues

During the research there were some issues and challenges to take into consideration. One issue discovered was the identification of the participants. Having used the numbers P1-P4 on both games instead of P1-P8 made it somewhat confusing from time to time presenting the results in a structured way. However this had no impact on the results or the participants. During the testing session it became clear that some of the games had more elements then initially mentioned during the game analysis. However, this had no impact on the results as the element was infinite game play in Dragonbox and Learn Spanish, which would not be seen by any of the participants considering they did not play for a long enough amount. When finishing the Dragonbox application the players were considered finished, not giving them the chance to discover this element. Another issue to take into consideration is the challenges of validity and reliability as mentioned and described in section 3.7. One last issue which occurred during the testing, was the point and combo elements in Dragonbox. They were both represented by the stars given at the end of each level (see section 4.4.4) and

confused some of the participants who had the impression that one element in the game could only represent one gamification element, causing them to doubt their own findings in the game.

5.2 Pilot testing

A pilot study was carried out to test the organization of the study and the data collection instruments. This was also to see if there should be done any changes in the procedures planned. The pilot tester for both applications was a female, 24 years old with good English skills, both verbal and written. During the pilot testing some key issues were identified:

- The time estimate for the tasks in Learn Spanish was way too long, resulting in reducing the time from 5 to 2 minutes.
- The time estimate for the pre-game test in Dragonbox was a bit long, so edited it into the option of early delivery.
- Important when giving the time estimate on Dragonbox, remembering to count in the complete testing with the questionnaire and pre and after test.
- The ID creation was really not needed, as they are referred to as P1-P4 in the research.
- The element "free lunch" was somewhat misinterpreted. The participants were asked to ignore this when answering the questionnaire.

One other major point which the pilot testing revealed had to do with sound and music. These were not identified earlier as gamification elements. Observing the test piloting it became clear that the sounds definitely had an impact. The test pilot hummed to the music, expressed feelings when the sounds for right and wrong answer were played. This resulted in an additional question being added at the end of the element questionnaire asking whether they found the sound and music either pleasing, irritating or didn't notice.

5.3 Dragonbox

Dragonbox is a learning application focusing on math and algebra. There are two versions of this game developed now, and the one used in the testing session is Dragonbox 5+. For more on the game see section 4.4.4.

5.7.1 Organization

There were 5 phases to the testing session:

1. Starting questions
2. Pre-test
3. Game playing

4. Post-test

5. Ending questions and questionnaire

To begin the testing, the participants had to answer some questions (see Appendix A first half) and take a pre-game test (see Appendix D). On the pre-game test they were given 20 minutes, but had the option of deliver early. After delivering the test, they started the learning application. The learning application have 5 chapters and for every chapter they gave notice and their time was written down and between the chapters they could take a break if this was necessary. Initially the time estimate for finishing the application was about 3 hours. The testing took place wherever the participants had the opportunity, whether it was out on a cafe, at home, or at school. When being in a "noisy" environment, the challenge was to have the participant completely focused on the task. The participants were given one "task" at a time. First the starting questions, then the pre-test followed by the game etc. This was to keep their focus on the given task and not letting them have all the paperwork at once, stressing over what comes next. After they completed all 5 chapters of the learning application, they answered some post-questions (see Appendix A last part), post-test (see Appendix D) and a questionnaire about the gamification elements (see appendix B).

5.7.2 The participants

Four participants (P) for this testing session were chosen based on their knowledge in math and algebra in addition to their relationship with digital games. The age range was 23-28 years and mixed gender. The educational level was from middle school to master degree. They also had different experience with math classes and courses. The information given in advance was that the subject of the testing was math/algebra and the time estimate to complete the testing. P1 has a moderate relationship to the subject, P2 dislikes it, and P3 strongly dislikes it, while P4 is quite comfortable with the subject but it had been quite some years ago this was relevant. P3 is the only one out of the four who plays several digital games on different platforms (PC, smartphone and playstation 3). The other participants play mostly on their phones, and P1 also added solitaire, which is played on the computer.

5.7.3 Testing session

With the exception of one, all of the participants finished the game, playing through all the chapters. The participant not finishing the application, P2, spent 30 minutes on the last level (in chapter 5) before uttering the wish to give up. Considering the fact that it was the last level and the last chapter it was allowed. P2 still took the after-test and answered all of the required questions. P2 was allowed to do this, because it was the last chapter and one of the last levels so it would have no particular impact on the results. All of the participants reacted negatively when seeing the pre-test, making

statements such as "oh no, am I supposed to do these?!" and "that is not going to go well" before even starting. However, when the game was played, they all seemed more motivated and positive about the tasks. P1 went from saying "uh, I can't do this one", to "I'll come back to this one". The task ended up being solved. When scoring the answers on the questionnaire, half a point was given on every "maybe"-answer. P3 in particular found it somewhat difficult to answer a clear "yes/no" answer, and ended up giving some "maybe" crosses as seen in figure 23.

