THE USE OF EDUCATIONAL ROLE PLAYING GAMES IN EDUCATION

Master thesis in ICT and learning: Høgskolen Stord/Haugesund

May 2008

Rune Andersen

Abstract

Example isn't another way to teach, it is the only way to teach.

(Albert Einstein)

Norwegian students are not performing well academically. Test results over the last few years have been gradually decreasing and show we are below average in practically every subject. There is however one field Norwegian students are the best, informal use of ICT. This includes ICT for games, chat, shopping, Facebook etc. The need for new ways to think is great.

The aim of this study was to try out educational role playing as educational tools and look into the following research questions:

1. Is it possible that the use of an educational role playing game can lead to increased extrinsic motivation or intrinsic motivation compared to traditional teaching[1] for the performance of the tasks presented?
2. Does an educational role playing game affect the learner's will and initiative to collaborate compared to traditional teaching?
3. Does the use of an educational role playing game have a stronger effect on a learner's recall of knowledge taught and its applications in different contexts compared to traditional teaching?
4. Are there any significant differences between solo learners and social learners when using an educational role playing game?

To look into these research questions, 3 classes of 9th graders were a part of a quasi experiment. Two classes played an educational role playing game, while one group didn't. The results are presented in this thesis with comments and analysis based on relevant theory related to games, transfer, contextualization and motivation. The experiment and how it was conducted is also explained in chapter 3. The findings were presented to the teachers involved for confirmation and the results matched explanations given by the teachers.

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[1] By traditional teaching I mean the classical classroom situation where a teacher lectures and students listen and makes notes.

The game they used were the first version of Lærelyst – Veien til motivasjon[2]. A role playing game where subject matter and tasks related to this is put into a fantasy story. The players have an avatar which face challenges of many kinds and is enhanced based on the effort put in to the schoolwork related to the game.

The game is now entering its last stages of development before online release. In order to make it as well as possible it is important to run formative research on it to improve the design of the product one intends to create. This thesis is based on this.

Some of the key findings were:

- Games have a great motivational effect compared to traditional teaching.

- To play an educational role playing game does increase collaboration.

- It can seem as using this type of games also increases the attitude towards the subject played.

- The differences between solo and social learners manifests themselves clearer using a collaborative role playing game.

- A game in itself gives no real learning effect as long as it has low contextualization. That means that as long as the story has no relation to the subject and tasks presented, learning effect is low.

- Students using the educational role playing game enjoyed it and wanted to use it more compared to traditional teaching.

The study reconfirmed the fact that games are highly motivational. But it was also possible to see better results on recall in the experiment groups, not only right after finishing the experiment, but actually six weeks later. But, in general, one might say that the use of a low contextualized role playing game has not a significant learning effect. The research has been very useful, and has given a valuable contribution to the work on fully contextualized, high fidelity scenarios made for educational role playing games. Later tries with higher contextualization indicates this.

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[2] Read more about the game in appendix 1.

Foreword

Before you become too entranced with gorgeous gadgets and mesmerizing video displays, let me remind you that information is not knowledge, knowledge is not wisdom, and wisdom is not foresight. Each grows out of the other, and we need them all.

(Arthur c. Clarke)

Schools today face different challenges. Results from several surveys (PISA, TIMSS) show that Norwegian students are failing to succeed in almost every field Media and others look at this as a major problem for the future of our nation. This inquiry deals with elements of motivation for learning. This is where we have to look for answers. If we are able to motivate young learners to work, then the results will come.

In order to be a part of the rapidly changing society, it is important that the educational system looks into and accept the enormous changes in the everyday life of the learner and adapt accordingly. ICT has achieved a dominating role in today's society; a role which governments and authorities have indicated will be even more dominating. Derived from this comes new approaches to education as well. Games in school have been used for centuries as a motivational aspect and as a reward for work well done. A student can spend hours trying to sort out a problem in an online game, but the same student resigns after five minutes when he encounters a problem in math. Why does this happen? Research based on games as motivational tools and tools to facilitate intrinsic motivation show that the basic element of a game engages, motivates and challenges people in a way that traditional teaching can't compete with.

Play is a very serious matter… It is an expression of our creativity; and creativity is at the very root of our ability to learn, to cope, and to become whatever we may be.
(Rogers & Sharapan, 1994)

A game offers challenges and tasks for all kinds of people regardless of age, gender, background knowledge etc. By creating and using educational role playing games based on the existing curriculum, students will feel like the work they're doing in school has relevance to the society they're a part of today. The question we need to ask ourselves is whether we

look for students that are only able to reproduce knowledge stated in written plans, or do we look for students that actively seek knowledge, collaborating in the process of developing it and are able to use this knowledge in different contexts?

All these thoughts have been running through my head in this process. The need for a different approach to teaching and challenges connected to this has been something I've always wanted to look into. This work has lead to the process of developing Lærelyst 2.0 and will be the foundation of an educational role playing system for schools that can be used in the classroom, online and as an extracurricular activity. Hopefully you will enjoy reading about this and maybe a spark of interest in the field will remain with you and pull you in to the collaborative wonderland of educational role playing.

This thesis has been hard work. To maintain focus when so many different agendas are running through your head is difficult and would not have been possible without the help of others. First I would like to thank the teachers at the program for ICT and Learning at HSH. Their excellent tutoring helped me through the frustration of entering the field of ICT. I would also like to thank Kjell Bjørn Minde for convincing me to apply to this Master's program and to Reidar Jortveit for support and discussions. To Professor Gavriel Salomon who has inspired me with his lectures, articles and books and has also used time to give me valuable feedback in the process, thank you. A thankful thought also goes out to my fellow students in the program and to my colleagues who inspired me to go on. But there are some that deserve more than a thank you. To Førsteamanuensis Lars Vavik, who has been my mentor, guide and support through the duration of my research and the working process, this would not have been possible to do without you. The last and greatest thanks go to my wife who has been there for me through the last two years while so much has happened. I could never have done this without you and my two sons which will have a little less distracted dad from now on. These are the most important, but there are many others as well. Thank you all!

Rune Andersen, Grimstad 08.05.2008

Contents

Chapter 1: Background

1.0: Problem area

> *Norway faces, over the next twenty years or so, a 'revolution' that might not be as different as one might first think from the industrial revolution of two centuries ago when the basis of wealth tilted away from land and agriculture towards machinery and industry. During the years that come, the basis of wealth will be tilting progressively towards intellectual assets.*

> (KUD, 2004)

This statement, made by Barry McGaw[3] in a speech held for Norwegian politicians, was presented after the second of the PISA[4] surveys were conducted. At that point it was already clear that a "revolution" in acquisition of knowledge was needed. We had to focus on our intellectual assets.

Now we are in the year 2008, and are looking back at the last of the PISA surveys conducted in 2007. When viewed through Norwegian eyes, the test results are not good. The results are steadily decreasing in every subject measured. Norwegian students scores significantly lower than the OEDC[5] average, and also all our Nordic neighbors. In a comparative study of the Nordic countries and their scores in the subjects measured in 2007(PISA, 2007), the results varies significantly from country to country, but Norway has the lowest test scores in every subject. What creates an even bigger concern is the fact that results are decreasing from the last surveys. It appears as if we are not investing enough in our intellectual capital. Looking at the motivation for learning, shows no uplifting results either. In a national survey, "Elevinspektørene" [6](Furre et. al, 2006), a large number of students were asked how motivated they were for working with schoolwork. The numbers indicated that there is something lacking with the motivation for learning. Only approximately 20% of the students are motivated for

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[3] Director for Education, Organization for Economic Co-operation and Development (OECD)

[4] PISA: Program for International Student Assessment, an international comparative survey of school systems in different countries performed by the OECD (Organization for Economic Co-operation and Development).

[5] Organization for Economic Co-operation and Development

[6] A national evaluation system for students in Norwegian schools.

school work. When the number of highly motivated students is as low as 20%, one can argue that there might be a connection between low scores on tests and motivation for learning. The problems raised in this inquiry are partly based on these results. In my own practice I have seen the same patterns over years. Student motivation is decreasing and so are their results. The solution might lie in creating new motivation for learning. To achieve this it is important to look at what Norwegian students are good at, and try to work from there. The PISA survey shows that Norwegian students score very high in the use of computers. The informal use of computers is among the highest in the world. Informal use indicates activity that is not necessarily related to teaching. In a survey conducted by Barneombudet[7] in Norway, they discovered that 9 out of 10 children between the ages of 9 and 16 played video games or other games. This shows that much of the informal use of computers is related to games. The PISA survey also shows that Norwegian students have a high grade of self confidence when working with computers. This could be a good foundation for creative solutions of re-creating motivation for learning.

Based on practice, and the results based on motivation and academic scores in different surveys, to research the possibility of using the large competency Norwegian students have in informal use of ICT seemed interesting. To determine if there was any way of combining this competence with "traditional" teaching in order to increase motivation for learning and in turn increase academic scores. Based on research (Barneombudet, 2006; SAFT, 2006) it is shown that video games play an important role in student's lives. I therefore attempted to combine the elements of the online role-playing game with elements of traditional teaching so that students would feel the framework of the game, and teachers would recognize the basic elements of teaching. In short one might say bringing the game from the computer screen and into the classroom and the learning environment from the teacher's desk and into the classroom. The computer becomes a tool only used when necessary.

1.1: About games in schools

Over the last few years the use of games in education has expanded rapidly. There are games made for basically everything. In an article in Dagbladet in 2007 it says: "*Youth learns in front of the screen*" (Arnseth & Kløvstad, 2007). The article points out the fact that young

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[7] Government appointed spokesperson for children's rights.

learners nowadays have different ways of learning, and that many schools are having problems following the speed of development. Another article published in Aftenposten in March 2007, it is referred to the GDC[8] conference in San Fransisco, where game developers speaks of games in schools as a decisive factor for teaching in school today (Bjørkeng, 2007)). These are both articles that deal with the schools current situation. Games are still looked upon as tools of entertainment by the majority of people. But gradually they have been given an extra "dimension". They have been adapted to become tools for education. So-called "Serious Games" is one of the fastest growing industries in the world today. According to an article in The Birmingham Post, the edugames market is worth over 10 million £ in 2007. The article goes on saying: *The Department for Trade and Industry also acknowledges Serious Games is the new 'hot topic' among mainstream games producers (2007).* Initiatives are being built up in many countries, also in Norway. However, the US is still the largest producers of these types of games, but others, such as Britain, is closing the gap. Norway has now seen the need for computer games and other games to be a part of both culture and education. This has resulted in a governmental report on computer games. Among other things, this quote is included. I have translated it from Norwegian:

> *In this report it is shown that computer games can be used as a starting point for discussions in the classroom based on the teacher initiating a game followed by questions and discussions. Games can work as a strong motivational factor for students that have a low level of competence. In order to succeed with computer games in school, it is necessary that teachers knows the games they are using and that the games are customized for the students. The games must be used according to the law and curriculum and not as a reward*

(St.mld 14, 2008)[9]

This indicates that games in education are looked upon as a valid method of teaching the generations which now enters the schools system. The use of games in education is not a new

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[8] http://www.gdconf.com/

[9] I meldingen vises det til at dataspill kan brukes som utgangspunkt for diskusjoner i klasserommet, basert på at læreren demonstrerer et spill etterfulgt av klassediskusjoner eller oppgaver. Spill kan virke motiverende på elever som ikke er skolesterke. For å lykkes med dataspill i skolen er nødvendig at lærerne setter seg godt inn i de spillene som tas i bruk, og at spillene blir tilpasset elevene. Spillene må benyttes i samsvar med uttalte læringsformål, og ikke som påskjønning.

thought, but because of the digital era it has become much easier to make the changes necessary in order to facilitate the use of such elements. Futurelab published in 2007 a discussion paper on computer games and learning. There are a few very interesting remarks in this paper.

> *It has long been argued, for example, that the lecture-based model of teaching in many schools and universities is a very ineffective method of ensuring that learning actually takes place.*

And the paper goes on saying:

> *Similarly, the games environment is seen as one that can support both the mundane "acquisition of facts" through drill and practice, and the complex acquisition of process kills through simulation. Games, it seems, hold the potential to both motivate and encourage diverse ways of engaging with learning.*

> (Facer, 2007, p.2)

It is apparent that now, and in the years to come, games will play a vital role in education. I noticed this several years ago and started working in the field. This Master's Thesis is the result of work and research in this field over the last years.

1.2: History based on practice

Meeting young learners for the first time that has lost all motivation for school and learning in general is not an easy task. But this is everyday life for many teachers. The options to what can be done to motivate and encourage learners are limited. I also experienced this when I started working as a teacher for the first time. In addition to regular classes, I was set to teach a small group of boys that had lost all motivation for learning. My job was to make sure they physically stayed at school. I understood that this had to be wrong. According to law, teachers are supposed to teach every student what he or she needs to know, and make sure they are taught at a level of competency that matches their own[10] (Opplæringsloven §1-2, 1998). I did not do this at the time, mainly because the students were unwilling to do anything. I tried to

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[10] Opplæringa skal tilpassast evnene og føresetnadene hjå den enkelte eleven, lærlingen og lærekandidaten.

engage them in different activities without any kind of success. Until I started thinking of something they all had in common. They all played computer games.

After that I made them imagine the thought of playing in a game themselves. The thought intrigued them and we started teaching how to play role-playing games. I used D&D[11] as a starting point. This was in English, so their first venture into learning was to translate the parts that were needed in order to play the game. The response was amazing. The boys looked up words, asked for lists made by teachers etc. After some time I introduced other subject elements in the game, replacing combat scenes and other non-educational tasks with tasks gathered from the curriculum. What happened was that none of the boys cared what the challenge was; they just wanted to perform well in the game. The questions, discussions and tasks were just elements that needed conquering in order to finish the game. They entered the "flow" zone[12]. They worked hard with their tasks, but this was really to be expected in some ways. There are much research done on games and motivation (Malone & Lepper, 1987; Prensky 2001, 2006; Gee, 2004; Whitton, 2007; Bixler, 2006) that shows the motivational effect. The learning effect is more discussed. I am looking into the importance of contextualization in order to promote learning. From experience I know that if a scenario in the game is very close to the subject being taught, the results are much better. Motivation and collaboration rises just by introducing the game. Over the years, development of the educational role-playing game Lærelyst – Veien til motivasjon[13] took place. It then became more and more apparent that the game element motivated young learners to do what they had been instructed. Over the years more schools have adopted the program and it is today being changed based on feedback from the users and research. The results experienced are not unique for this particular game. Edugames in general are motivating in their nature. Just to introduce games in education is enough to catch learner's attentions. In addition to elements such as activities and social interaction, it also holds the element of fun. This is explained more in chapter 2.

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[11] Dungeons & Dragons (abbreviated as D&D or DnD) is a tabletop fantasy role-playing game (RPG) originally designed by E. Gary Gygax and Dave Arneson, and first published in 1974.

[12] Explained in chapter 2. Theory presented by M. Csikszentmihaily.

[13] An educational role-playing game written by Rune Andersen. Translated to Joy of Learning, referred to as LL. Described in appendix 1.

The digital revolution has sped up the process of game based learning. Computers and other consoles are available to almost anybody, and producers are producing games that are supposed to have learning effects. The results when it comes to actual learning varies, but the intention is clear. One major problem has occurred; the speed of the process. Teachers, schools and infrastructure are not able to keep up with the development when it comes to ICT. It is therefore important to use the best of both digital competence and "traditional" teaching. That is one of the fundamental things in my work here. To create a learning situation based on an educational role-playing game adapted for the average teacher which is not to complex, and with computer support not computer based.

In 2008, serious games are expected to sell for somewhere between 1, 5 and 2 billion dollars. Most of these are ICT based games that have little or no relevance to the curriculum at the schools that buys them. The industry is rising because there is much need for it. The important part is to find games that works, and that really teaches something relevant.

1.3: Research in the field of serious games or games in education

In chapter 2, the term serious games is debated in greater detail, but I present the following short definition of serious games: *Serious games are designed with the intention of improving some specific aspect of learning, and players come to serious games with that expectation* (Derryberry, 2007). There has been conducted a lot of research in this field. I will present a few different research projects here that are of relevance to this paper.

The first one is called: "Report on the educational use of games" (McFarlane et. al, 2007) this is a report looks into several aspects around this topic. Among others:

- Data on pupil use of games out of school.
- Pupil and parent views on game playing out of school.
- Ways in which games support the learning and teaching of curriculum content.
- Ways in which games support the learning styles and skills and processes which support school based learning.
- Ways in which games can be integrated into classroom use.
- Ways in which game play can be referenced and utilized in classroom use.

Many findings in this report are very interesting. They show, among other things, that both boys and girls utilize the tool that a game is in order to learn. They work together online or in the context of a game. It may look as the fear of learners growing anti-social because of games is not valid. As a matter of fact, the report states that the majority of both girls and boys report that working together in pairs or teams are the most common skill learned by from games. The second most common skill is decision making. When it comes to learning schools subjects, about 19% of boys report that they learn from the use of games, but over 31% of girls' reports doing it. Only a low number of respondents reported the use of games in school, but many welcomed it as part of education. The report emphasizes the importance of games in education and offers several solutions on how to achieve this. But it also points out the importance of a few things that are vital for success.