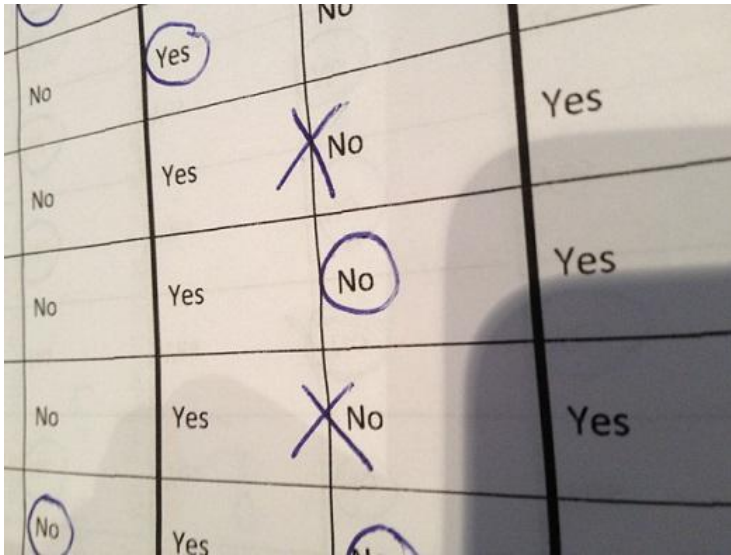


Figure 19: P2s answers on element list

On the post-test, most of the participants spent more time on the tasks in addition to seeming more positive about the tasks. P3 stated that the tasks went better on the post-test but did one less attempt on the tasks because after playing it became clear that "I now know, that what I tried on the pre-test was wrong, so I'm going to leave the task unsolved this time".

5.7.4 Data collection

The data for the research was collected through the questionnaires, the tests, observation and the game.

5.7.5 Findings Dragonbox

The result from the element questionnaire on whether or not the participants noticed the different elements is shown in figure 20. The chart is based on how many "yes" were crossed off in the questionnaire, and 0.5 point for every "maybe" answer. The reason for given points on "maybe" was simply because the participants was not sure if they had noticed the element, or that they thought they had, but were unsure.

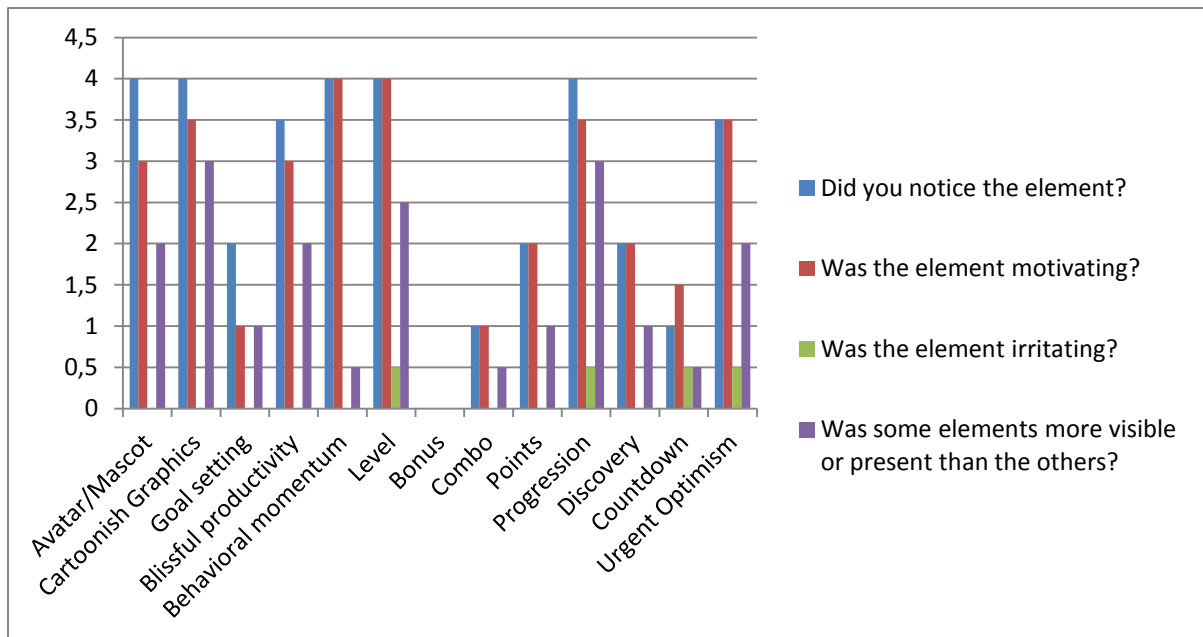


Figure 20: Element questionnaire Dragonbox

Only 5 elements were found irritating and they only got half a vote, which means the participant thought it was slightly, "maybe" a bit irritating not being completely sure how to feel. The bonus element is not noticed by any of the participants; otherwise all the elements were seen and observed one or more participant. Bonus, however it is not an element easy to spot in Dragonbox and the element is usually more visible in standard games where it often is represented with big letters or a voice saying "bonus". The stars given at the end of each level are also indicators of points, which 2 of the participants noticed. If the participants did not know or think that the stars could represent two elements (bonus and points), they might have eliminated the least probable, but this was not asked during the testing sessions. Five elements were noticed by all the participants; avatar/mascot, cartoonish graphics, behavioral momentum, level and progression, but only behavioral momentum and level were found motivating for everyone. Goal setting and combo scored low on the motivation scale, but also found more visible than the others by one of the participants. The cartoonish graphics and progression were the two most visible elements for the participants.

If not taken into consideration that P2 giving up on chapter 5, chapter 3 was the one taking the most time from the participants, while chapter 1 and 4 took the shortest amount of time to finish as shown in figure 21 below.

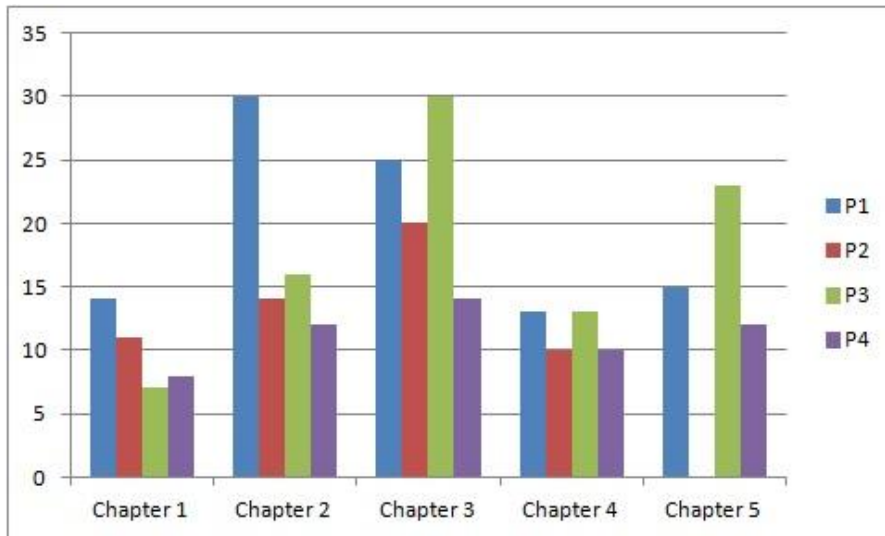


Figure 21: Time spent on each chapter Dragonbox

On every chapter beside the second, the participants spent almost the same amount of time. P4 spent the least amount of time on the chapters, which, when looking at the relationship to the subject (see section 4.2.2) is somewhat expected. The other three participants had an average about the same, counting in the 30 minutes P2 used on chapter 5 before being allowed to stop.

P2 also had two tasks where the plus and minus was mixed, so P2 was given 0.5 point per misunderstood task. In table 22 the amount of correct answers before and after the test is presented. All of the participants improved their score from the pre-test.

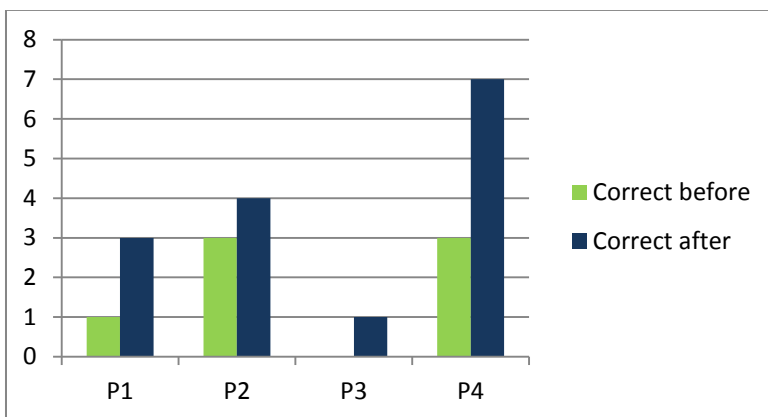


Figure 22: Correct answers Dragonbox

Another observation was the number of tasks they attempted to solve before and after playing Dragonbox. With exception of P3, as seen in table 23, all of the participants improved their number of attempted tasks. This gives the impression of the motivation being lifted after playing the game, which is very important for the educational purpose.

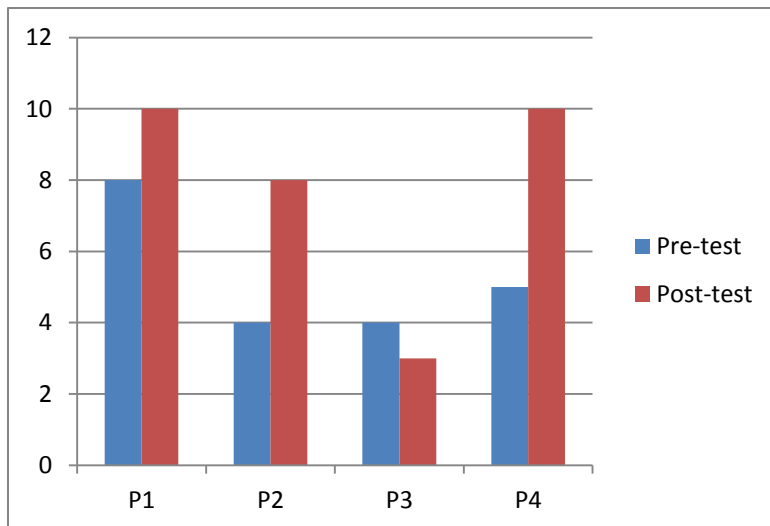


Figure 23: Attempts on tasks Dragonbox

Even though P3 did not improve the amount of tasks attempted to solve, the results on how many correct answers still improved. Being aware of knowing that the approach tried in the pre-test was wrong, was also an important finding. It shows that the participants understand the right approaches even if they are not able to solve the tasks afterward.