> *Perhaps extending the challenge to ensure that further thinking and problem solving takes place would be a valuable extension of the activity and immediate success is not as important as some developers think.*
> (McFarland et.al, 2007)

Futurelab[14] in Britain published in 2007 a discussion paper written by Facer. Computer games and learning was the topic of discussion. Much of the information published in this paper concerns not only games played on the computer, but games in general. The motivational factors of games are described in the paper: *Games, then, are seen to generate motivation, through rule-based, goal-directed challenging play. Importantly, these are seen to generate "fun"*(…) (Facer, 2007 p.3). The paper brings up several topics related to games and education. The most interesting ones being:

- ♠ Computer games and motivation

- ♠ Computer games and learning

- ♠ Managing learning with games in school

- ♠ Assessing learning through games

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[14] Futurelab is a not-for-profit organization largely funded by the Department for Education and Skills

Especially the last point is one I am discussing in further detail in my thesis. The key question asked on this point in this paper is: (…) *how do we know whether we are simply assessing the ability to play the game or the acquisition of skills that might be transferred to other settings*? (Facer, 2007 p.7). This question is vital to the future of educational games. Futurelab works, trying to elaborate on these themes.

Becta[15] released a research report on a project named: "Computer Games in Education project" (Becta, 2007). The focus in this report is the different aspects of computer games as educational tools. There are two very interesting elements in this report that is important to look into. First it is the advantages of games, in particular when it comes to the area of motivation. As shown in table 1, there are a lot of advantages when it comes to motivation in a game.

Table 1: Overview of motivation in games (BECTA, 2007)

What indicates motivation?	independent work self-directed problem posing persistence pleasure in learning
What generates motivation?	active participation intrinsic and prompt feedback challenging but achievable goals a mix of uncertainty and open-endeness
What can motivation usefully support?	collaborative interaction peer scaffolding of learning creative competition or co-operation equal opportunities
What does sustained motivation rely on?	a version of reality relevance to the user recognisable and desirable roles for players
What are problems with motivation?	motivation may lead to obsession motivation may cause transfer of fantasy into reality motivation may induce egotism

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[15] Becta is the Government's lead agency for Information and Communications Technology (ICT) in education, covering the United Kingdom.

The other issue worth mentioning in this report is different research findings. They have listed a number of interesting research findings after using computer games as educational tools, the teacher's significant role in ensuring effective learning being the most interesting one. To ensure learning, structure and control, the teacher needs to be the key element, not the digital media or the game itself.

In 1987 Lepper & Malone published their paper: Making learning fun: A taxonomy of intrinsic motivations for learning. In this paper they look into different aspects of intrinsic motivation both individual and inter-personal using games as a reference point. Their findings have been used in many papers discussing the use of games as both motivational agents and learning agents. Findings in their research indicated strongly that games have strong motivational factors.

There are many research reports and papers published in the field of games and education. It is only possible to give a brief overview over the most relevant ones in this thesis. I will finish with a paper published in 2006 called: "Before every child is left behind: How epistemic games can solve the coming crisis in education" (Schaffer et.al, 2006). In this paper the present educational system in the USA are looked upon with a critical look. The authors predict that there will be great problems if the government and schools don't change their patterns of thought in time. Focus is put on the time we live in, the digital era. Tools for education need to evolve together with the generations that are to be taught. The crisis is described as:

> *The coming crisis is this: Young people in the United States today are being prepared—in school and at home—for "commodity jobs" in a world that will, very soon, only reward people who can do "innovative work" and punish those who can't.* (Schaffer et.al, 2006 p.1)

They believe the solution lies in the use of games, epistemic[16] games to be more specific. By using these, learners will learn what they need to learn, and do it in contexts and setting that are relevant to their lives after school.

> *In playing epistemic games, students learn basic skills, to be sure. They learn the "facts" and "content" that we currently reward. But in epistemic games students learn facts and content in the context of innovative ways of thinking and working. They learn in a way that sticks, because they learn in the process of doing things that matter.*
>
> (Schaffer et.al, 2006)

These reports elaborate on the motivational effects of games, collaboration and learning effects. This is one of the most active fields of research at the present, and a field that needs to be looked into. We have entered a new era, the digital era, where schools have the opportunity of doing things that were impossible only 10-15 years ago.

1.4: Thesis and research questions

Prensky published in 2001 a paper that dealt with the notion of digital natives and digital immigrants. Digital immigrants were the ones that belonged to the "traditional" way of teaching that means people born before 1990. They had to learn everything from scratch, while the digital natives are defined as follows:

> *What should we call these "new" students of today? Some refer to them as the N-[for Net]-gen or D-[for digital]-gen. But the most useful designation I have found for them is **Digital Natives.** Our students today are all "native speakers" of the digital language of computers, video games and the Internet.*
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> (Prensky, 2001, p.1)

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[16] The word *epistemology* comes from the Greek root words *episteme*, meaning "knowledge" or "understanding," and *logos*, meaning "thought" or "study." Thus e*pistemology* is the study of knowledge and what it means to know something. Epistemic games are games that help players learn the ways of thinking–the *epistemologies*–of the digital age.

He goes on saying:

> *The single biggest problem facing education today is that our Digital Immigrant instructors, who speak an outdated language (that of the pre-digital age), are struggling to teach a population that speaks an entirely new language*

(Prensky, 2001, p.2).

Some of the same issues were raised in the use of an educational role playing game. Games were known to be motivating, but a game working as a framework for teaching was something relatively new. Combined with digital recourses and digital tools to help the students, it became difficult to get everyone to fall for the idea. But after introducing the game and the results manifested themselves almost immediately, several teachers tried themselves. Many positive elements that the game contributed with in the learning situation were experienced. After introducing the game it became apparent that a lot needed to be done in order to get teachers to use it on a large scale. It was therefore necessary to look into my problem area in a formative way when it came to the game and a more theoretical way when it came to the effects of the game. The problem area is wide and can be approached from different perspectives so it needed to be more specified and limited. Schools are in general showing poor academic results, especially when it comes to boys (PISA, 2007). Today the use of videogames such as MMORPGs[17] and other types of games are extremely popular. The question is if motivation embedded in games can be transferred into active teaching. Based on this I formed the first of the research questions.

Is it possible that the use of an educational role playing game can lead to increased extrinsic motivation or intrinsic motivation compared to traditional teaching[18] for the performance of the tasks presented?

It was also important to look into whether the use of an educational role playing game not only affected motivation, but also if it had an effect on collaboration. This brought on the second research question.

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[17] **Massively multiplayer online role-playing game** (**MMORPG**) is a genre of online computer role-playing games (CRPGs) in which a large number of players interact with one another in a virtual world.

[18] By traditional teaching I mean the classical classroom situation where a teacher lectures and students listen and makes notes.

Does an educational role playing game affect the learner's will and initiative to collaborate compared to traditional teaching?

The question still remaining when looking into collaboration is whether there are differences between different types of learners. I wanted to look into these differences and rose a third research question.

Are there any significant differences between solo learners and social learners when using an educational role playing game?

After looking at the motivational and collaborative aspects of the use of educational role playing games, I also wanted to look into learning effects of the game. This resulted in a fourth and final research question.

Does the use of an educational role playing game have a stronger effect on a learner's recall of knowledge taught and its applications in different contexts compared to traditional teaching?

Based on the research questions presented it might be possible to form a statement along these lines: **"**The use of an educational role playing game will have a positive effect on motivation, collaboration and recall, and facilitate low road transfer". An important element that could be added is: If designed properly. But it will require more research.

However, there are various reasons to believe that especially the collaboration part in role-playing games will have different impact on the learners. The theory of social and solo learners (Salomon, 2005), might explain mixed findings, not only in my work, but on research concerning collaborative work in general. This problem will probably transfers to role-playing games in general. The results on recall will most likely also differ based on the contextuality of scenarios used in the game. If tasks and facts are deeply integrated in a scenario, the results will be good. On the other hand, are tasks and fact only loosely integrated or not integrated at all, recall won't be significantly higher, it might even be weaker than learners not using the game.

Based on the currents situation in the field of teaching in Norway, and my experiences from practice, I will look into relevant theory concerning my research questions in chapter 2. Based on theory I will conduct my experiment and see if I can find the answers I am looking for. My

experiment will also have an element of formative research embedded in it. It will be vital to point out the elements in the educational game used in this inquiry in order to use those results to make a better version afterwards.

1.5: An overview of the thesis

This Master's thesis is divided into 6 different chapters. In addition to these chapters there is an abstract or a preface if you like, with a short description of the work done. There are also a number of appendixes towards the end, and in addition to this a complete list of tables and figures. At the very end you will find the list of references.

Chapter 1 is an introduction to my problem area and an oversight of relevant research. It is also a presentation of my rational and research questions. Chapter 2 is the theory chapter. In this chapter I have discussed relevant theory used in my work. There are also references to relevant research if anyone is interested in looking deeper into some of the theories used. The third chapter is an overview of my research model. It describes research methods, the research process, alternative ways of conducting research etc. In chapter 4 the empirical data gathered in the field is shown graphically with explanations. It will be presented both in tables and illustrations. Chapter 5 includes the analysis of the empirical data based on the findings and theory, and finally in chapter 6, a summary of my findings, brief answers to the research questions and conclusions. Finally a glimpse into the future and discusses briefly further research in the field. There is also a brief look into different didactic challenges when creating educational role playing games.

Chapter 2: Theory

2.0: Game and learning theory; an introduction

It is difficult for teachers to identify how a particular game is relevant to some component of the curriculum, as well as the accuracy and appropriateness of the content within the game. In many situations, the amount of irrelevant content or functionality in a game waste valuable lesson time. On the other hand the potential of digital game-based learning or traditional game-based learning seems to remains largely unrealized. It has been argued that designers of "edutainment" games have never understood how and why games are effective and how to align curriculum with the game world without "sucking the fun out" of the games (Eck, 2006). This chapter shows an overview of the research of educational role-playing games with a particular focus of what components or features of conventional computer games can be taken and used in learning classroom-based curriculum related content delivery.

The first part of the chapter will present games and subgroups of games. This is done in order to clarify terms used in the text and to define what is debated in this text. The main part of the chapter will deal with the use of educational role-playing games. Relevant research is briefly presented followed by a discussion of the different theoretical perspectives when it comes to game based learning. One of the first elements presented in theory around games is motivation. This is discussed later in the discussion as well as the elements of contextualization, fidelity learning and transfer. Because of the nature of the role-playing games, it is natural to bring up collaboration. By doing this, a brief discussion on the term solo and social learners inevitably comes in towards the end of the chapter. Everything is summed up at the end of the chapter.

2.1: Games definitions and explanations

There are many definitions of a game. Crawford (1982) and Asgari & Kaufman (2004) speaks of a game as a set of voluntary activities which has participants, goals, rules and some kind of physical and mental competition. They also focus on the dynamics of a game and the interpersonal elements (Crawford, 1982; Asgari & Kaufman, 2004) Juul (2000), made the following two-point definition:

- *A game is a pastime with a formal and predefined set of rules for the progression of a game session, with built-in and quantitative definitions of success and failure.*

- *What goes on in a game is considered "unreal"; has another status than the rest of the world*

(Juul, 2000)

This is a very general definition of games. Juul also says: *Games have rules that must be sufficiently well-defined that you do not argue about them every time you play (in a board or card game), or sufficiently clear that they can be implemented in a computer program* (Juul, 2000). He shows the importance of a link between the board games and the computer games. This link is important since the attempt is to look into the connection between the digital games and the traditional table top games.

Crawford contrasts what he call "games" with "puzzles." *Puzzles are static; they present the "player" with a logic structure to be solved with the assistance of clues. Games, by contrast, are not static, but change with the player's actions* (Crawford, 1982).

A game is a form of art in which participants, termed players, make decisions and perform actions in order to pursuit some kind of goal. The goal of a game can vary from a determined result, to a feeling. One of the most common reasons for playing a game is fun. This has been shown in several research projects (Malone, 1980; Federoff, 2004). Malone argues that the primary objective of a game is to entertain the user. Entertainment in a game, or the goal of a game, may vary a lot from user to user. Sometimes it is just fun to play a game. Nobody wins and nobody loses. The Sims[19] is a type of game that doesn't have winning as a goal, but just the feeling of having fun. Monopoly, on the other hand, has a certain goal that one has to achieve to win. So, based on looking into the different types of games, it is possible to say that games has rules that needs to be upheld if the game is to be played. A game also has to have goals for the players to feel. This might be the feeling of victory, some defined achievement or just the feeling of playing the game.

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[19] The Sims is a life simulation game available on many platforms, but most popular for the personal computer (PC).

Serious Games

The serious games field focuses on designing and using digital games for real-life purposes such as education, health care, safety, public policy, and business development. Serious Games is a term that has evolved over the last few years. It has had many different names such as: Edutainment, Educational Games, Simulations, Digital Game Based Learning, and Games for Change and so on. Today there is an initiative to gather all games that falls into this category. The organization Serious Games defines a serious game as: *A serious game may be a simulation which has the look and feel of a game, but corresponds to non-game events or processes, including business operations and military operations. The games are intended to provide an engaging, self-reinforcing context in which to motivate and educate the players* (The Serious Games Networking Portal). It is in under this category a lot of the work in this paper is done; the role-playing game as an educational tool. The educational role-playing game can be summed up in a few words. They have a scenario to play in and they face challenges and tasks. The major difference is that the teacher is the GM[20], the story is based around different subjects and that the only way to improve your avatar is through work on your subjects. An example of an educational RPG is Lærelyst[21].

Educational games have long been used in the classroom to add an immersive aspect to the curriculum. While the technology has a cadre of strong advocates, formal reviews have yielded mixed results. Two widely reported problems with educational games are poor production quality and monotonous game-play. On the other hand, commercial non educational games exhibit both high production standards (good artwork, animation, and sound) and a diversity of Gameplay experience. Recently, educators have started to use commercial games in the classroom to overcome these obstacles (McFarlane, et. al, 2007). They have run a research program through the Teem Organization[22]. However, the use of these games is often limited since it is usually difficult to adapt them from their entertainment role.

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[20] Game Master, the one who runs the game and is in charge of rules and activities.

[21] See appendix 1.

[22] Organization in Britain to evaluate and distribute digital tools for learning.

When it comes to the question of which games are educational and which are not, another story appears. Different theorists claim that practically all games have an element of learning in them (Gee, 2002; Prensky, 2002; Jenkins, 2006). Others again claim that certain elements need to be present in order to give them real learning value. Some games will even have a negative effect on learning (Schaffer, 2006; Oblinger, 2006).

Role-Playing games

Role-playing games are defined in many different ways. I define an RPG as something between a game and a story, where players interact in a setting with different roles led by a leader known as the game master (referred to as GM). Padol calls it a game composed of one or more sessions where a group of gamers gets together in one place to play. They might be described as "make believe with rules" (Padol, 1996). A role-playing game can be played in any setting desired by the players. The game is played through an avatar[23]. The main objective is to work the avatar through different tasks and challenges placed in a virtual world by the GM. A role-playing game can take the form of a board game or a computer game, but the objectives are the same. Because of the structure of the game one never knows the outcome. Padol writes: *The story, then, is created by the players and the GM, and perhaps the author of a supplement. All of these people are artists or storytellers* (Padol, 1996).

Henry includes another important part of the role-playing game in an article from 2003. She says: *The participants in role-playing games, or RPGs, are engaged in a complex process of group narrative; they are the authors, narrators, characters, actors, readers, and audience of a text that can be both experiential and product orientated* (Henry, 2003).

MultiUser Online Role Playing Games (MMORPG)

Role-playing games are today often computer based. One can buy a game and play by oneself or with friends on local computers. Although today role-playing games online are often referred to as MMORPGs. Techweb defines it as: **M**assively **M**ultiuser **O**nline **R**ole **P**laying **G**ame, a role playing game on the computer played by many people simultaniously. An MMORPG differs from a regular computer role playing game because its environment is perpetual. People log on, join the game, take on their role and leave whenever they wish, but

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[23] An avatar is a virtual body or a personal figure used to represent oneself in a virtual world such as a role-playing game.

the game continues. In a way one might say that the board game feeling has been transferred to a virtual world with real people interacting.

Similarities between board games and computer games

- In this Master's thesis the goal has, as explained in detail in chapter 1, tried to link the best elements of a board game and a computer game and use that in the classroom. Most of the key elements of games are found in both computer and board games. But in order to make them work in an educational setting, it is vital to adapt them to each other. This means to pick the best parts of each type of game and create some sort of "hybrid" game. This was done in Lærelyst, but it did not succeed to create the connection between computer and table top games. So to do a formative study on this was essential in order to accomplish the intentions of the game. The use of a scenario has its benefits whether it is played online or in a classroom. Rutter & Bryce points out a few key elements in any educational game that makes them more efficient learning tools:

  - *Results (the "effect") can be obtained quickly, therefore providing feedback on the outcome on a particular strategy;*

  - *With some games, scenarios could be developed by a facilitator (Game Master[24]) with a view to repeat use;*

  (Rutter & Bryce, 2006)

They also see the pitfalls such as scenarios being limited to the complexity of the games and that chance and luck elements are infrequently programmed into games (Rutter & Bryce, 2006). This is where the educational RPG can prove its worth. In this type of game, it is up to the GM to use different scenarios or even change them as the game progresses. The key element here will be contextualization, which is discussed later in this chapter. The GM (read teacher) can also add elements of luck and chance as the players go along. When computers are used to support a game, not run it by itself, the control remains with the players.

As mentioned earlier, the rules and goals of video games are the same as table top games. Role playing have changed nowadays. The young people, the so-called digital natives[25], start

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[24] My comment. A game master always leads the games and keeps track of what is done.

[25] Marc Prensky 2001

playing videogames as young as three years of age according to research being conducted by the BBFC[26] in 2007. This means that instead of doing it like before and change table top games into computer games, we are looking at skilled students that can change computer games to table top games. In order to meet both this generation of learners and the previous, it is important to focus on elements that are recognizable by everyone. If this is achieved, nobody gets left behind.

2.2: The use of role-playing games in education

The use of games in education is not a new phenomenon. Researchers have looked into the effects and benefits of games in education for many years. Already in 1938 Huizinga published the book: "Homo Ludens A study of the play Element in Culture". In this book he introduced us to the "playful humans or "Homo Ludens" as he calls it (Huitzinga, 1938). Later the term Ludology has been used for research in the field of gaming and games. Throughout the 50s and 60s the use of games as educational tools were widely used in the army and intelligence agencies around the world. They played role-playing games to prepare agents for the tasks ahead. In the late 60s and early 70s, the game also got introduced into the classrooms around the world. In his book from 1970, Abt use these words on games in education:

> *Games are effective teaching and training devices for students of all ages and in many situations because they are highly motivating, and because they communicate very efficentialy the concepts and facts of many subjects*
> (Abt, 1970)

Abt researched games and their effect on different kinds of learning. He was one of the first to present the term Serious Games. In research reports from the early 1980s evidence of high intrinsic motivation in games are shown (Malone, 1980). Over the past twenty-five years several researchers has produced a substantial body of psychological, educational and development literature highlighting the educational potential of both digital games and games in general (Gee, 2003; Prensky, 2001, 2006; Malone & Lepper, 1987). Also educational facilities both in the USA, England and Norway have put focus on the learning possibilities of

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[26] British Board of Film Classification.

games. In a report published by the Federation of American Scientists they refer to research showing the many benefits of introducing games in education (2006). The Norwegian institute for information technology ITU also had this focus in their annual conference in 2006. Linderoth et.al in Sweden published in 2002 an article about mapping of research around computer games and learning. The focus is on the use of computer games, but they also focus on the point that even though they have used computers, the results counts for all kind of games. They speak about the acquisition of cognitive skills from the use of games.

> *These competencies develop from non-educational game play in non-educational settings. Thus, this line of argumentation can broaden the study of learning with games to count for all sorts of games, in all sorts of settings. All of these cognitive processes suggest that educational and recreational software are complementary. Understanding how recreational game players successfully process such complex information can benefit the development of learning and instructional models for the information technology world*
> (Linderoth et. al, 2002)

They further continue by emphasizing on the learning of content. They elaborate on different areas where games might function as learning tools and speaks of: …*games will facilitate learning in some subject matter, and that they will do this in a better way than other learning approaches* (Linderoth et.al, 2002).

In Britain Futurelab[27] just published a research report called "Learning science socially through game creation" (2007). The findings here indicated that the participants learned a lot through the use of a digital game/tool, but the necessity of teacher control were important. Teem in Britain published a report named: "Report on the educational use of computer games" (2006). The findings here are similar to findings in other research papers etc. The use of games has a clear effect on the results of the participants. Whether it is a lasting effect remains to be shown. But in the report they state:

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[27] http://www.futurelab.org.uk/about_us

> *Games provide a forum in which learning arises as the result of tasks stimulated by the content of the game, and skills developed through the content of the game, and skills are developed as a result of playing the game*
>
> (McFarlane et. al, 2006, p. 4).

Looking at research done in this field shows that the perspectives of learning are different when speaking of games as educational tools. Researchers such as Gee and Prensky look at educational role playing games from a very situated point of view, what Lave and Wenger (1991) would refer to as a peripheral legitimate participation (Gee, 2003; Prensky, 2001) while other researchers look at it from a more cognitive point of view (Blatner, 2002; Salomon & Perkins, 1998). Over the years there have been strong disagreements between these two perspectives when it comes to result of learning and how learning is achieved. While one part looks at learning as a number of activities, the other looks at learning as a process in which the goal is to transfer what is learned into different contexts. The situated perspective does not put emphasis on transfer. They focus on how human knowledge develops in the course of activity, and especially how people create and interpret descriptions (representations) of what they are doing (Clancy, 1995). It has its origin in constructivism, but focuses on participation rather than the personalized, individualistic view on learning. Learning is context based and in the form of an activity. Activity Theory[28] is central in this learning perspective. Lave & Wenger describes learning as a situated activity like this:

> "*Learning viewed as a situated activity has as its central defining characteristics a process that we call legitimate peripheral participation. By this we mean to draw attention to the point that learners inevitably participate in communities of practitioners and that the mastery of knowledge and skill requires newcomers to move towards full participation in the socio-cultural practices of a community. L.P.P. provides a way to speak about the relations between newcomers and old-timers, and about activities, identity, artifacts, and communities of knowledge and practice*"

> (Lave & Wenger, 1991 p.29)

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[28] Activity theory originated in the former Soviet union as part of the cultural-historical school of psychology founded by Vygotskij, Leontjev and Lurija. The theory is a philosophical framework for studying different forms of human praxis as developmental processes, with both the individual and the social level interlinked.

It is easy to see how games fall under this category. They are limited to an activity, they require participation etc. But they discard the element of transfer from one context to another. Although several cognitive researchers also speak of learning effects through digital games or other types of games, but they relate it to the notion of transfer of learning through these games (Salomon & Perkins, 1998). This thesis emphasizes the focus on the notion of transfer in games and a cognitive perspective, but it is very important to understand both sides of this discussion. In many ways they are both right. The attempt to bring these perspectives closer together was initiated by Sfard in her article published in 1998, where she spoke of the danger of using only one perspective, or metaphor of learning as she referred to it (Sfard, 1998).

In this inquiry the attempt has been to show that educational role playing games have an impact when it comes to motivation, recall, collaboration and transfer. It is important to look at educational role playing games from both the cognitive perspective and the situated perspective of learning. These learning perspectives have been very opposed to each other, but lately we have seen supporters from both sides listening to each other and looking for them to co-exist. Sfard speaks of the two perspectives as metaphors. She refers to them as the acquisition metaphor (AM) and the participation metaphor (PM). I use these as well.

> *While the AM stresses the individual mind and what goes on into it, the PM shifts the focus to the evolving bonds between the individual and others. While AM emphasizes the inward movement of the object known as knowledge, PM gives prominence to the aspect of mutuality characteristic of the part-whole relation*

> (Sfard, 1998, p. 6)

She argues the importance of both perspectives and how they have qualities that supplement each other. The dangers of using only one perspective are great. She concludes that we have to use both.

> (…) *relinquishing either the AM or the PM may have grave consequences, whereas metaphorical pluralism embraces a promise of a better research and a more satisfactory practice.*

> (Sfard, 1998, p. 10)

The educational role-playing game has elements from both perspectives. In table 2 I use Sfard's Metaphorical Map to illustrate this. I have tried to show the elements of the game where the different metaphors are in use. My additions are made under my comments.

Table 2: The Metaphorical Mappings (viewed from an educational role playing game)

AM	My comments		PM	My Comments
Individual enrichment	To create a strong avatar	Goal of learning	Community building	To create the best possible group to play with
Acquisition of something	To increase personal knowledge in order to enhance the avatar	Learning	Becoming a participant	To participate in solving the challenges and tasks presented in the game
Recipient (consumer), (re)constructor	To retrieve knowledge and use it in different contexts in the game	Student	Å peripheral participant, apprentice	Work together towards a common goal in the best way possible
Provider, facilitator, mediator	Provider of knowledge and ways to solve tasks and challenges	Teacher	Expert participant, preserver of practice/discourse	The one that participants can rely on helping them in the game. The mentor.
Property, possession, commodity (individual, public)	Knowledge and items for the individual in the game, gathered from tasks achieved oneself.	Knowledge, concept	Aspect of practice/discourse, activity	The learning process, learning activity, active learning.
Having, possessing	Internalized knowledge that can enhance your avatar in the game.	Knowing	Belonging, participating, communicating	To achieve a community that works well together and together holds enough knowledge to face anything.

It is hard to argue the link between these metaphors and games. Most theorists that work with games, and in particular video games, look at them from a situated point of view. Gee explains the situated perspective on games in a chapter published at MIT: *Content is rooted in experiences a person is having as part and parcel of taking on a specific identity (in terms of goals and norms stemming from a social group)* (Gee, 2008 p. 6). He goes on saying: *Learning is situated in experience, but goal-driven, identity-focused experience* (Gee, 2008, p. 6). Other game theorist claims the same (Schaffer, 2006; Prensky, 2001; Squire, 2002). So it has been an unspoken truth that games are situated in their nature, belonging to a specific context, or activity, and with little or no transfer value. Other theorist argues against this. Even though mastery of chess is a situated activity, certain skills can develop that are transferable to other situations. There is ample evidence of that (Perkins & Salomon, 1992;

Wojcio, 1982). Wojcio showed several examples of transferable skills through the chess game in his article.

2.3: Motivation, contextualization and transfer in educational role playing games

A lot of research supports the fact that games in general, role playing games, increases motivation (Malone & Lepper, 1987; Gee, 2006; Shaffer, 2006; Habgood, Ainsworth & Benford, 2005; Linderoth et.al 2002). Why games are motivating in an educational setting is debated, but Linderoth et.al gives a straight forward explanation in an article about research on computer games: *Learning is seen as a side effect of play, where the gaming activity is not directly related towards learning. Instead, play, as such, has different qualities that are pleasurable* (2002).

There are two main types of motivation; extrinsic and intrinsic. They are both important factors when it comes to learning. Extrinsic motivation might be used to trigger someone to start something in the first place. The enjoyment of the activity might then create lasting intrinsic motivation. Different types of motivations can also relate to different kinds of learners.

Intrinsic motivation will most often be the desired form of motivation - the kind of motivation that is self-driven, or the mastery of something or the satisfaction that come with a feeling of, nothing else. Several theorists have conceptualized intrinsic motivation in terms of generalized needs and affects that are psychological rather than physiological in nature (Ryan & Deci, 1985). To achieve intrinsic motivation it is important to have challenges that are optimal for ones capacities. By that I mean that the action in question must be hard enough to interest someone without creating fear of failure. It is also important not to make it so easy that one loses interest. To have the optimal feeling, one needs to be in between boredom and anxiety. This is also the title of a book about intrinsically motivated behavior. The author claims that intrinsic motivation occurs and is maintained in what he calls a condition of flow, flow being defined as: *When action follows upon action according to an internal logic that seems to need no conscious intervention from the actor* (Csikszentmihalyi, 2000). It is, however, a fact that that extrinsic and intrinsic motivation often has close relations to each other and also occurs together more often than not. I might enjoy playing soccer so much that I do it for the love of the game. But one is also motivated by the money it might brings, social

status etc. Very often intrinsic motivated behaviors are accompanied by extrinsically motivating elements. Will the role playing game itself function as a reward and thus be classified as extrinsic motivation, or will the feeling where accomplishment in itself becomes the reward that triggers the flow concept? The argument will be that games in general are motivating, and as I explain later in this chapter, there are elements in the framework of a game that enhances intrinsic motivation. It might be possible to say that serious games, in particular, work to activate motivation for learning through games as a facilitator for intrinsic motivation. The learners don't need any kind of reinforcements for maintaining the activity. The activity is motivating in its nature. I will use the experiment to look into this element. As mentioned earlier it is the intrinsic motivation that triggers flow. A definition of flow is made by Burleson & Picard: *A feeling of being in control; concentration and highly focused attention; mental enjoyment of the activity for its own sake* (…) (Burleson & Picard, 2004). They also speak of the opposite feeling, a feeling it is very important to avoid in a game based educational tool, and the feeling is referred to as "stuck". They define it as: *a, lack of concentration and inability to maintain focused action (…) a non-optimal experience* (Burleson & Picard, 2004). Practically the same wording as used by Ryan and Deci on intrinsic motivation. But they refer to intrinsic motivation as an optimal challenge (Ryan & Deci, 1985). The elements of flow and stuck are shown in table 3.

Table 3: Elements of Flow: Optimal Experience and Stuck: Non-Optimal Experience (Burleson & Picard, 2004)

Flow: Optimal Experience	Stuck: Non-Optimal Experience
All encompassing	All encompassing
A feeling of being in control	A feeling of out of control
Concentration and highly focused attention	A lack of concentration and inability to maintain focused attention
Mental enjoyment of the activity for its own sake	Mental fatigue and distress caused by engagement with the activity
A distorted sense of time	A negative distorted sense of time, taking forever or never ending and taxing endurance
A match between the challenge at hand and one's skills	A perceived miss-match between the challenge at hand and one's skill
Frequently associated with positive affect	Frequently associated with negative affect

Table 3 illustrates what an educational game needs to focus on and what it needs to avoid. If such a game succeeds, intrinsic motivation will be achieved and the learning process will be

rewarding in itself. If one can find the flow of a game, then intrinsic motivation will be built in the aftermath.

The motivating factors of an educational role playing game can be connected to instant feedback, collaboration, variation, tasks made for the student's level of competence etc. But the most important factor is the element of fun. As mentioned earlier, there has been much research done on the motivational factors of a game. They all include the element of fun. It is harder to define what fun is for every player, but Federoff (2002) explains several definitions of fun in games.

> *Fun relates to more than just the user interface of a game; it also relates directly to game play.* (…)
> *Offering challenge and the opportunity to master a skill seems to provide sufficient motivation for people to engage in games. The resulting satisfaction makes the activity fun. (…) fun lies in unexpected opportunities for growth and that games offer an intrinsic reward of needed brain stimulation*
> (Federoff, 2002, p.9).

Lepper & Malone's work on intrinsic motivation in instructional games is important. They point out that an important factor for intrinsic motivation lies in the element of fantasy (Lepper & Malone, 1987). Over the next paragraphs, motivation in games is discussed in greater detail. Games fascinate practically all types of people. In a study conducted at MIT in 2005, the results showed that about 88% of the students enjoyed playing games of different types (Jenkins, 2005). The reasons for enjoying games are diverse. But when it comes to commercial games one might argue that the main motivation is fun, entertainment, social settings and challenges. Many factors are the same in educational games as in commercial games. This is what makes them very well suited for teaching. Games have been a part of human culture and used for enjoyment and entertainment for over 8000 years.

In their now famous paper from 1987, Malone and Lepper focus on intrinsic motivation for learning based on games. They defined intrinsic motivation as an activity that people engage in for its own sake rather than in order to receive some external award or avoid some external punishment (Malone & Lepper, 1987). Words such as fun, interesting, enjoyable, fascinating

and daring are all words that describe an intrinsically motivating experience. Malone & Lepper divided intrinsic motivation into four "classes" of individual motivations and three interpersonal motivations. If these are present in a game, the conditions for learning are optimal. In table 4 the different classes mentioned by Malone & Lepper are listed and shows how an educational role playing game has the elements present.

Table 4: Overview of intrinsic motivations (Malone & Lepper, 1987) with my comments

Intrinsic individual motivations	Educational RPG
Challenge (goals, uncertain outcome, self esteem etc)	Has explicit goals, the outcome is seldom fixed, self esteem is built through avatars etc.
Curiosity	There is always something happening that the players don't know. Teachers can also "invent" new situations as they go along.
Control	The players are in control of their avatars and their actions. No one can force any one to do anything. Freedom of choice. (Except players can be forced into playing the game of course)
Fantasy (evokes mental images etc)	There are scenarios and whole worlds based on all kinds of fantasy elements.
Intrinsic interpersonal motivations	
Cooperation	Players work together in many different ways. They are totally dependent on that in game play.
Competition	Even though they cooperate and collaborate, they also earn individual experience points that separate them from each other.
Recognition (process, product, result)	All levels of recognition are found here. The players are evaluated constantly, they show what they do and use it and the results of their choices shown right after they are made.

It was the use of computer games that made Lepper & Malone interested in the aspects of motivation. They saw the unreleased potential that lies within games in general.

> *For some children, for instance, the identification with fantasy characters in role-playing games like Dungeons and Dragons may be a central aspect of the motivational appeal of these activities. For others, however, this fantasy may provide only a largely incidental context in which an opportunity to tackle challenges and establish one's competence is embedded.*

(Malone & Lepper, 1987)

Everyone has different reasons for why they are motivated, and everyone needs different things to motivate them. The good thing about an educational role playing game is that it is

possible for everyone to get the sense of identification with characters since it is possible to change the setting and environment in every new scenario. In that way you can keep the high grade of intrinsic motivation in young learners.

Marc Prensky refers to of the importance of motivation and how games and gameplay motivates. In 2002, an article called: "The Motivation of Gameplay or the real 21th century learning revolution" was published. In this article he explains in detail how games and education have the same goal, to motivate the user for action, but approach it in different ways. Whereas gameplay has but one purpose, to keep the user engaged and coming back for more, education focuses on instructions, i.e. getting the material across to the learner. He argues that the true learning revolution of the 21th century is that learning is finally throwing of the shackles of pain and suffering that have accompanied it for so long (Prensky, 2002). Prensky claims, as so many of us, that fun is the key to learning. It is the element needed for intrinsic motivation to occur. *So fun in the learning process creates relaxation and motivation. Relaxation enables learners to take things in more easily; motivation enables them to put forth effort without resentment* (Prensky, 2002, p.6).