5.8 Learn Spanish

Learn Spanish is a learning application focusing on the Spanish language. The game is according to the website great for all ages. Because the game is in English, all of the participants were informed of this and that they had to have a basic understanding of English. For more on the Learn Spanish game, see section 4.4.3.

5.8.1 Organization

There were 5 phases to the testing session:

1. Starting questions
2. Pre-test
3. Game playing
4. Post-test
5. Ending questions and questionnaire

To begin the testing, the participants had to answer some questions (see Appendix A first half) and take a pre-game test (see Appendix E). On the test they were given 2 minutes per task, but could deliver before time. Two minutes may seem short, but the tasks the participants were given were quite short and quick to answer.

The application has several lessons (numbers, time, calendar, conversation etc) so for this test "Numbers 0-20" and "The house" were chosen. All the lessons have 21 words and they have the possibility to see how the words are written and pronounced before starting one of the minigames. The participants had to choose a level of difficulty based on their current knowledge of Spanish and a tutorial is then given by the application about how it works, and on game number 1 called Swell, see Figure 8 (a) and (b). The lesson was changed to "Numbers 0-20" and the participants were given 10 minutes to play the two first games, Swell and Belly, before they had to take the test over again. Then the procedure was repeated with the second lesson "The house". In the 10 minutes given they were able to listen to the words and play the two games. They were not given any rules on how to manage their time other than that they had to play both the games at least once. They were also given a notice on the time spent if wanted.

After the testing was finished, the participants had to answer a new sheet of questions (see Appendix A last part) before taking the post-test (see Appendix E) and fill out a form based on which elements they noticed and not (see Appendix C).

5.8.2 The participants

Four participants (P) were chosen for the testing session based on their knowledge of Spanish (and English considering the application is in English), educational level and age, trying to test as many different factors as possible. The age range was from 23-56 and the educational level was from high school to a bachelor degree. The information given in advance was that they were taking a small test in Spanish and playing a game, before answering some questions. Their experience with the subject varied from completely beginner to "somewhat understands it". Although they all crossed of beginner on the questionnaire, P2 used to have a vacation house in Spain and not unfamiliar with the language, P3 also wrote a comment on the side saying "holiday Spanish". When choosing their difficulty in the game (see figure 9(b)) the participants chose either "Non-existent" or "Jumbled up words without any structure". P2 and P3 are the only participants playing digital games besides on their phone. P4 only plays the game Wordfeud (digital Scrabble).

5.8.3 Testing session

All of the participants understood the tutorial and played through without problems. After having explained they had 10 minutes per lesson to listen and play, they started right away. It was obvious that all of the participants thought the testing was based only on their knowledge and how well they did and not the gamification aspects. P4 stated during the testing "I have to remember this, because I guess I have to take the test again or something". Which also was correct, but when given the element list at the end of the testing session they seemed a bit surprised and P1 stated "Oh, so THIS

was the real purpose". P2 spent the most amount of time listening to the sounds. P4 also spent some time studying the words before starting the games, but neither of the other two spent any significant time on this. P1 and P2 got very emotional when playing, showing frustration when answering wrong and joy when answering correct. P3 seemed excited but calm while playing, which was opposite to the other participants. P3 laughed when answering incorrect after having played for a while and pointed out that "the answer should be obvious by now". P4 was calm through the playing and answered almost everything correct right away. When taking the post-test P4 panicked for a while having a "brain freeze" on the numbers, which reduced their total score. P3 pointed out during the post-test and questionnaire that it would have been beneficial with more time to see the learning outcome a bit clearer. In figure 23, P2 has answered the pre and post-test, and the number they answers improved. In addition, when answering the first test, writing the numbers, P2 spent time counting on fingers, talking out loud to get it right and mixing the numbers seven and eight. On the post test, there was no hesitating and P2 seemed surer of the answers.

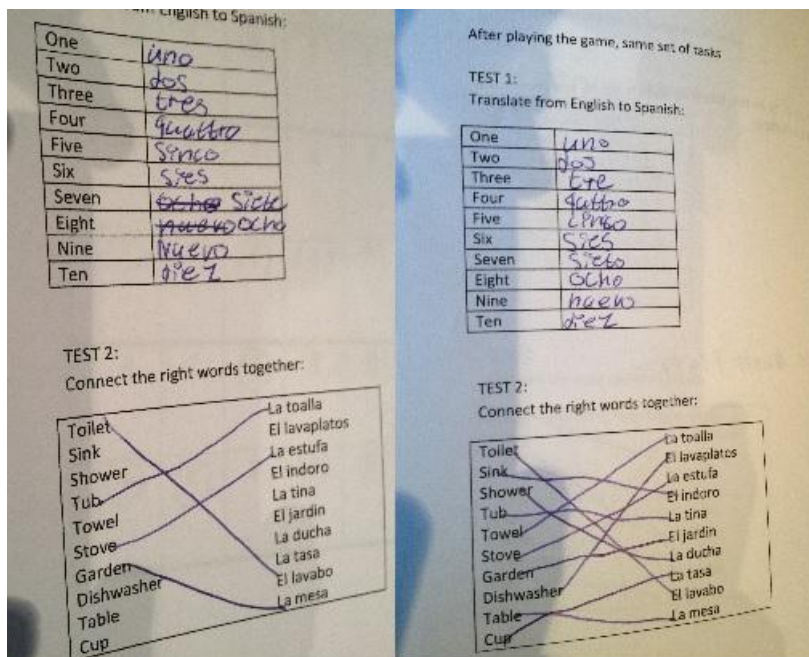


Figure 24: P2 Pre and post test in Learn Spanish

5.8.4. Data Collection

The data for the research was collected through questionnaires, the tests, observation and the game itself.