The theory about motivation for learning through games is wide and informational. The focus in this thesis will be to look at the effects on motivation among 15 - year old students. Will gameplay create motivation for the learners? Prensky answers the question about gameplay and motivation as follows: *By keeping the player engaged at every moment* (Prensky, 2002). All activity, motivation and learning is based on the ability to keep the player (student) engaged at all times. Keep them in the flow zone. But in order to stay in the flow zone it is important to fell that learning occurs and that what is thought and played has relevance to what one is supposed to do.

There are many surveys and research reports that show the learning effect with a game (Malone & Lepper, 1987; Habgood, E:Ainsworth & Benford, 2005; Squire, 2003). Just by introducing this element, students will do more at least for a period of time. The effect of the game as an educational tool is also researched and shown (Futurelab, 2006; Squire 2005, Shaffer, 2006). But what kind of learning do they encourage, and how does the learning take place? Is the learning effect the desired one? Is the learning isolated to that particular activity, or does transfer occur? I will leave these questions for another time and place. In this inquiry the argumentation is that educational role playing games in many ways will encourage

transfer to take place. Transfer of learning is described by Salomon and Perkins: *Transfer of learning occurs when learning in one context enhances (positive) or undermines (negative) a related performance in another context* (Perkins & Salomon, 1992). Transfer of learning is an important aspect of learning, since most of education aspires to this. There has been a lot of research conducted when it comes to transfer of learning (Salomon & Perkins, 1989; Oblinger, 2006; Subedi, 2004; McKeough et.al, 1995). Research specifically done on transfer in educational games is more difficult to find (Oblinger, 2004; Banerjee & Stone, 2007). The different terms used in this inquiry was presented by Salomon & Perkins in 1989.

There are two main kinds of transfer. There is what known as "low road" transfer, described as transfer based on skills mastered to near automaticity by continuous and repeated practice. So-called "high road" transfer, on the other hand, requires the mindful abstraction of a principle, the effortful search in ones memory, the selection of the appropriate principle and, finally, its application to a new instance (Perkins & Salomon, 1992). In an educational role playing game low road transfer will be the most apparent. High road transfer could be achieved through a closer bond between the game scenario and the subject matter. When it comes to the techniques used to achieve these two types of transfer, they are referred to as: "bridging and hugging[29]" (Perkins & Salomon, 1992). High contextualization will enhance high road transfer and low contextualization will enhance low road transfer.

One might also see that no contextualization might lead to any transfer of learning at all. There are many ways to look at the term contextualization.

> *The contextualization idea implies that the cognitive representations of stimulus events are toned by, and integrated with other events they accompany. This may be other stimuli in the same sensory modality—like in processing a letter in a particular word—or other aspects of the same event experienced via other modalities.*
> (Hommel et.al, 2000, p. 5)

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[29] Bridging is used when teaching high road transfer. The teacher helps the students to build a bridge from the context of learning to other contexts of potential.

Hugging is used when teaching low road transfer. Make the learning situation more like the situation which transfer is desired (Perkins & Salomon, 1992).

That contextualization plays a vital role in the learning process has been shown before (Rine, 2006; Gumperz 1982). *"(…), the contextualization cue serves to activate and retrieve the necessary background knowledge base so that a contextually appropriate process of inference can take place* (Wilson, 2004). As mentioned in appendix 1, the Lærelyst system is based on a traditional role playing game platform consisting of avatars working their way through scenarios[30]. If the tasks and challenges, together with the subject that are to be taught, are very closely linked to the scenario played. Will the scores on recall then rise? It is possible to argue that if there is a high level of contextualization in a scenario, then the chance of high road transfer to occur is greater. However, many of the scenarios in educational RPGs are stories with facts and tasks put in to different scenarios based on the teacher teaching the class at one particular moment. This leads to low contextualization, which again results in the occurrence low road transfer will occur or maybe no transfer at all. This is the background of the discussion between Papert and Pea & Kurland. Papert claimed that LOGO[31] was able to teach students strategies that they could use in different subjects. In short, the use of LOGO would create transfer. This was contested by Pea & Kurland. They claimed that the context in which something was learnt had a huge impact on the result. Through research Pea & Kurland showed that the use of LOGO in math, geometry to be more specific, led to an improvement using the programming language, but they could not measure any transfer from the use of LOGO on to other part of math or other subjects.

> *For learning to program, goals of the programming activity need to be contexted for the child in terms of other meaningful and goal-directed activities, connecting either to everyday world affairs, to other aspects of the curriculum, or both*

(Pea & Kurland, 1984 p.149)

This is also the dangers of a decontextualized game. Students learn how to do something in one context, but the learning is not transferable to other contexts. This was shown in research by Pea and Kurland.

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[30] Stories that are used in the game play where the avatars live. All subject content is integrated in the scenario.

[31] Programming language created by Seymore Papert. http://el.media.mit.edu/Logo-foundation/logo/index.html

Though encouraging since math exploration and "mathland" play are likely to support math learning, studies have not shown any effects of "math exploration" during programming outside the programming environment.

Pea & Kurland, 1984 p. 159)

In educational games this is also a valid point to look at. There is a high chance that the game will have an effect on learning in the game context; the question is in what grade it will be transferable to other contexts? There is a high chance of low transfer in a game like Lærelyst because the scenarios are not closely linked to the actual subject taught. This point is also mentioned in an article from 1985. It says: (…) *contrary to Papert's idealistic individual "Piagetian learning," suggests that self-guided discovery needs to be mediated within an instructional context* (Pea & Kurland, 1985).

 There might even be a chance that the only thing they learn is reproduction of the tasks in the game. All that is achieved is so-called "traditional" learning or normal learning. Normal learning can also be referred to as: "very near transfer" (Perkins & Salomon, 1992). The need for contextualization is illustrated in a sentence by Gumperz: (…) *lack of shared background knowledge leads initially to misunderstandings* (Gumperz, 1995 p.120). This will be valid for an educational role playing game. The more background knowledge implemented in scenarios, the higher are the chances of recognition and transfer to occur. As mentioned earlier in the chapter, the context of a game is motivating and entertaining. This again leads to an increase in motivation when using a game as an educational frame. By using a role playing game, one will also have a higher grade of collaboration since role playing games, by nature, are games that promote collaboration. To achieve transfer of learning, it is important to internalize the knowledge presented in a game context. It is therefore important to make the game as close to the subject presented as possible. This is what is meant by a highly contextualized scenario.

An example is used to understand the use of contextualized scenarios. The Pythagorean Theorem is the topic of learning. Players are going to learn how to use the Pythagorean Theorem. They are playing a group of wanderers trying to enter a city. On the city wall they are presented with tasks about Pythagoras and his theorem. They will have to work on these tasks, and the city gates do not open before they have the correct answers. When this task is done the gates opens. The first thing they see inside is roofs falling down, carpenters trying to

measure the length of logs etc, all examples where Pythagoras Theorem is needed. They will be given the same kind of tasks in different contexts throughout their stay in the city. The entire story will be built around what they are going to learn presented in different contexts.

In a low contextualized scenario, the players will walk around and randomly meet tasks and challenges from different subjects in a story that has little or nothing to do with the knowledge the players are supposed to acquire. In this experiment this was often the case, so I will have to be prepared that the scores on motivation and collaboration will be high in the experiment groups using the educational RPG, but low when it comes to recall.

To further understand the importance of contextualization in order to achieve transfer, it is necessary to look in to Fidelity theory. Squire defines them as:

> *Hi-Fidelity simulations attempt to model every interaction in a system in as life-like a manner as possible, whereas Low-Fidelity simulations simplify a system in order to highlight key components of the system*

(Squire, 2005).

Two main types of games are Simulations (system dynamic games) and event based games. The first type is high fidelity games where the game is as close to the actual practice as possible, ex. flight simulators or military games. An event based game put more emphasis on the gameplay rather than the content. It might therefore be possible to argue that they have a low contextualization and low fidelity. They partly cover areas of practice but not structured and organized. A typical educational role playing game, and most video games, will fit into the category of event based games; Low-Fidelity games. They simplify the systems so that they are easy to use and that the things that are important are the ones that are attended to. It is known that most Low- Fidelity simulations do not use computers at all. They use board games and role-playing games. By using Low-Fidelity games, it will be natural to speak of low grade of contextuality thus a low road transfer. However, it is possible to model every interaction in a system in an educational role playing game. One might also see the total opposite result where high transfer occurs because of the extra mental effort put into the abstraction to see the relationship between the facts that are to be learned and the setting they are presented in. It might be possible to argue that with high-fidelity the chances are higher for high road transfer to occur. Contextualization is also strong when every interaction is modeled. Models using

High-Fidelity theory are often computer based. In chapter 1 it is argued that it is possible to take the best out of computer games and use that in a table top RPG. This is also supported by Squire in his article on Video Games in Education.

Hi Fidelity simulations need not be digital, however, "dress rehearsal" of an event or procedure might be considered a simulation (Squire, 2005). According to theory, Lærelyst[32] as it stands today does not have the contextualization needed on every level to fulfill all its expectations, thus this formative approach will also show in the results of the experiment. It has been shown through empirical research that embedding material in a fantasy context can enhance learning more than a generic, low contextualized environment (Cordova, 1993).

Figure 1: Illustration of context

Hi fidelity $\Longrightarrow$ High grade of contextualization $\Longrightarrow$ High road transfer

Low fidelity $\Longrightarrow$ Low grade of contextualization $\Longrightarrow$ Low road transfer

2.4: Collaboration and types of learners

The theories about learning and elements connected to learning have now been discussed. It is also important to look into some of the core elements of a role playing game and the impact that might have on learners. Any role playing game will, by default, attempt to make the players collaborate or cooperate. The word collaboration is at the core here; it is often mistaken for cooperation, which is not the same. In a cooperative setting a task is handed out to a group. The group looks at it and divides it into fragments that can be worked on individually. When the work is done, they gather to put together the fruits of their individual work. Collaboration, on the other hand, is defined as: *A situation in which two or more people learn or attempt to learn something together* (Dillenbourg, 1999). Dillenbourg also speaks of collaboration turning into a method of teaching when used in a scenario based on roles (Dillenbourg, 1999). The impact of this heavy focus on social skills might have an effect on each individual learner. It is therefore important to look at the different types of learners. In this inquiry I will look into the difference between so called *solo and social learners*. In short one can argue that solo learners prefer the cooperative approach if they have to work with someone, while social learners collaborate.

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[32] Lærelyst, educational role-playing game presented in appendix 1.

If we go all the way back to the legendary cognitive thinkers we find Piaget[33]. Many live under the assumption that Piaget focused solely on the solo considerations of learning, but this is not right. There are many examples of the opposite (Betz, 2006). Salomon and Perkins have done a lot of work in the field of solo and social learners. They firstly admitted that until recent years, social learning (and social learners), has been underemphasized in relation to individual (solo) learning. A solo learner is defined as one who prefers to acquire knowledge by himself for himself. Solo learners are more comfortable having control over the learning situation themselves. A social learner enjoys the collaborative and cooperative elements of learning. The participation with others in the learning process is vital to their way of learning. Solo learners have traditionally been looked upon as the type of learners admired by scholars and schools systems over the centuries. However, times are changing and a new field of thought appears. *Social learning is in the air. Daily observations and experiences as well as recent scholarly traditions suggest that some learning takes place beyond the confines of the individual mind* (Salomon & Perkins). To look further into this they identified six meanings of social learning for the sake of conceptual clarity (Salomon & Perkins, 1998). The meanings are as follows:

1. Active social mediation of individual learning. One of the most fundamentally social forms of learning occurs when a person or a team helps an individual to learn.

2. Social mediation as participatory knowledge construction. Social mediation of learning and the individual involved are seen as an integrated and highly situated system in which the interaction serves as the socially shared vehicles of thought.

3. Social mediation by cultural scaffolding. Learning derived from a social artifact or media.

4. The social entity as a learning system. A collective agency that as a collective acquires more knowledge, understanding, or skill.

5. Learning to be a social learner. Learning to learn in ways that participate in and capitalize on the social milieu.

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[33] Swiss philosopher, biologist and developmental psychologist, well known for his work studying children and his theory of cognitive development.

6. Learning social content. How to get along with others, how to maintain reasonable assertiveness, how to collaborate in reaching decisions and taking collective action.

(Salomon & Perkins, 1998)

The first four meanings are the most interesting ones. They describe the dynamics of learning, in contrast to the last two, which deal more with what is learned (Salomon & Perkins). *Salomon & Perkins have identified the relationship between solo and social learning as a reciprocal spiral, which too is in accord with Dewey's two principles of continuity and growth* (Betz, 2006).

This experiment looks into the difference between solo and social learners because it could be interesting to see if there is any difference when it comes to grades, motivation, attitude towards collaboration etc. By doing this I want to look at the different learner's attitude to an educational role playing game. Will there be a significant difference between solo and social learners when it comes to motivation for learning through an educational role playing game? I will expect social learners to score high in motivation by using an educational role playing game. One role in a virtual world would be lonely and not very motivating. Players have to rely on each other, they have to both cooperate and collaborate in order to do what is asked of them. I expect solo learners will have problems fitting into this pattern. The same goes for the impact of collaboration. However, there is one important point that needs to be considered when looking at collaboration. Salomon brings up the term interdependency in an article written on the subject. He describes interdependency as: a need to share, a joint endeavor, and a pulling together of minds (Salomon, 1995). He points out that many collaborate when it gives an advantage for them but works otherwise individually. This has been looked at in many different research projects. Tolsby, on his work on CSCL[34] and digital portfolios, noticed the same things. He writes:

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[34] Computer supported collaborative learning (CSCL) has grown out of wider research into computer supported collaborative work (CSCW) and collaborative learning

> *For example students may be sufficiently engaged in a subject to search their teacher's portfolio for knowledge, and teachers are obliged to revise and guide their students in portfolio making. However, students in-between will not use their portfolios to collaborate unless they believe they can benefit from it or they are forced to do it.*

(Tolsby, 2002 p. 238)

Tolsby also suggests ways to enhance collaborative action and points out peer review and shared portfolios as important ways to do this. Looking at educational role playing games, this is exactly what their intentions are.

As shown above, the educational role playing game might enhance these points and it's clearly indicated that social learners will have an advantage in such a system. But this doesn't mean that solo learners can't be a part of this or that solo learning is overlooked. Even when learning is fostered through processes of social communication, individual activity and reflection still plays a critical role. Individual and social learning should be considered side-by-side to exploit the advantages of each as a protection against theoretical excesses (Salomon & Perkins, 1998). The same is emphasized when it comes to solo and social learning as Sfard emphasizes when it comes to the two metaphors. The worst thing that one can do is to chose one of them and discard the other. This also counts for educational role playing games. Both ways of learning must be represented and there must be room for different kinds of learners. In many cases solo learners can benefit from social learners in certain situations and vice versa. The important thing is to bring the different kind of learners into those kinds of situations. This can be done through a role playing game.

The research conducted in this experiment has a formative approach. The intention is to check whether something that is under development is working and what needs to be changed, kept, discarded etc. A formative research is commonly done as an integral part of developing new systems. Educational role playing games are examples of such systems. Hernandez gives a definition of formative research which is valid when looking at the approach chosen in this thesis: *Formative research is any research that helps define the content of an intervention. It may be either primary or secondary research, and can be qualitative or quantitative* (2000).

2.5: Summary

The key elements presented in this chapter are all related to the use of games as educational tools. The main focus was to report if the results on motivation, collaboration and recall are affected positively if the students are being exposed to educational games. It seems to be different views on this. There has been conducted much research in the field of motivation and games, showing very strong correlations between the use of games and motivation (Malone & Lepper, 1987; Prensky, 2003). When it comes to the effects of learning and transfer, results are mixed. The connection between high contextualization and learning has been shown in several research projects (Pea & Kurland, 1984; Gumperz, 1982; Squire, 2005). This is not a surprise, but it indicates the need for this connection if games and education are to result in higher learning effect. That students perform well in tasks given in a game setting is also showed (McFarlane et. al, 2007). So the connection between games and education lies in the element of contextualization. It is however the motivational aspects of the games that has been studied the most without looking thoroughly into the educational aspect. This inquiry shows the need to combine the two.

The different perspectives of learning are discussed in order to show the different views on games as educational tools. The main focus in this inquiry has been put on the aquisitional metaphor as opposed to the participatory metaphor of learning (Sfard, 1998). In the acquisitional metaphor of learning, the notion of transfer becomes an important topic of discussion. Theory indicates that games often produce so called low road transfer. One of the reasons for this might be the contextualization of the game. I have explained the need for contextualization in order to achieve good results. Fidelity learning has also been discussed in the same context. This is done in order to look for explanations for why academic results seem to be weaker in a group using decontextualized educational games. The groups are motivated, but the results do not correlate with the amount of motivation. There might be good reason to argue that what is learnt in a game context can be used there and is not transferable (Pea & Kurland, 1984).

Finally, at the end of the chapter I bring up the notion that there are two main categories of learners that need to be attended to; solo and social learners. When using an RPG as an educational tool, knowing that it requires collaborative skills. One might exclude a group of learners. I have therefore discussed the terms social and solo learners in order to give a full

view into problems that might have impact on the results of my research. Will there be room for everyone in a game setting?

Based on the theory presented in this chapter and knowledge of educational role playing games, this resulted in a formative research to look into the didactic challenges that presented themselves when using games as learning tools. It also resulted in looking further into the connection between contextualization and learning, and finally to look into the differences between types of learners.

Chapter 3: Methods and Research

3.0: Introduction

After looking into the problem area and theory concerning games and education it is time to look into the actual research process.

3.1: Research questions

The problem area and research questions were developed from observations in the area of games and education. In this chapter the methods used in order to look into the research questions and how they are analyzed is described. The research questions are described in chapter one page 18. In this chapter several approaches are looked into in order to find reliable answers to these questions. A detailed description is presented on the research itself and also of alternative approaches looking into the same issues.

3.2. Framework for Research

Chapter 2 shows parts of the extensive research done in the field of games and education. Games can be looked at from two different perspectives; the cognitive and the situated perspective. Sfard refers to these views as two metaphors for learning, the acquisition metaphor (AM) and the participation metaphor (PM) (Sfard, 1998). These metaphors are elaborated on in chapter 2.

It is possible to argue that the metaphors represent different typologies when it comes to methods of research as well; the qualitative[35] and the quantitative[36] approach. While the PM traditionally has been associated with the situated perspective based on socio-cultural theory and traditionally a qualitative approach, the AM is associated with the cognitive perspective and traditionally based on a quantitative approach. There are of course exceptions from this generalization. The hypothesis formed in this thesis is leans towards a cognitive view on learning. However, both typologies of research have been looked in to in order to give a broader view on how to find results that could be of highest possible validity.

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[35] Qualitative research is based on text and gives textual descriptions such as interviews (Ringdal, 2007). A more in depth approach

[36] Quantitative research is based on numbers and gives a description of reality in numbers and tables (Ringdal, 2007). To put it in other words, something that can be measured.

Initially the focus was on a so-called Hypothetic-Deductive Method (Fig. 2).

> "*This view in research looks upon research as a circle including both induction and deduction. According to Karl R. Popper projects starts as guesses that forms into hypothesis that can be tested by real life observations*"

(Ringdal, 2007 p.40, My translation).

Using this approach would broaden the research and given it improved validity. Triangulation[37] is looked upon as a good approach in research because in increases the validity of the results. The important issue is to use both an inductive and deductive approach.

Figure 2: The science circle. Source: Wallace 1971
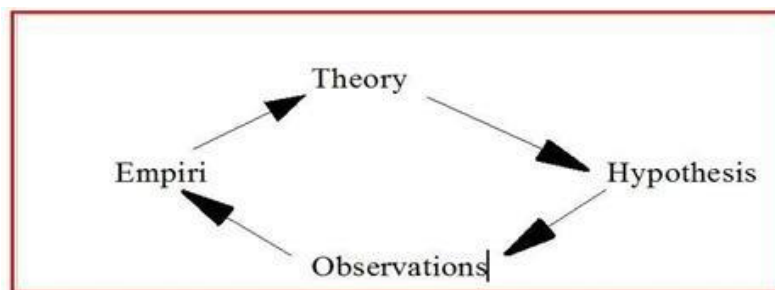
However, as the project progressed, it became apparent that including elements of both quantitative and qualitative research would be both difficult and time consuming. The amount of data that was gathered only in the experimental part was immense. I therefore decided to use only a quantitative approach, an experiment. A qualitative approach with interviews and observations was also an alternative that was considered. It would have been possible to play an educational role playing game with a group and interviewed the as well as observed the process. It would have given a deeper insight why certain things occurred, an inner validity, but it would be very hard to generalize results based on a small number of interviews from a small group of informants, let alone make any valid conclusions on the effect on learning, motivation and collaboration. I wanted to look into a general effect of an educational role playing game, so I discarded this approach. As mentioned above observations were also considered. It was initially thought of in combination with the experiment. However, after collecting the first data, it became clear that there was an enormous amount of data that

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[37] The use of several methods of research in the same project, both quantitative and qualitative, in order to increase validity.

appeared just through the experiment. If observations were used as well, it would be more work than could be done within the disposable timeframe. A quantitative approach was then chosen knowing that it might lower the validity of some of the findings, or leave questions of certain findings unanswered.

When deciding on a quantitative approach, the first thought was a large survey study of the use of educational role playing games and measure the results gathered in this survey. It would then be possible to say something about the frequency of games in schools, the time spent, grades achieved etc. One problem is that it requires a lot of respondents and is pretty time consuming if one is interested in valid data.

It became clear that an intervention study, an experiment, was the approach of choice. The experiment could help find the missing elements in the game and lay the groundwork for the next. This resulted in a formative perspective of research as well. To bear in mind that not only was the goal to look into effects, but also point out flaws and strengths The experiment is the classical scientific research design used in natural science, but also in medicine and social science (Ringdal, 2007 p. 109, my translation). This is commonly used in research looking into effects on learning or other effects concerning education. An experiment is defined as: *An attempt by the researcher to maintain control over all factors that may affect the result of an experiment. In doing this, the researcher attempts to determine or predict what may occur* (Key, 1997). It is important to be aware that there are different types of experiments. The true experiment is built up by two groups, a control group and an experimental group. By random assignment we anticipate that the groups are similar in every way, except that the control group does not receive the treatment that the experimental groups receive. The strength of the true experiment lies in the internal validity. Internal validity means that by using random selection, the results are more valid to make assumptions based on the findings. External validity is lower in a true experiment. To run a true experiment is very hard since it is difficult to find identical groups in schools, or anywhere else. It is very seldom a true experiment is possible in pedagological research; it is usually used in research on medicine etc.

I therefore ended up with a Quasi experiment known as the Non-Equivalent Groups Design (hereafter NEGD) (Trochim, 2006). A quasi-experimental design looks very much like an experimental design but lacks the key ingredient; the random assignment (Trochim, 2006). The NEGD is defined as:

One of the strongest and most widely used quasi-experimental designs. It differs from experimental designs because test and control groups are not equivalent. Comparing pretest results will indicate degree of equivalency between experimental and control groups

(Key, 1997).

Conducting such an experiment will have an impact on the internal validity, because of the lack of random assignment. To determine exactly why results occur can prove to be difficult. However, it will have a positive impact on external validity making it is easier to generalize the findings. The design of the experiment is shown graphically in figure 3.

Figure 3: NEGD (Trochim, 2006)
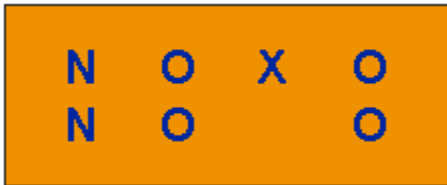
The advantage of such an approach is being in control of the experiment. Three classes of 9th graders were the basis of the experiment. The teachers in three parallel classes at the same school were all interested in looking at some of the same things looked at in this thesis. Another reason for choosing this school, and these teachers, was that they never worked with the game in school prior to the experiment.

3.3: The questionnaires and tests

Another name for this design is the pre-test post test design. This means that questionnaires are used at the initiation of the experiment, called the pre-test (appendix 2). After the experiment has been conducted another questionnaire is answered, known as the post-test (appendix 3). From the results of these tests, especially the post-test, it is possible to see if the experiment has had any effect on things that one wanted to look into. It is because of this it is important to run validity checks of the questionnaires and conduct a pilot study. By doing this, it is easier to argue the validity of the results presented form the experiment. The pre-tests and post-tests are together with the recall test the «heart» of the experiment. They will make it possible to create selective factors based on a factorial analysis. They also lay the basis of looking into the elements of motivation and collaboration as well as defining social and solo learners. An analysis of reliability before conducting the experiment was conducted. This test

of reliability was also conducted on the Geometry test and re-test used in the experiment. Cronbach's Alpha[38] is used to define the reliability of the different variables in the questionnaires and to ensure higher validity to the results derived from them. The tests were conducted in a small pilot study. The alpha on the test and re-test was .763. This is a high correlation of reliability coefficient in pedagological research. The first drafts for questionnaires were used in the pilot. After the pilot the questions in the questionnaire were looked into and correlated. The ones that answered the same question or belonged to the same construct were kept, the others discarded. This ensured a valid questionnaire before the real experiment. The results from the questionnaires and tests will be run through SPSS[39], where they will be used to look into the different elements of the research. It is the data from SPSS that will be analyzed in order to find answers to the research questions formed in chapter 1.

3.4: The experiment

When conducting an experiment, there are a few things that are important to be aware of. Key lists up six key elements in an experiment. These were good guidelines through the course of the experiment. They were followed in detail as described in this chapter.

1. Identify and define the problem.

2. Formulate hypotheses and deduce their consequences.

3. Construct an experimental design that represents all the elements, conditions, and relations of the consequences.

    a. Select sample of subjects.

    b. Group or pair subjects.

    c. Identify and control non experimental factors.

    d. Select or construct, and validate instruments to measure outcomes.

    e. Conduct pilot study.

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[38] Cronbach's alpha is a coefficient (a number between 0 and 1) that is used to rate the reliability of an instrument.

[39] Statistical Package for the Social Sciences: A software system for data management and analysis. SPSS may be used for many univariate and multivariate statistical analyses and has facilities for sorting and merging files and manipulating data. SPSS can deal automatically with complex files (Nicotera, 1995).

   f. Determine place, time, and duration of the experiment.

4. Conduct the experiment.

5. Compile raw data and reduce to usable form.

6. Apply an appropriate test of significance.

  (Key, 1997)

The experiment was run over 3 weeks. As mentioned in chapter 3.3 there were 3 9th grade classes which had 26, 28 and 29 students (n=83). Not all students participated throughout the duration of the experiment for various reasons. This was to be expected though, and has been accounted for in the analysis in chapter 5. The numbers of boys and girls varied in the classes and all together there were 59 boys and 24 girls, another indication that this is a quasi experiment. Although one expects classes to be somewhat similar, this was not necessarily the case here. Prior to the experiment, I had to apply to NSD[40] in order to check if my experiment needed any form of special attention when it came to elements of anonymity etc. This was not an issue here as long as none of the participants had any risk of being identified. When the answer from NSD arrived, the experiment was initiated. The first week of the experiment was used to introduce the students to the educational role playing game and to conduct the pre-test. All students answered the first questionnaire at the same time, using as long as they felt they needed in order to get it right. They answered it anonymously and individually. After this the experiment groups were introduced to an educational role playing game called Lærelyst – Veien til motivasjon[41].

In short the game is based on students to work the role of an avatar[42]. The avatar has no abilities or skills to begin with, but through academic achievements students can improve their avatar and make him or her accomplish gradually more difficult tasks in the game as well. In short one might say that, the more time spent on schoolwork and topic related themes, the stronger the avatar gets. There is a more detailed description of the system in appendix 1. The control group started the school work immediately. The experiment groups also began the

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[40] http://www.nsd.uib.no/

[41] Appendix 1.

[42] A virtual person players chose to play in the game.

process of using Pythagoras Theorem, but not as intensely as the others. They also had to learn the different steps of the game. The experiment groups were instructed differently as well. One of the groups (G2) used individual or paired avatars and the other group (G3) was up till 5 students playing an avatar together. They played through the same scenarios in the game play. The control group read the same pages and worked on the exact same tasks as the experiment groups. Through the duration of the experiment, all the groups were allowed to use the same tools for aid in the learning process. They had their books, teachers, Internet availability etc. It would also have been possible to use a web based editor to keep track of points and progression. However, this was discarded due to lack of time. In retrospect one might argue that this was a bad decision. Keeping track of every avatar is usually the biggest problem in the game play. The ICT tools were hardly used at all. That might have been one of the reasons that time became such an issue for the experiment groups. The editor shows the avatars, keeps track of experience points and facilitates the process of starting up every time. Then the updated avatar can be printed out instead of the teacher having to check every one of them. A mockup from the editor is shown in figure 4.

Figure 4: Mockup of editor for educational RPG, Lærelyst – veien til motivasjon.
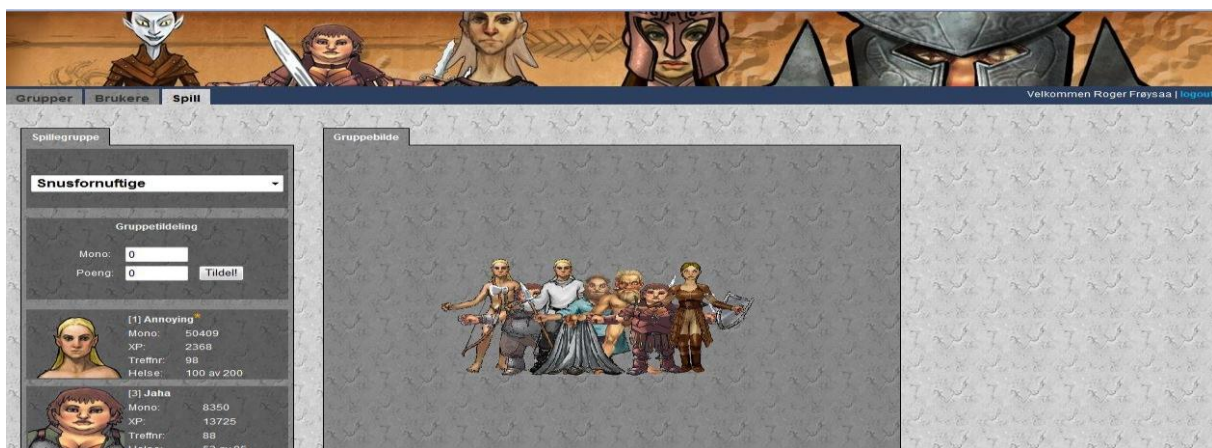
Results from the pre-test was put into the SPSS program and compared with the results from the post-test that were given two days after the experiment was finished. This questionnaire asked the same questions after being exposed to the educational role playing game. At the end of the experiment period, they had a test in Pythagoras theorem (appendix 4). This was done to measure recall, what they had remembered from the 3 weeks of working with the topic. The same test was conducted again 6 weeks after finishing the experiment, to see if there were

any difference between the experiment groups and the control group when it came to remembering the topic in a different context at a different time. The students were totally unaware of the re-test. The results of the tests are shown in chapter 4 and analyzed in chapter 5. Following this, all data is compiled, and are being reduced through SPSS to usable form.

In figure 5 below, you will see an illustration of my research model. It shows the framework of the experiment. It starts with the initiation, and following the framework described earlier in this chapter. The duration of the actual experiment was 3 weeks, but the re-test was conducted 6 weeks after finishing the experiment. The framework does not include the process before the actual experiment started. This shows a model from day one of the experiment until it was ended nine weeks later with the re-test in Geometry.

Figure 5: Graphical sketch of experiment.
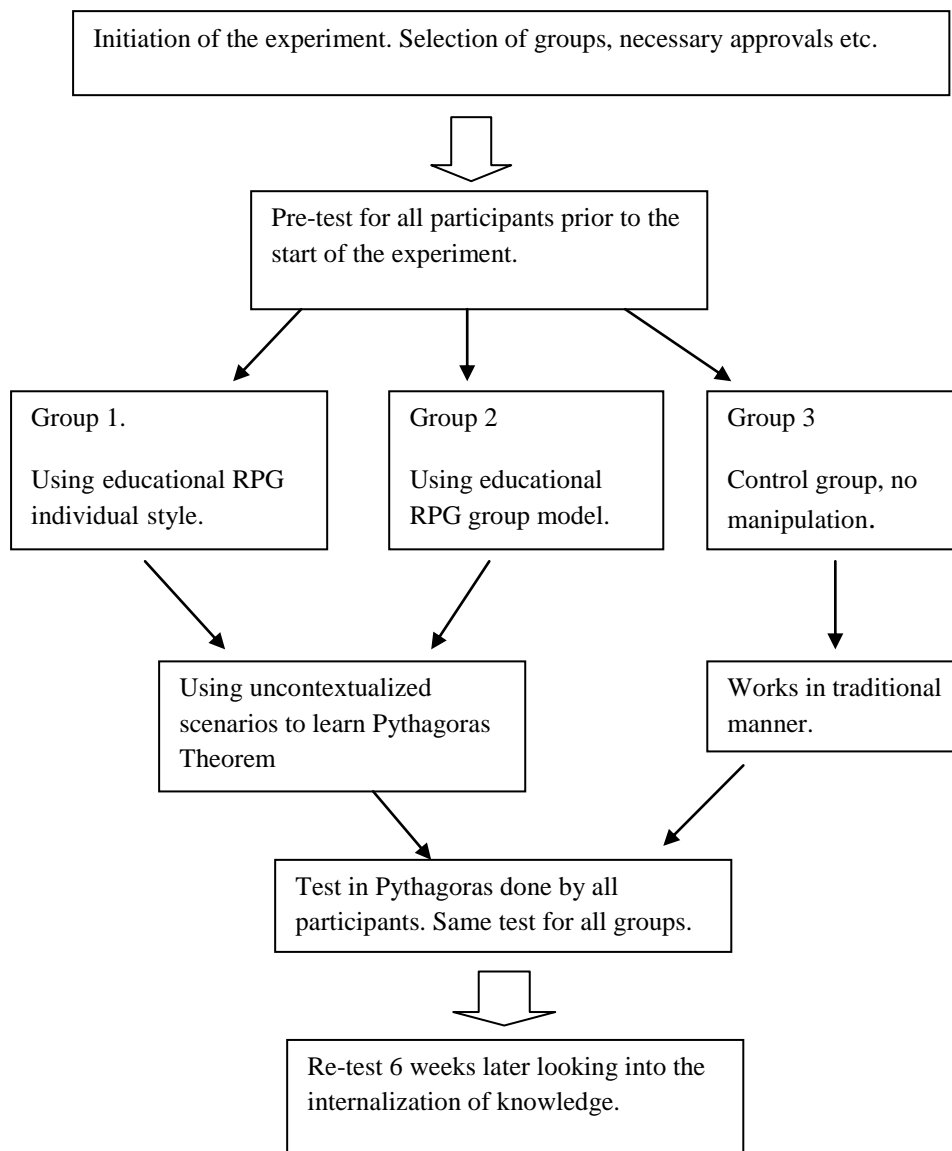
3.5. Analysis

When analyzing data, there are a few key elements that have to be kept in mind. Most of these elements such as the standard deviation, mean etc are handled by the statistic programs on the computer, such as SPSS. My empirical data will follow the standard procedures for testing of a hypothesis. The data is presented in chapter 4 and will be analyzed in detail based on theory in chapter 5.