5.8.5 Findings Learn Spanish

All of the participants improved their result after playing the application as seen in the figure 22.

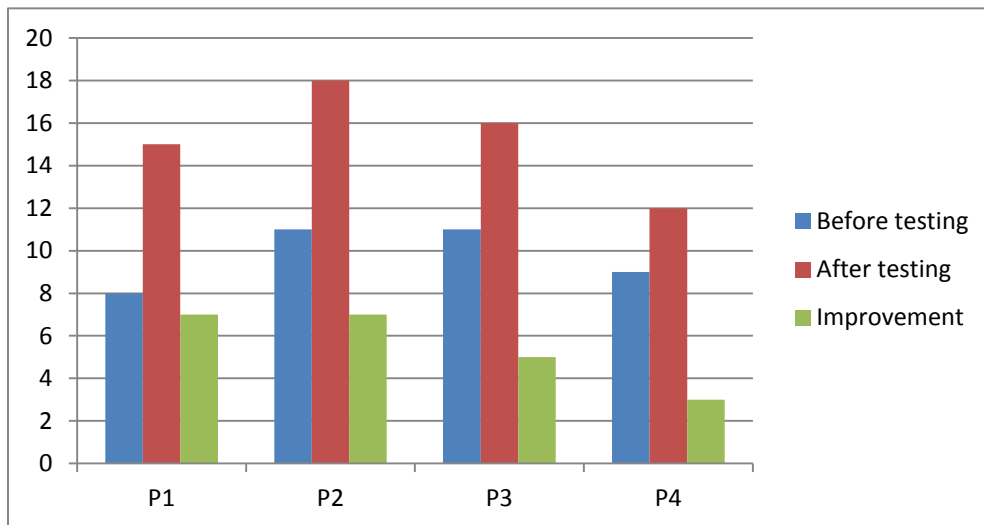


Figure 25: Improvement Learn Spanish

The test consisted of 20 tasks (see figure 24) in total and the highest score was at 18 after playing the game. P1 and P2 were the two improving their score the most with 7 more correct answers each. The figure shows an improvement for each participant. The total amount of possible correct answers was 20, and the average before the game was 9.75 correct, and after playing is 15.25, which shows a solid improvement.

When looking at the results for recognition of the gamification elements, several were noticed by all 4 participants, and only one element was not noticed by any of the participants. The results are shown in figure 23. They were also given the choice to choose "maybe" if not sure whether they noticed the element or not. For every maybe answer the element was given 0.5 point.