3.5.1: Model of analysis

The first part of an analysis will be to look at the raw data and give a descriptive analysis of the main elements such as standard deviation, means etc. All descriptions that will have any relevance to the further analysis is laid out first and explained. Following the descriptions it will be relevant to run several ANOVA[43]s in order to look into the main effects. An ANOVA compares the variation (measured by the variance) between populations with the variation within populations. If the between variation is much larger than the within variation, the means of different populations will not be equal. If the between and within variations are approximately the same size, then there will be no significant difference between population means. But as mentioned in chapter 2, research has shown that there is reason to believe that educational role-playing games will have different impact on different people. It will therefore also be necessary to look into selective effects as well. To look into that it will be natural to use a factorial design or a MANOVA. A MANOVA is simply an ANOVA with several dependent variables (French et.al, 2002). Confidence intervals are usually calculated so that this percentage is 95% in educational research, which means an alpha at .05. Researchers' points out the advantages of a MANOVA in the type of research I am conducting. I am manipulating variables in order to see if there are significant differences that occur by doing so.

> *MANOVA is useful in experimental situations where at least some of the independent variables are manipulated. It has several advantages over ANOVA. First, by measuring several dependent variables in a single experiment, there is a better chance of discovering which factor is truly important. Second, it can protect against Type I errors that might occur if multiple ANOVA's were conducted independently. Additionally, it can reveal differences not discovered by ANOVA tests.*

(French et.al, 2002)

I want to run a MANOVA in a 2*2 factorial design. The reason for this is because factorial designs are the only way to effective examine interaction effects (Trochim, 2006). Trochim defines the important features for a factorial design as follows:

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[43] Analysis of variance or ANOVA is an inferential statistical procedure that examines the difference or variance between a treatment and control group on some type of posttest.

First, it has great flexibility for exploring or enhancing the "signal" (treatment) in our studies. Whenever we are interested in examining treatment variations, factorial designs should be strong candidates as the designs of choice. Second, factorial designs are efficient. Instead of conducting a series of independent studies we are effectively able to combine these studies into one. Finally, factorial designs are the only effective way to examine interaction effects.

(Trochim, 2006)

In general one can say that ANOVA is used to test main effect and MANOVA is used for testing selective effect. After analyzing my data I have to show the validity of my results based on reliability.

In addition to use ANOVA and MANOVA, regular correlation studies are done as well as looking into means between the groups. There will also be conducted analysis looking into gender and the use of educational role playing games. In the end an overview of learning effect will be presented and a two-way analysis of variance with repeated measures looking into the group's progression from their initial grades through two new tests.

3.5.2 Reliability

Reliability is together with validity what determines whether your results are transferable to other situations. The data needs to be as reliable as possible. Through high reliability comes high validity. Reliability is the empirical part of your data, while validity also must be founded in theory (Ringdal, 2007 p.86).

There are two main approaches to look into reliability: Initially we have the Test-Retest Reliability. This approach assumes that there is no substantial change in the construct being measured between the two occasions. Time is an important factor here. In my research this can be hard to check since there is one month between the tests. More than two weeks apart showed significant differences in answers according to Jacobsen (Jacobsen, 1999). But this might be one way to look into the correlation between variables. The other approach is the Internal Consistency Reliability. This is based on Split-Half Reliability. *We randomly divide all items that purport to measure the same construct in two sets. We administer the entire*

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instrument to a sample of people and calculate the score for each randomly divided half (Trochim, 2006). The spilt-half reliability estimate is simply the correlation between these two total scores. This technique works on scales with a large number of indicators. This reliability is measured with the Cronbach's Alfa. This measures how well a set of items (or variables) measures a single non dimensional latent construct. I am using Cronbach's Alpha to check the reliability of my set of variables. In research the Alpha has to be over 0, 70 to have a satisfying reliability.

3.5.3. Validity

Whereas reliability is an empirical matter, validity also needs a theoretical basis. But in general one can say that high reliability also gives high validity. So what is validity? Trochim defines it as: The best available approximation to the truth of a given proposition, inference, or conclusion (2006). One might argue that reliability measures if the results are the same from time to time, while validity looks into if what is measured is really what was we intended to measure. We separate validity into internal and external validity. In this research the internal validity is low since the test groups has been picked out and not using random assignment. This has also been mentioned earlier in this chapter under the true experiment. However the external validity is of a greater interest. My results are easier to generalize since all the respondents basically belong to the same group. There is also reason to believe that the results are also easy transferable to other students because of the Norwegian school system with a government made curriculum. Field experiments have in general a stronger external validity. There are, however, several threats to both internal and external validity. The two main threats to the quasi experiment's external validity are different problems within the selection and missing data. Critics can claim that the selection is not representative, that the results found is only valid in one setting with that exact selection, or only in a limited place in time. The other threat is mortality, respondents that quit, are sick or for any other reason does not participate in the entire experiment. There are different kinds of mortality, in my research the mortality is accidental, and that means that it was elements outside the experiment that caused the respondent not to be able to participate in the duration of the experiment. Fortunately there are ways to improve validity. The best one is to do replicas of the same experiment. By repeating the same experiments different places and achieve basically the same results will improve both external and internal validity. This has been done here. Through my pilot I have shown that the results from two different schools are in large the

same. This adds reliability to the data, and it made me able to sort out questions that did not correlate with the different variables.

3.6: Summary

This chapter has presented the framework for the research and research process. Over the next two chapters the empirical data and the analysis of this data will be presented. Chapter 4 includes the presentation and comments on the findings, while chapter 5 will draw the lines from my problem area to the empirical data and analyze them based on my theoretical basis presented in chapter 2.

Chapter 4: Presentation of empirical data

4.0: Introduction

The framework for my research was shown in chapter 3. In this chapter the attempt is to show important parts of the empirical data and explain them briefly in order to have them as background for discussions and analysis in chapter 5. This chapter will initially present the groups in my experiment, a list of variables and a description of status. The remainder of the chapter will present data looked at from different views in order to look for any significant deviations. An important part of information is that the first test is referred to as the post-test and the second test is referred to as the re-test.

4.1: Description of starting point

The first part of a description will be a definition of the gender of the respondents. As shown in table 5, there were a lot more boys than girls in the experiment. Boys are referred to as 1 and girl as 2. This was also unevenly spread in the groups. I have not focused very much on it though, since it initially was not something the thesis wanted to look into. However, it will be discussed in chapter 5 whether there is a significant difference between male and female when it comes to the use of educational role playing games. In 4.1 only descriptions are made. In 4.2 there are shown one way ANOVAs to look at the significance.

Table 5: Male – female ratio in experiment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	52	61,2	63,4	63,4
	2	30	35,3	36,6	100,0
	Total	82	96,5	100,0	
Missing	System	3	3,5		
Total		85	100,0		

Before looking at data compared with each other and any significant impact on the thesis formed, it is important to show the starting point before any manipulation occurred, in other words, status before the experiment. In table 6, I have shown a comparison of the groups before the start of the experiment.

Table 6: Math grade before initiating experiment

Game_Free (1), Game_Medium(2), Game_Intensive(3)	Mean	N	Std. Deviation	Median	Minimum	Maximum	Variance
1	3,63	24	,970	3,50	2	6	,940
2	3,50	24	1,022	4,00	2	6	1,043
3	3,04	24	1,083	3,00	1	6	1,172
Total	3,39	72	1,042	3,00	1	6	1,086

As one can see from table 6, the mean differed between the groups as did the standard deviation. This became even more apparent after the math test they underwent immediately after finishing the project. This is shown in table 7. The retest is shown in table 8.

Table 7: Description of groups after Geometry test.

Game_Free (1), Game_Medium(2), Game_Intensive(3)	Mean	N	Std. Deviation	Median	Minimum	Maximum	Variance
1	4,40	20	1,314	4,00	1	6	1,726
2	3,63	24	1,610	4,00	1	6	2,592
3	3,19	27	1,618	3,00	1	6	2,618
Total	3,68	71	1,593	4,00	1	6	2,536

Table 8: Description of groups after retest.

Game_Free (1), Game_Medium(2), Game_Intensive(3)	Mean	N	Std. Deviation	Minimum	Maximum	Variance
1	4,68	25	1,314	2	6	1,727
2	4,14	21	1,621	2	6	2,629
3	3,25	24	1,482	1	6	2,196
Total	4,03	70	1,569	1	6	2,463

This shows that even though the groups to begin with looked very much the same, differences has occurred. It is especially their level of math knowledge that differs. As one can see in table 7, the mean is very different between groups 1 and 3. This also shows in the retest in table 8. I am aware of that throughout the process of analyzing the data.

The groups also had different views on the subject Mathematics as well. Table 9 shows the group's view of the subject before starting the experiment. Group 2 and 3 were initially more skeptical than group 1. This might have had an impact on the results that later appeared.

Table 9: Attitude towards Math initially

Game_Free (1), Game_Medium(2), Game_Intensive(3)	Mean	N	Std. Deviation	Median	Minimum	Maximum	Variance
1	3,45	22	1,535	4,00	1	6	2,355
2	2,83	24	1,711	3,00	1	6	2,928
3	3,08	26	1,598	3,00	1	6	2,554
Total	3,11	72	1,615	3,00	1	6	2,607

In figure 6 and 7 one can see graphical images of the student's attitude towards math in the pre test and post test. Figure 11 shows the attitude before the experiment and figure 12 the attitude after the experiment was conducted.

Figure 6: Attitude towards math before experiment
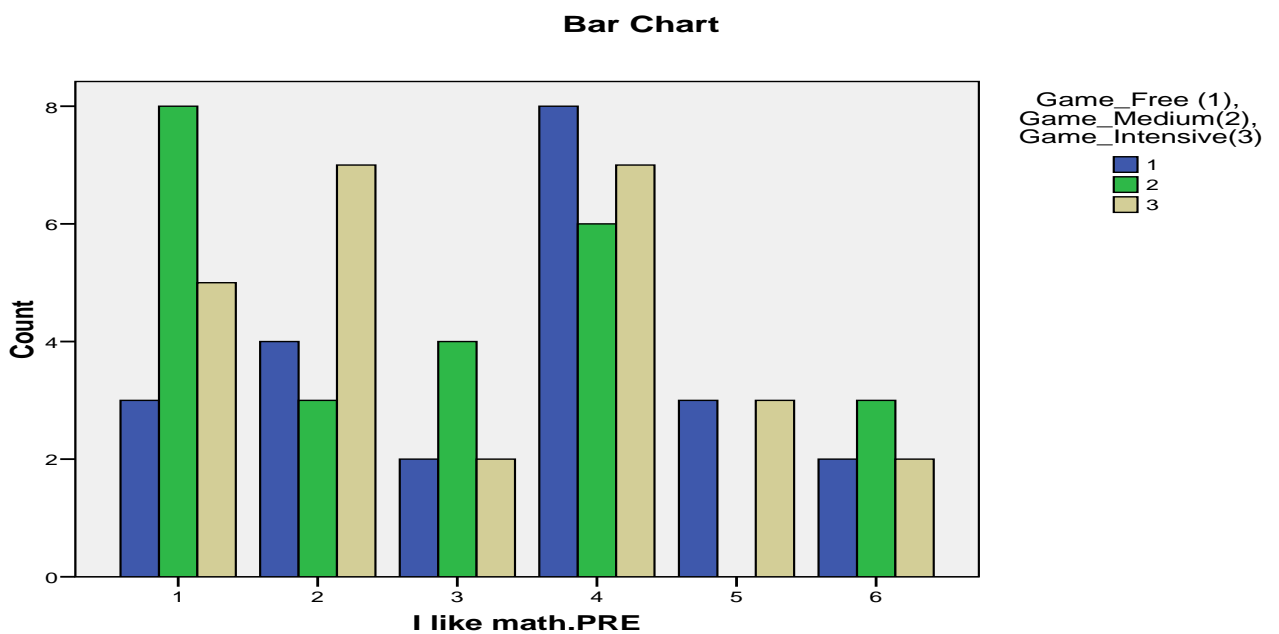
Figure 7: Attitude towards math after experiment
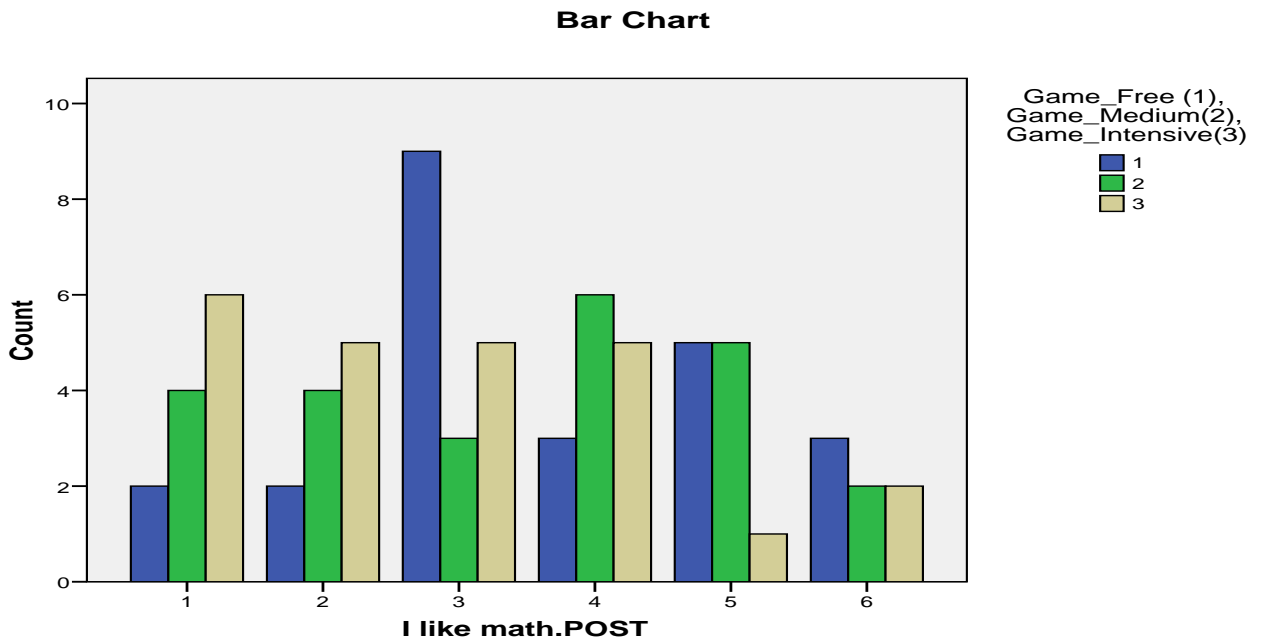
By looking at these two different images it is possible to see a difference in attitude towards math, especially in group 2. But whether this is a significant difference or not remains to be seen.

After working with the experiment for about three weeks the students had a test in the subject that had been taught throughout the project. The results of this test are put into a boxplot[44] below. I use a boxplot to show a visual description of the data gathered before looking further into the data. I have put the results of the Math test into the boxplot in figure 8.

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[44] A boxplot is a way of summarizing a set of data measured on an interval scale. It is often used in exploratory data analysis.