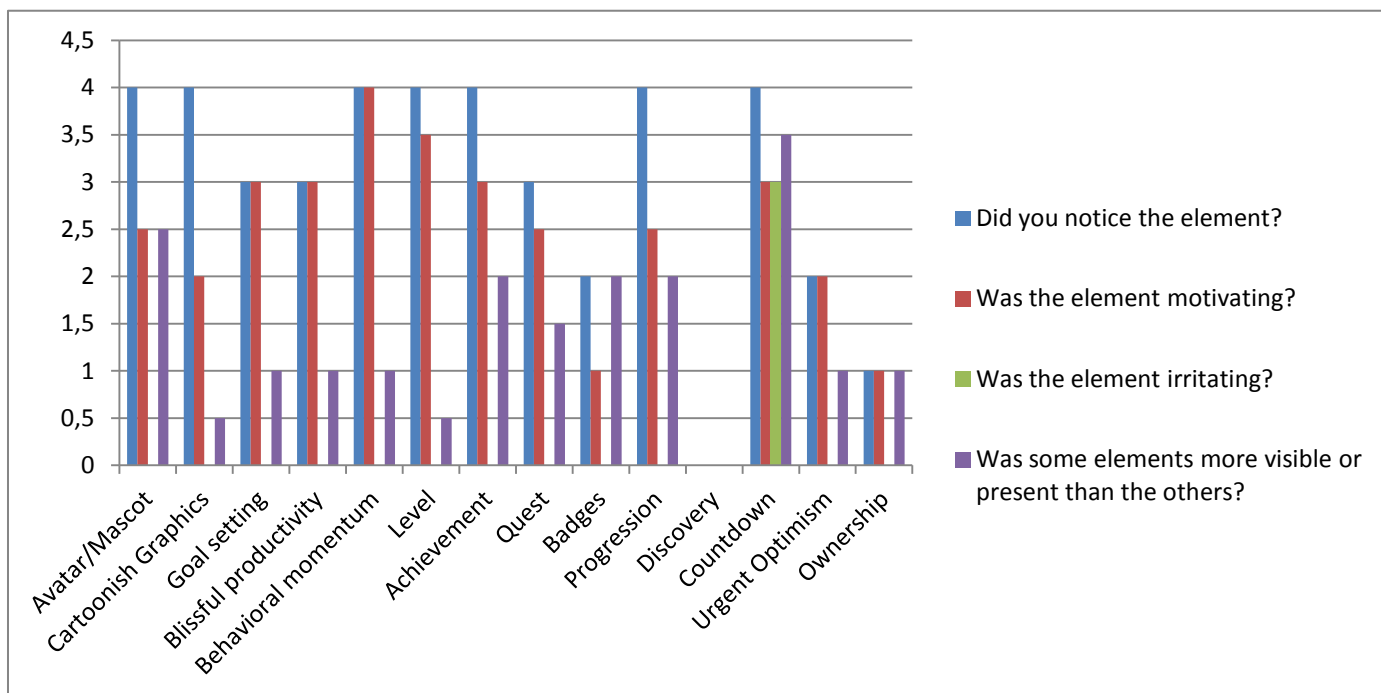


Figure 26: Element questionnaire Learn Spanish

As the chart shows, the element discovery was the element not noticed by anyone. When filling out the questionnaire, P3 said "this element might be more visible if given more time". This makes sense considering that in order to unlock the levels, the player needs to level up and play for a while. If they had the chance to see this, perhaps the element would have been clearer. Only one element was found irritating, which was countdown. Three out of 4 found it irritating, and when asked to explain, they all explained they found it stressful. However, P3 and P4 had a split decision between motivating and irritating, causing the element to have 3 "yes" on the question of being motivating in addition to 3 "yes" at the question of being irritating. Countdown was also the only element which was found noticeable. The element that everyone found motivating was behavioral momentum, an important element considering it answers the question if the participant would like to keep playing. Several of the elements were noticed by all 4 participants; avatar/mascot, cartoonish graphics, behavioral momentum, level, achievement, progression and countdown. All of the participants leveled up and saw (or were supposed to see) the level up screen (see figure 10(b)).

5.9 Discussion

This section first discusses the findings for the learning application before the chapter is summarized.

In both learning applications tested in the field trial, several gamification elements were found by all the participants. These are listed in table 7.

Table 7: Gamification elements noticed by all participants

Dragonbox	Learn Spanish
Avatar/Mascot	Avatar/Mascot
Cartoonish graphics	Cartoonish graphics
Behavioral momentum	Behavioral momentum
Level	Level
Progression	Achievement
	Progression
	Countdown

There are several similarities in both applications, which might imply that these elements are easier to discover than others and are more visible to the player. However, it is the motivational factor, which is the most important considering the learning outcome. The motivating elements are the ones who keep the players playing, finding it meaningful and fun while learning. These elements create a good user experience, which is one of the key points in using gamification (see section 2.2 definition 2). Table 8 lists out all the elements found motivating by 50% or more participants.

Table 8: Elements found motivating by 2 or more participants

Dragonbox	Learn Spanish
Avatar/Mascot	Avatar/Mascot
Cartoonish graphics	Cartoonish graphics
Blissful productivity	Goal setting
Behavioral momentum	Blissful productivity
Level	Behavioral momentum
Points	Level
Progression	Achievement
Discovery	Quest
Urgent optimism	Progression
	Countdown
	Urgent optimism

In both applications blissful productivity, behavioral momentum, and urgent optimism were noticed, 3 elements which base themselves on the user experience during the play. Despite the other elements also contributing to a good user experience, these three are the only elements that represent feelings. As mentioned in the previous sections, behavioral momentum was found

motivating by all the participants. Being the element described as "the tendency of players to keep doing what they have been doing" (see section 2.5) this is a positive result considering the user experience. Observing the participants testing the learning applications, they often commented on the elements as a side-sentence such as "what a cute fish!" about the Swell mini game, probably not realizing it was there with the intention of motivating.

Progression and level are elements, which give the participants feedback on improvement, were also noticed and found motivating. When answering the post-questionnaire (see Appendix A) all of the participants with the exception of one (P4 in Dragonbox) prefer both learning applications and regular blackboard/book lectures, showing that although they found the learning applications fun and interesting, regular teaching is still not being forgotten. In addition, they all felt the tasks were easier to carry out after playing, except for P2 in Dragonbox. On the question on how they feel about using digital games in a learning context, everyone answered positively, which was a good response having used both digital natives and digital immigrants (Prensky 2001) in the testing sessions. In this research, digital games (see section 2.1.4) has been defined as something different than learning applications (section 2.1.2), but taking into consideration that some of the participants were not familiar with either digital games, technology or learning applications, the term digital games was used in order to make it easier for the participants to understand and answer without any further help.

However, there have been some negative findings both in this research and in media research as well, which should be taken into consideration. Ruth Clark (2013) wrote an article pointing out how most games don't have the ability to teach and she also points out the lack of evidence showing learning value from games. All the participants except for one (P2 in Dragonbox) answered that they thought the tasks were easier after playing the applications which shows one of the issues with using learning applications and gamification in education. Not everyone finds games (or gamification) entertaining and even if they do, it might not be the right approach in learning situation. In the study conducted by Sandford et al. (2006), one of the teachers said: *"Put a computer with anything in front of children, that's what they'll watch, they won't pay attention to you."* (Teacher G). This also implies that using game elements can be distracting and take the focus away from the learning goals.

At the beginning of this the research, several research questions were defined;

RQ1: How are gamification elements used in learning applications?

RQ1a: What are gamification elements?

RQ1b: How are gamification elements used in existing learning applications and games?

RQ2: Do they create a good user experience?

RQ2a: What is a good user experience?

RQ2b: Do the gamification elements work for or against their purpose?

RQ3: Is there any evidence that learning is taking place?

During this research, gamification elements have been defined as game elements used a non-gaming context, answering **RQ1a**. It is possible to find several gamification elements in the games already developed, but if they are noticed is very individual to the player. The learning games tend to have a cartoonish graphic interface, if not, they can be easily mistaken for a simulation game. All the participants noticed the avatar/mascot in both of the games, as well as the graphics, level, progression, and behavioral momentum. The behavioral momentum is tied to the user experience, which can indicate that the participants all enjoyed playing and is something they would like to continue doing.

During the analysis of the games and learning applications, several gamification elements were found as presented in section 2.5. According to the 3 gamification definitions stated in section 2.2, the elements are used for improvement of the user experience and engagement, in addition to promote learning (**RQ1b**).

Both of the two games encompassed 12-14 gamification elements each. Most of them were noticed, but did not having an impact on the player in the sense of standing out or being irritating. In Learn Spanish, all the participants noticed the elements countdown and achievement. Almost every element noticed was found motivating, but the countdown element was found annoying by 3 of the participants, saying it was stressful in addition to motivating. However, at least one or two of the 4 participants also found several of the elements motivating. If this were to be tested in a bigger environment, perhaps it would increase the number of players finding the elements motivating. Having only conducted the testing with 4 participants per game makes it hard to tell if the results would have been different in another situation. What the results do show, however, is the improvement of the skill learned.

When looking at the results after conducting the testing sessions, with improvement on scores for nearly everyone, learning is taking place (**RQ3**). Considering the wide range in participants and their different relationship to games, the charts in figures 22 and 25 showing improvement is promising, indicating that these learning applications are appealing to several target groups. Taking into consideration that all of the participants enjoyed the playing and found it meaningful also indicates a good user experience for all the participants (**RQ2a**). A good user experience is when the user feels

positive about the experience, having enjoyed it, finding it meaningful either as pastime or learning. With only one element found irritating by the participants, the findings for **RQ2b** indicate that the elements are positive for their purpose. In addition, the element found irritating (i.e. countdown) was also found motivating at the same time, with some of the participants stating they became stressed and nervous, which implies that the participants related irritating to stress, not necessarily to irritation over the element being there.

5.10 Summary

This chapter described the field trial and the testing sessions reporting findings for each game. The chapter concluded with a discussion of the findings.

Chapter 6 Conclusion and future work

In the introduction of this thesis, the notion of gamification is presented and learning applications are introduced, before several research questions were raised. These questions revolved around the use of gamification elements in learning applications and how this influences the learning outcome and user experience. In order to answer these questions, desk work and an analysis of different learning applications and games was carried out resulting in a list of gamification elements, and a field study was carried out with 2 of the games to determine the role of gamification elements in the user experience.

The results of this research the results have been positive, supporting the main ideas of the researchers such as Kapp, Jenkins, McGonigal and Squire who all believe in gamification. During the research, each research question was answered. Part 1 revolves around what gamification elements really are and the usage of gamification in existing learning applications and games. After creating the elements list and analyzing the games, it gave enough data to move to testing their role in user experience. Part 2 looks into the user experience of the playing, what a good user experience is and if the gamification elements work for or against a good user experience. The field trial gave valuable insight on each participant's experience, making it possible to analyze data and determine a positive feedback. The last question was if there is any evidence of learning taking place, which also was answered by using the data collected during the field trial. In general, this research has given mostly positive results, supporting previous positive findings on the use of gamification.

Despite most of the results being positive, there is still a need for more research and testing of gamification in learning applications. There is also a need for testing in bigger environments, involving a larger amount of participants. With the development of technology and games, gamification will only become more important.

6.1 Future work

The field of learning games will continue to grow, requiring more research. Gamification is a way to make the learning applications more fun, motivating, etc. and plays an important role in the future learning applications, environments, and society in general as it continues to be implemented in different contexts. Understanding its role in learning games is important and requires more research in the future showing results. Showing results on paper or in a laboratory is one thing, using the work out in the field is another, meaning there should be more field studies conducted in order for teachers to try out learning applications and gain a firsthand experience. Feedback from teachers and students is valuable when integrating learning applications in the curriculum.

As Jane McGonigal said:

“A game is an opportunity to focus our energy, with relentless optimism, at something we’re good at (or getting better at) and enjoy. In other words, game play is the direct emotional opposite of depression”. (McGonigal 2011)

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Appendix A - Questionnaire Empirical study

Questionnaire empirical study

Before the test

1. What is your relationship to the subject?

//master, intermediate or beginner?

2. What is your relationship to games?

//fun? not a fan?

3. How do you feel about using digital games in learning context?

//good or bad idea?