Figure 8: Boxplot over Geometry test
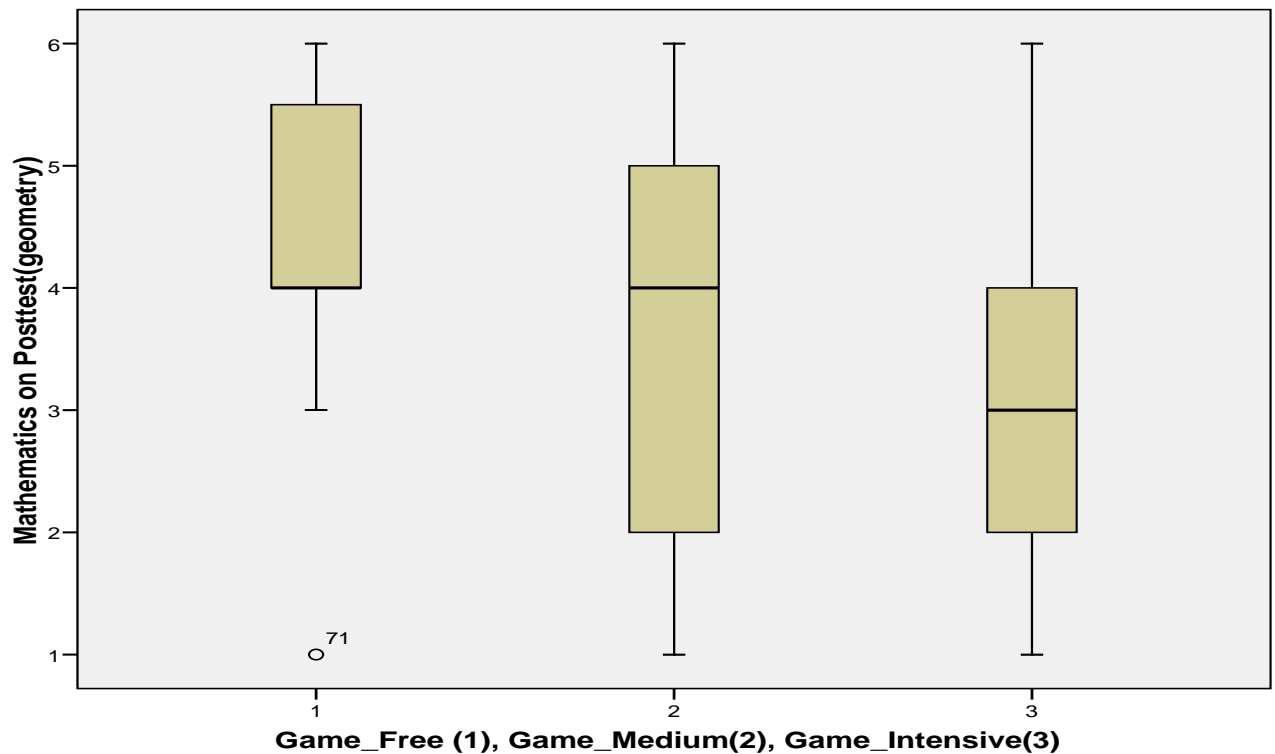
In each of the groups the median[45] is shown as a thick, black area. The first and thirds quartiles[46] are marked in brown and the "tails" in each end defines the maximum and minimum scores. It is apparent in this boxplot that the first group has scored higher than the other two groups, but it is still very important to look at the average score of the test before making any further analysis of the significance of the results. I have shown the average scores and standard deviation in table 10

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[45] If one lines up the values in a dataset, from largest to smallest. The one in the middle will be the median.

[46] The first quartile cuts of the 25 lowest % of a dataset, the second quartile is the median and the third quartile cuts of the top 25% of a dataset.

Table 10: Average score on Geometry test.

Game_Free (1), Game_Medium(2), Game_Intensive(3)	Mean	N	Std. Deviation	Median
1	4,40	20	1,314	4,00
2	3,63	24	1,610	4,00
3	3,19	27	1,618	3,00
Total	3,68	71	1,593	4,00

The next step will be to run different analysis of variance to see if the differences are significant. This is done in table 18.

Six weeks after the Math test, the test was given again. The boxplot in figure 9 shows the scores in this re test.
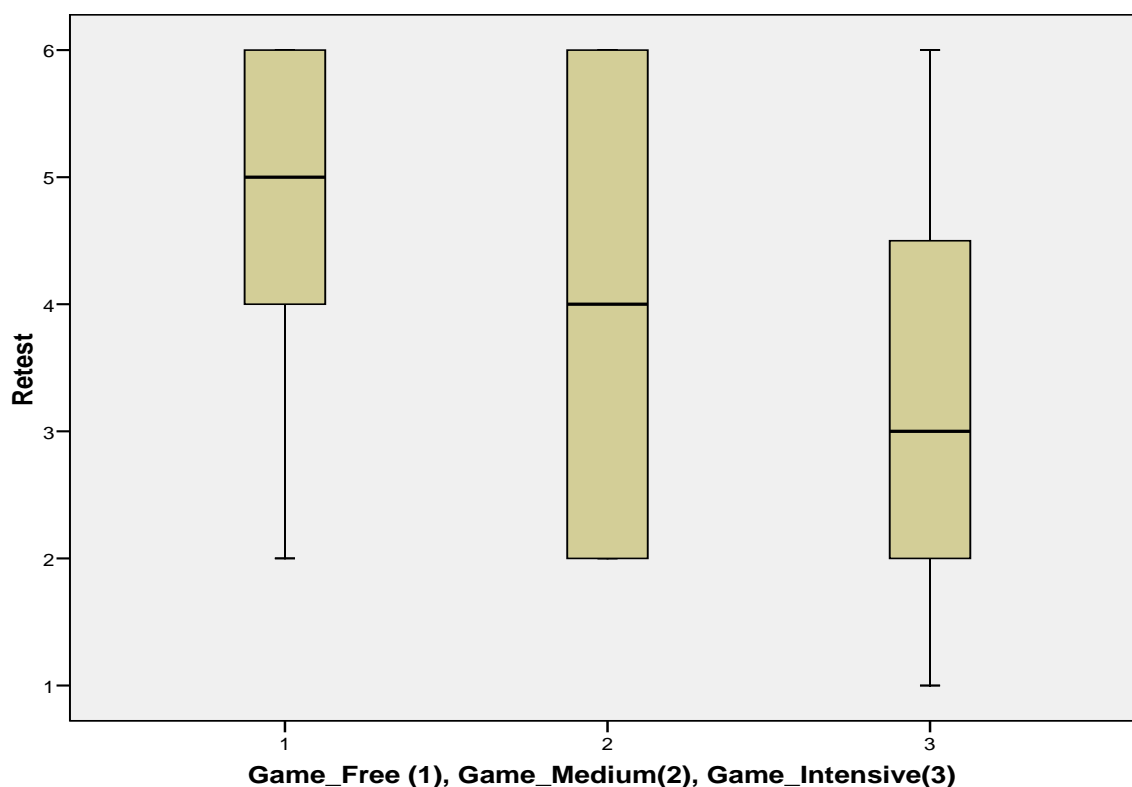
Figure 9: Boxplot over re test Geometry

Table 11: Mean scores on re- test

Game_Free (1), Game_Medium(2), Game_Intensive(3)	Mean	N	Std. Deviation	Median
1	4,68	25	1,314	5,00
2	4,14	21	1,621	4,00
3	3,25	24	1,482	3,00
Total	4,03	70	1,569	4,00

Through these two boxplots it is possible to say that something happened to the groups, especially group 2. Whether it has any significant impact remains to be seen after a closer analysis.

As seen from the different descriptive views presented, it is obvious that the groups were different to begin with. Even though they were selected randomly, it became clear that they had different means and standard deviations. This was kept in mind when working on the data. The data was gathered from a questionnaire that had several questions that looked into four major constructs. An attempt was made to combine the questions that look into the same variable as one of the constructs. The four main constructs that is looked into are: Intrinsic motivation (IM), extrinsic motivation (EM), solo learners (SOLO) and finally social learners (SOCIAL). In the main variable set each variable has been tagged with a code based on the main constructs[47]. That means that all questions regarding intrinsic motivation have been tagged as IM1, IM2 etc. In the table below I have tried to show the questions that are relevant for each construct. I found them through a correlation analysis. They are therefore shown with their code and their alpha in table 12.

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[47] Appendix 6 will include a copy of these"codes".

Table 12: Overviews over main constructs

IM	Alpha	EM	Alpha	SOLO	Alpha	SOCIAL	Alpha
IM1	,720	EM1	,841	SOLO1	,821	SOCIAL1	,620
IM2	,775	EM2	,496	SOLO2	,802	SOCIAL2	,705
IM3	,700	EM3	,869	SOLO3	,361	SOCIAL3	,715
IM4	,808					SOCIAL4	,376
IM5	,866					SOCIAL5	,634
IM6	,658					SOCIAL6	,677
						SOCIAL7	,798

It was difficult to get SPSS to make single constructs out of several variables. This was a necessity in order to look into the motivational aspects and the collaborative aspects. The decision made was to look at each variable's % of variance using a factor analysis and then using ANOVA on the variables that covered around 50 % or more of the variance. The alpha of the variables has already been shown in table 12, so it has been shown that all variables cover the same area. By doing that it is possible to argue that a single variable can tell us something about the relation between the variable and the question one is looking into. Another approach could have been to use an analysis of covariance, but this became too time-consuming and advanced at this point. I ended up using the following variables (bold typed) when looking into intrinsic motivation, extrinsic motivation and solo – social learners and their attitude towards math and their results on pre test – post test. In the further analysis in chapter 5, it is important to have this in mind when looking at the results as well. To use a smaller number of variables may lower validity in certain areas, but when they all correlate it still gives us a good indication.

Table 13: Overview of key variables

IM	% of variance	EM	% of variance	SOLO	% of variance	SOCIAL	% of variance
IM1	**57,4**	**EM1**	**56,8**	**SOLO1**	**48,2**	**SOCIAL1**	**47,9**
IM2	15,1	EM2	28,5	SOLO2	31,9	SOCIAL2	16,6
IM3	10,6	EM3	13,5	SOLO3	19,7	SOCIAL3	11,6
IM4	7,8					SOCIAL4	8,3
IM5	6,4					SOCIAL5	6,5
IM6	2,5					SOCIAL6	4,8
						SOCIAL7	4,1

Finally in the description of the groups, a table over each group is presented with the main variables shown in table 13 correlated. This is done in order to show how the groups at their starting point. In table 14 group 1 is presented, the control group. Table 15 shows group two and table 16 shows group 3.

Table 14: Key variables correlated in group 1

		Mathematics on Posttest(geometry)	...Then everybody does their part and gathers to combine each part afterwards.	We don't work enough together in lessons at school.	I work best if I am rewarded for what I do.	School is a place I enjoy being.PRE	Retest
Mathematics on Posttest(geometry)	Pearson Correlation	1	,145	-,224	,145	,048	,148
	Sig. (2-tailed)		,543	,343	,543	,846	,544
	N	20	20	20	20	19	19
When I work with others I like the task presented and divided. Then everybody does their part and gathers to combine each part afterwards.	Pearson Correlation	,145	1	,140	,147	,002	-,008
	Sig. (2-tailed)	,543		,515	,494	,993	,973
	N	20	24	24	24	19	22
We don't work enough together in lessons at school.	Pearson Correlation	-,224	,140	1	,134	-,297	-,200
	Sig. (2-tailed)	,343	,515		,532	,217	,371
	N	20	24	24	24	19	22
I work best if I am rewarded for what I do.	Pearson Correlation	,145	,147	,134	1	-,345	-,237
	Sig. (2-tailed)	,543	,494	,532		,148	,288
	N	20	24	24	24	19	22
School is a place I enjoy being.PRE	Pearson Correlation	,048	,002	-,297	-,345	1	,102
	Sig. (2-tailed)	,846	,993	,217	,148		,659
	N	19	19	19	19	22	21
Retest	Pearson Correlation	,148	-,008	-,200	-,237	,102	1
	Sig. (2-tailed)	,544	,973	,371	,288	,659	
	N	19	22	22	22	21	25

Table 15: Key variables correlated in group 2

		Mathematics on Posttest(geometry)	...like the task presented and divided. Then everybody does their part and gathers to combine each part afterwards.	We don't work enough together in lessons at school.	I work best if I am rewarded for what I do.	School is a place I enjoy being.PRE	Retest
Mathematics on Posttest(geometry)	Pearson Correlation	1	-,020	,058	-,062	-,108	,774**
	Sig. (2-tailed)		,926	,788	,775	,634	,000
	N	24	24	24	24	22	20
When I work with others I like the task presented and divided. Then everybody does their part and gathers to combine each part afterwards.	Pearson Correlation	-,020	1	-,110	,318	-,110	,107
	Sig. (2-tailed)	,926		,610	,131	,627	,652
	N	24	24	24	24	22	20
We don't work enough together in lessons at school.	Pearson Correlation	,058	-,110	1	,044	-,169	,183
	Sig. (2-tailed)	,788	,610		,837	,453	,441
	N	24	24	24	24	22	20
I work best if I am rewarded for what I do.	Pearson Correlation	-,062	,318	,044	1	-,226	,257
	Sig. (2-tailed)	,775	,131	,837		,312	,274
	N	24	24	24	24	22	20
School is a place I enjoy being.PRE	Pearson Correlation	-,108	-,110	-,169	-,226	1	,017
	Sig. (2-tailed)	,634	,627	,453	,312		,945
	N	22	22	22	22	24	20
Retest	Pearson Correlation	,774**	,107	,183	,257	,017	1
	Sig. (2-tailed)	,000	,652	,441	,274	,945	
	N	20	20	20	20	20	21

Table 16: Key Variables correlated in group 3

		Mathematics on Posttest(geometry)	and divided. Then everybody does their part and gathers to combine each part afterwards.	We don't work enough together in lessons at school.	I work best if I am rewarded for what I do.	School is a place I enjoy being.PRE	Retest
Mathematics on Posttest(geometry)	Pearson Correlation	1	,333	,142	,184	,381	,744**
	Sig. (2-tailed)		,112	,509	,389	,067	,000
	N	27	24	24	24	24	24
When I work with others I like the task presented and divided. Then everybody does their part and gathers to combine each part afterwards.	Pearson Correlation	,333	1	-,181	-,003	,165	,062
	Sig. (2-tailed)	,112		,397	,990	,474	,783
	N	24	24	24	24	21	22
We don't work enough together in lessons at school.	Pearson Correlation	,142	-,181	1	,325	-,032	,216
	Sig. (2-tailed)	,509	,397		,121	,890	,335
	N	24	24	24	24	21	22
I work best if I am rewarded for what I do.	Pearson Correlation	,184	-,003	,325	1	-,241	-,079
	Sig. (2-tailed)	,389	,990	,121		,293	,727
	N	24	24	24	24	21	22
School is a place I enjoy being.PRE	Pearson Correlation	,381	,165	-,032	-,241	1	,481*
	Sig. (2-tailed)	,067	,474	,890	,293		,027
	N	24	21	21	21	26	21
Retest	Pearson Correlation	,744**	,062	,216	-,079	,481*	1
	Sig. (2-tailed)	,000	,783	,335	,727	,027	
	N	24	22	22	22	21	24

There are no significant differences to look into when it comes to group 1. As shown earlier, this group is the most homogenous group. In group 2 and 3 there is a high correlation between the tests and re-tests indicating that the game had a significant impact on the result. Group 3 also has a strong correlation between intrinsic motivation and the re-test. Table 14-16 shows the point made initially, that there are differences between the groups which needs to be kept in mind while analyzing the results presented in this chapter.

4.2: ANOVA and further analysis

In this thesis the goal has been to look into the effect of an educational role playing game when it comes to collaboration, motivation and recall. The data has, as mentioned earlier, been reduced into 4 different constructs. The first two constructs look into the motivational aspect, while the last two constructs looks into the attitude when it comes to collaboration. In addition to this, a test in Geometry and a retest in the same topic look into the element of recall.

The first step will be to look at the ANOVA of the grades initially held by the participants shown in table 6.

Table 17: ANOVA of math grade before initiating experiment

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4,528	2	2,264	2,152	,124
Within Groups	72,583	69	1,052		
Total	77,111	71			

There is no real significance at a .05 level. But still it is possible to see that there are differences between the groups initially.

The next step will be to run an ANOVA of table 7 and 8 which is also shown in the boxplots. The analysis of variance will help us look into whether the differences seen in the boxplots and the mean tables are significant on a 0.05 level. This will make us able to accept or discard the 0 hypothesis. A one-way ANOVA is run on both the Geometry test and the retest in order to look at the significance.

Table 18: ANOVA, Geometry test

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	17,050	2	8,525	3,612	,032
Within Groups	160,499	68	2,360		
Total	177,549	70			

After running the ANOVA on the test we found the significance to be 0,032. It is then possible to argue that the result is significant on a 0.05 level. This means that the 0 hypothesis can be discarded and it is shown that there is a difference between the groups. In table 19, the same analysis has been used on the retest.

Table 19: ANOVA, retest

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	25,431	2	12,716	5,895	,004
Within Groups	144,511	67	2,157		
Total	169,943	69			

As one can see, this was significant on a 0.05 level. The 0 hypothesis can be discarded and it is shown that the groups are significantly different. The ANOVA shows that the groups have significantly different results on both the test and retest. This will be explained more in

chapter 5. But it is clear to see that the use of the game had an effect on group 2 in particular, if the effect is significant compared to the others remains to be seen.

Motivation is divided in to two different areas in this thesis; intrinsic and extrinsic. When looking at them, I used ANOVA first to see which groups that had the highest grade of extrinsic motivation overall. In figure 10, it shows that group 2 had the highest number of extrinsic motivated students.