After the test

1. What is your first impression of the game?

2. Was it easy to understand the game?

//The instructions

3. Did you think about the learning aspect while playing?

4. Was it easier to conduct the tasks after playing the game?

5. Did you think the subject was easier after playing?

6. Would you prefer the game in class OR the regular book/blackboard teaching?

Appendix B - Questionnaire Element list Dragonbox

Questionnaire Element list:

DRAGONBOX:

ELEMENTS	Did you notice the element?		Was the element motivating?		Was the element irritating?		Was some elements more visible or present then the others?	
	Yes	No	Yes	No	Yes	No	Yes	No
Avatar/Mascot								
Cartoonish graphics								
Goal setting								
Blissful productivity								
Behavioral momentum								
Level								
Bonus								
Combo								

Points								
Progression								
Discovery								
Countdown								
Free lunch								
Urgent optimism								

In addition:

1. What did you think about the sound (music and sound effects):

//Ring around the most correct answer

Funny

Irritating

Didn't notice

Appendix C - Questionnaire Element list Learn Spanish

LEARN SPANISH:

ELEMENTS	Did you notice the element?		Was the element motivating? (Did it give a good feeling)		Was the element irritating?		Was some elements more visible or present then the others?	
	Yes	No	Yes	No	Yes	No	Yes	No
Avatar/Mascot	Yes	No	Yes	No	Yes	No	Yes	No
Cartoonish graphics	Yes	No	Yes	No	Yes	No	Yes	No
Goal setting	Yes	No	Yes	No	Yes	No	Yes	No
Blissful productivity	Yes	No	Yes	No	Yes	No	Yes	No
Behavioral momentum	Yes	No	Yes	No	Yes	No	Yes	No
Level	Yes	No	Yes	No	Yes	No	Yes	No
Achievement	Yes	No	Yes	No	Yes	No	Yes	No
Quest	Yes	No	Yes	No	Yes	No	Yes	No
Badges	Yes	No	Yes	No	Yes	No	Yes	No
Progression	Yes	No	Yes	No	Yes	No	Yes	No
Discovery	Yes	No	Yes	No	Yes	No	Yes	No
Countdown	Yes	No	Yes	No	Yes	No	Yes	No
Free lunch	Yes	No	Yes	No	Yes	No	Yes	No
Urgent optimism	Yes	No	Yes	No	Yes	No	Yes	No
Ownership	Yes	No	Yes	No	Yes	No	Yes	No

In addition:

1. What did you think about the sound (music and sound effects):

//Ring around the most correct answer

Funny

Irritating

Didn't notice

Appendix D - Test sheet Dragonbox

TEST SHEET DRAGONBOX

Give a notice when the general information is filled out and you are ready to begin the test. The first you are required to do is to make an ID. To do this, take you mothers initials and your house number (e.g Jane Doe, Bergensgate 14 equals ID:JD14).

ID:

Age:

Educational level:

Last time you had a math course:

How often do you play digital games:

Name the top five digital games you play:

- 1.
- 2.
- 3.
- 4.
- 5.

TEST, you have 20 minutes to complete, but can deliver before time. You can use a separate sheet for the calculation if needed.

1.

$$x + 0 + 0 + 0 = a$$

2.

$$b + x = c$$

3.

$$a + (-1) + \frac{1*3}{3} = x * (-5) * b$$

4.

$$4 = x * b$$

5.

$$(-b) + \frac{x}{-f} = d$$

6.

$$\frac{a}{b} = \frac{c}{x}$$

7.

$$\frac{2}{x} + \frac{d}{e} = \frac{b}{x}$$

8.

$$5 + a - a - 5 = d$$

9.

$$\frac{100}{100} + \frac{a}{a} + (-1) + (-1) + 6 = x$$

10.

$$\frac{10}{a} = \frac{x}{a}$$

After playing the game, same set of tasks

TEST, you have 20 minutes to complete, but can deliver before time. You can use a separate sheet for the calculation if needed.

1.

$$x + 0 + 0 + 0 = a$$

2.

$$b + x = c$$

3.

$$a + (-1) + \frac{1*3}{3} = x * (-5) * b$$

4.

$$4 = x * b$$

5.

$$(-b) + \frac{x}{-f} = d$$

6.

$$\frac{a}{b} = \frac{c}{x}$$

7.

$$\frac{2}{x} + \frac{d}{e} = \frac{b}{x}$$

8.

$$5 + a - a - 5 = d$$

9.

$$\frac{100}{100} + \frac{a}{a} + (-1) + (-1) + 6 = x$$

10.

$$\frac{10}{a} = \frac{x}{a}$$

Appendix F - Test sheet Learn Spanish

TEST SHEET LEARN SPANISH

The first you are required to do is to make an ID. To do this, take your mother's initials and your house number (e.g. Jane Doe, Bergensgate 14 equals ID:JD14).

ID:

Age:

Educational level:

Last time you had a Spanish course:

How often do you play digital games:

Name the top five digital games you play:

- 1.
- 2.
- 3.
- 4.
- 5.

TEST 1:

Translate from English to Spanish:

One	
Two	
Three	
Four	
Five	
Six	
Seven	
Eight	
Nine	
Ten	

TEST 2:

Connect the right words together:

Toilet	La toalla
Sink	El lavaplatos
Shower	La estufa
Tub	El indoro
Towel	La tina
Stove	El jardin
Garden	La ducha
Dishwasher	La tasa
Table	El lavabo
Cup	La mesa

After playing the game, same set of tasks

TEST 1:

Translate from English to Spanish:

One	
Two	
Three	
Four	
Five	
Six	
Seven	
Eight	
Nine	
Ten	

TEST 2:

Connect the right words together:

Toilet	La toalla
Sink	El lavaplatos
Shower	La estufa
Tub	El indoro
Towel	La tina
Stove	El jardin
Garden	La ducha
Dishwasher	La tasa
Table	El lavabo
Cup	La mesa