Figure 10: Overview over extrinsic motivated groups
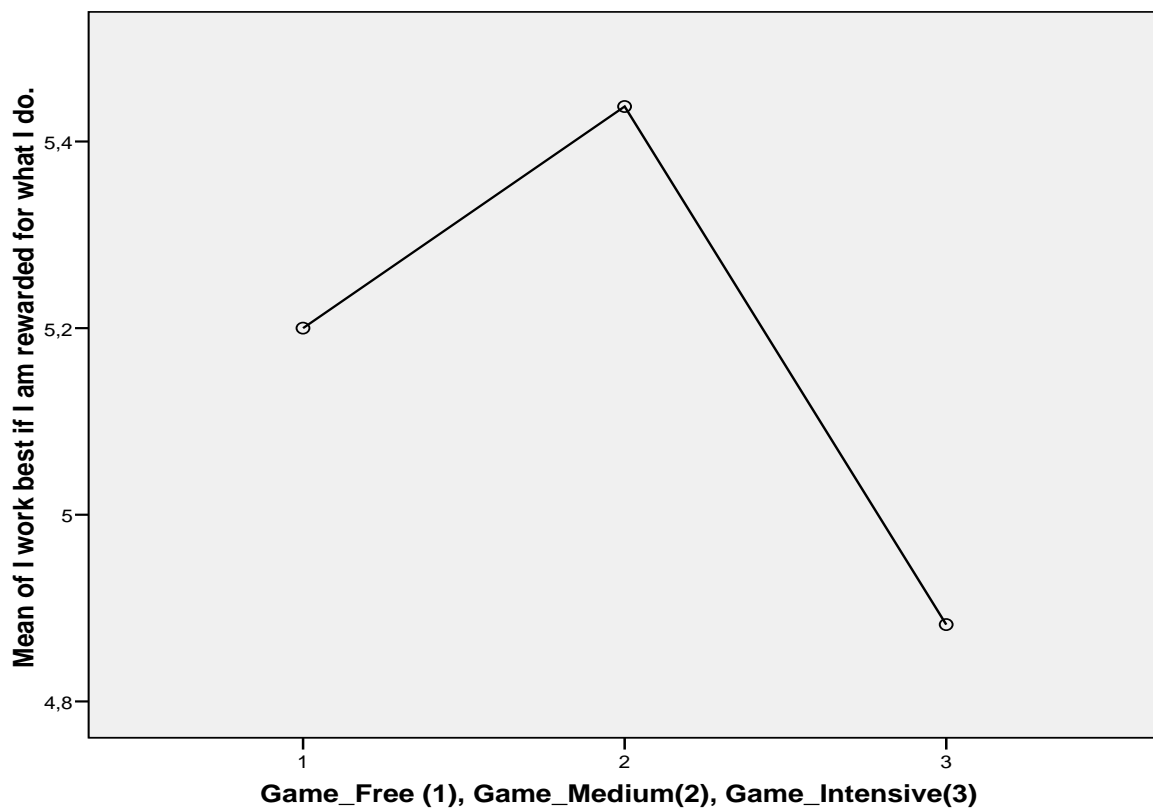
But it is not a significant difference. As seen in table 20, it is apparent that the difference is minimal.

Table 20: Significance of difference in extrinsic motivation

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2,569	2	1,285	1,952	,153
Within Groups	32,902	50	,658		
Total	35,472	52			

The same counts for intrinsic motivation. There is no significance between the groups when they are asked about this to. This is shown in table 21

Table 21: Significance of difference in intrinsic motivation.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	,297	2	,149	,089	,915
Within Groups	115,203	69	1,670		
Total	115,500	71			

It is also possible to look at motivation by asking the students about their attitude towards school. I did this before the experiment and after. Both groups that were manipulated have a higher liking towards school. It is the same pattern seen in previous figures when looking at the subject Math. But although they show a slight change in means, the difference is not significant. This is shown in table 22.

Table 22: Effect on attitude towards school.

		Sum of Squares	df	Mean Square	F	Sig.
School is a place I enjoy being.PRE	Between Groups	,297	2	,149	,089	,915
	Within Groups	115,203	69	1,670		
	Total	115,500	71			
School is a place I enjoy being.POST	Between Groups	1,444	2	,722	,647	,527
	Within Groups	77,000	69	1,116		
	Total	78,444	71			

One element that is important to look at when it comes to intrinsic motivation and games is shown in figure 11 and 12. Group 3 had a higher grade of intrinsic motivation that group 2, but scored lower on the test. Intrinsic motivation is often related to solo learners and extrinsic to social learners. As shown later in figure 15, group 2 scores high on extrinsic motivation. They also scored higher in the re-test. This indicates that there might be a relation between social learners and the effect of an educational role playing system.

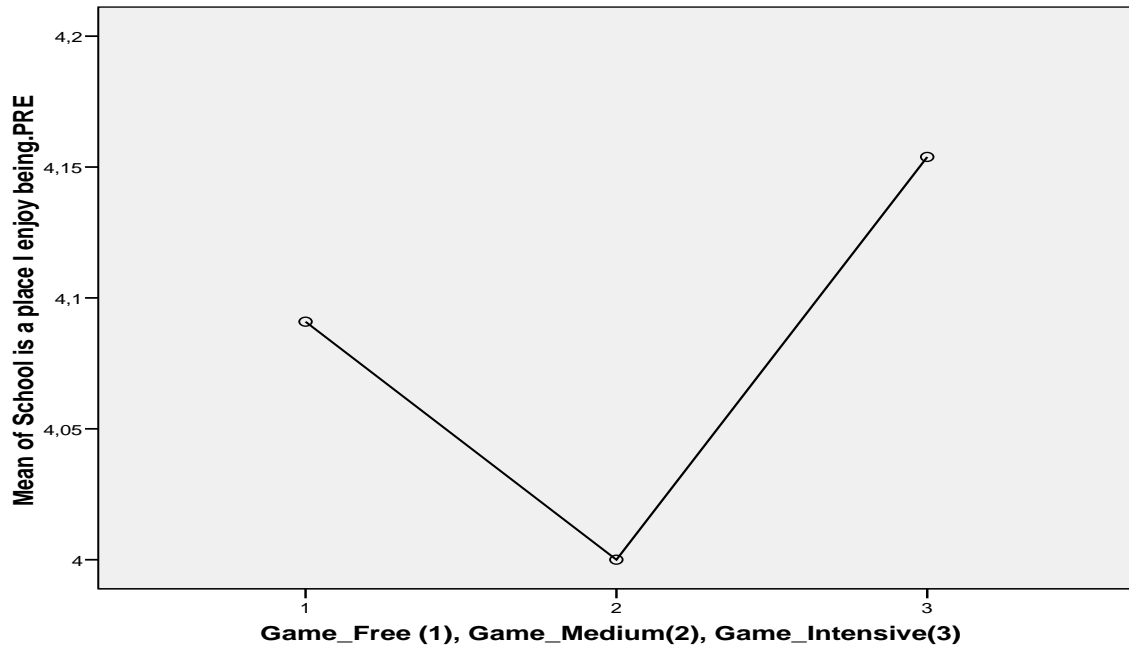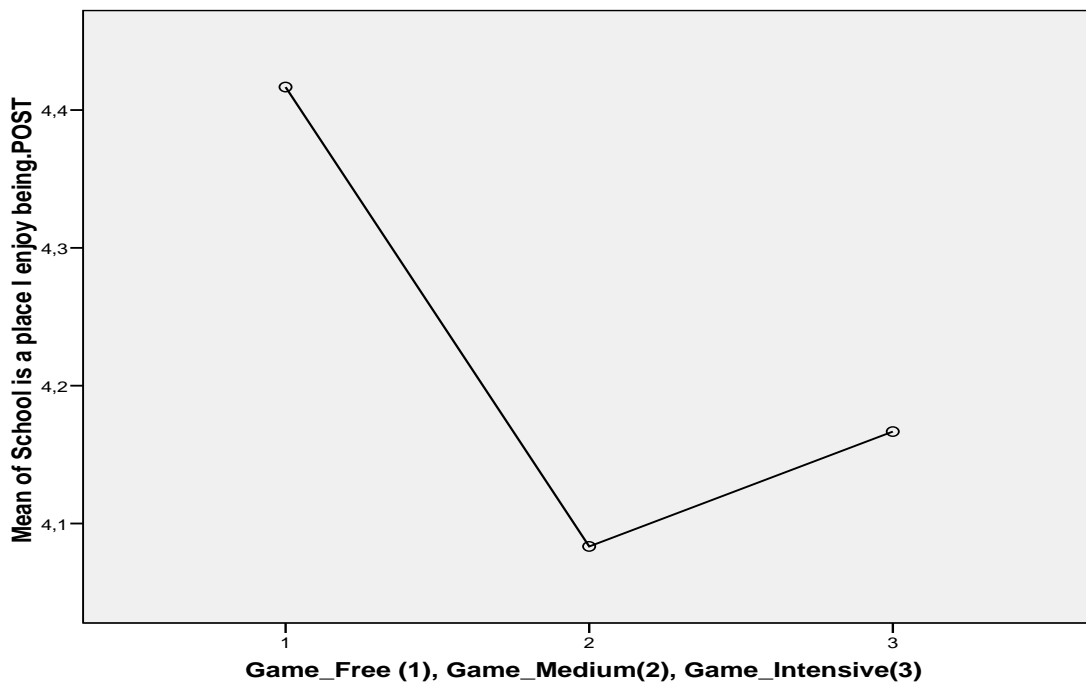**Figure 11: Intrinsic motivation pre-test**

Figure 12: Intrinsic motivation post-test

Group 3 had a higher grade of intrinsic motivation when they started the experiment, and this did not change very much during the experiment. What is more interesting is to see the results on the test and re-test made by the different groups. As shown earlier. Group 2 scored higher in the re-test, which matches the results on extrinsic motivation. By working hard, they might achieve more points in the game. The extrinsic motivation might be the factor that makes them perform. The interesting part is the intrinsic motivation. Group 3 scored highest there, but performed the worst. This might be connected to the fact that the intensity, cooperation and other factors ruined their natural motivation and the game became a hindrance instead of a motivational factor. By loosing intrinsic motivation, the results suffered as a consequence of this. There is however a positive curb especially in the re-test. This might be because after playing for a while, they are able to connect to the motivational elements in the game and work harder based on that. Looking at differences between genders and attitude towards math will be natural. The game seems to have a positive effect on females. This also manifests itself in female's attitude towards school shown in table 23. Scores on test and re-test gender wise are shown in figure 13 and 14.
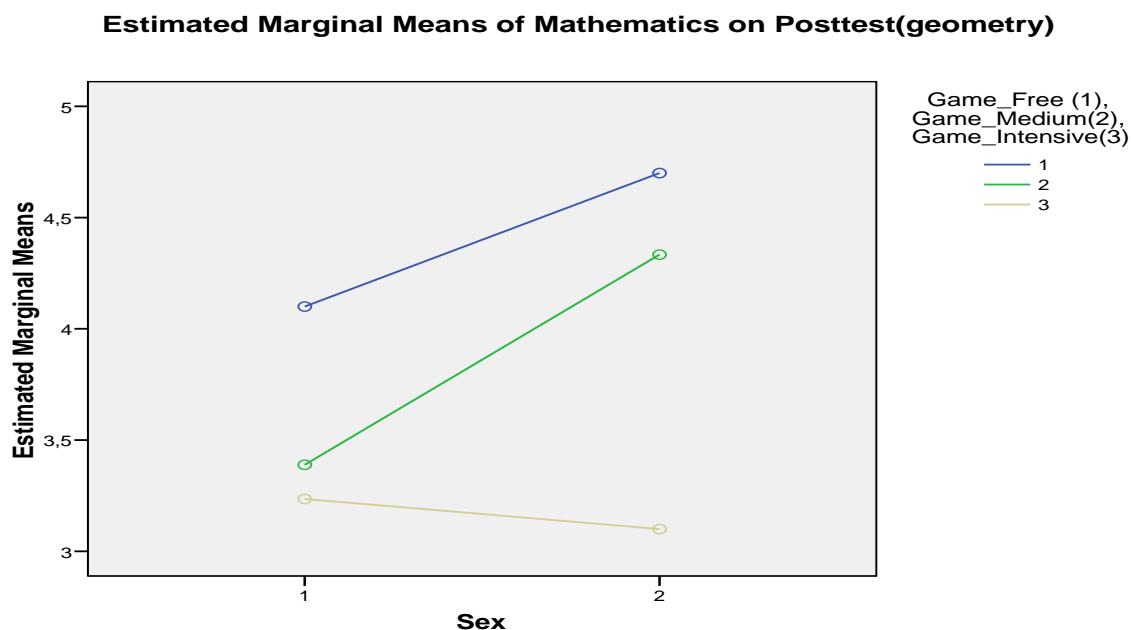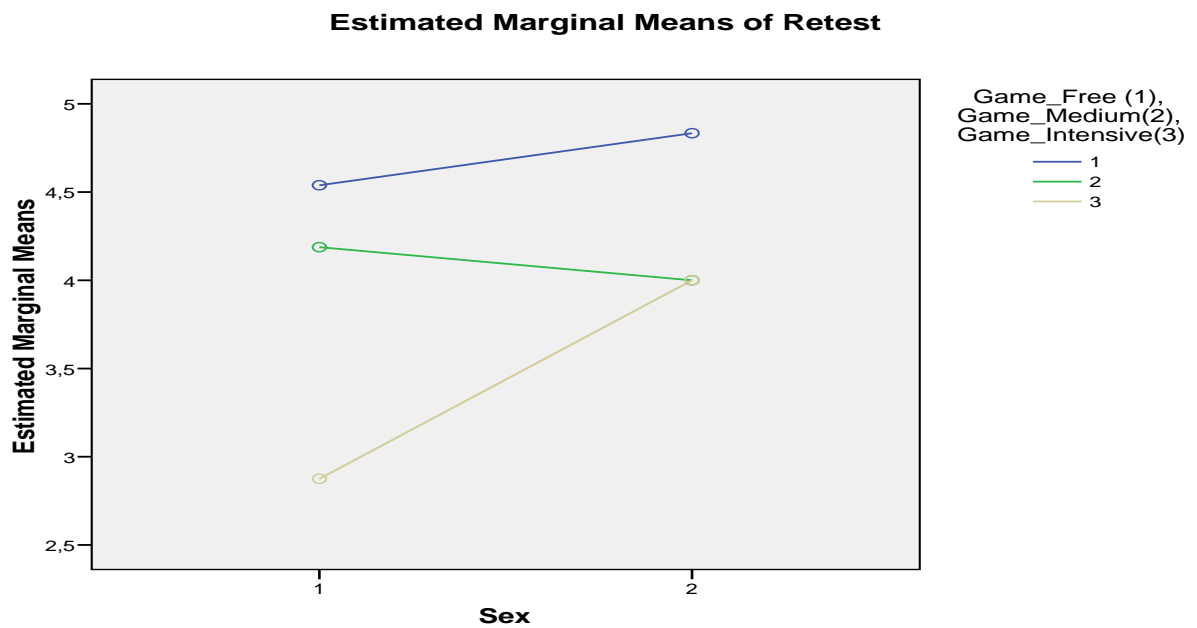
Figure 13: Gender differences on post test

Estimated Marginal Means of Mathematics on Posttest(geometry)

Figure 14: Gender differences on re-test

Estimated Marginal Means of Retest

It is also possible to look at the differences between genders when it comes to attitude towards school.

Table 23: Gender and attitude towards school.

|	Game_Free (1), Game_Medium(2), Game_Intensive(3)	Sex	Mean	Std. Deviation	N
School is a place I enjoy being.PRE	1	1	3,78	1,202	9
		2	4,60	,966	10
		Total	4,21	1,134	19
	2	1	4,18	1,590	17
		2	3,80	,837	5
		Total	4,09	1,444	22
	3	1	4,08	1,188	13
		2	4,25	1,669	8
		Total	4,14	1,352	21
	Total	1	4,05	1,356	39
		2	4,30	1,222	23
		Total	4,15	1,304	62
School is a place I enjoy being.POST	1	1	4,11	,601	9
		2	4,90	,738	10
		Total	4,53	,772	19
	2	1	4,18	1,425	17
		2	4,00	1,225	5
		Total	4,14	1,356	22
	3	1	4,08	1,115	13
		2	4,25	,886	8
		Total	4,14	1,014	21
	Total	1	4,13	1,151	39
		2	4,48	,947	23
		Total	4,26	1,085	62

As one can see, there are differences in the scores of females using the educational role playing game. Data shows that the educational role playing game has a small effect on female students (figure 13 and 14). The difference is not only visibly valid, but there is also numbers in an MANOVA that suggests that this difference is significant (table 24). The significance is 0.20 so it's not strong evidence but an indication. This also is according to expectations since females are often more socially oriented when it comes to both learning and personalities. This shows itself in table 23 where the means between females and males are looked into. After coming out of the setting with the majority of solo learners, they flourish and perform better on the next, identical test.

Table 24: MANOVA over gender difference

| Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	32,858(a)	5	6,572	3,068	,015
Intercept	978,334	1	978,334	456,749	,000
Methode	17,930	2	8,965	4,185	,020
Gender	2,489	1	2,489	1,162	,285
Methode * Gender	4,126	2	2,063	,963	,387
Error	137,085	64	2,142		
Total	1306,000	70			
Corrected Total	169,943	69			

a R Squared = ,193 (Adjusted R Squared = ,130)

The last thing that would be needed to look into is whether there is a significant learning effect of an educational role playing game such as Lærelyst. As mentioned earlier, it was easy to see that it had an impact on collaboration and motivation. Was it also possible to see an increased learning outcome from this? As shown in figure 15, the results were disappointing when it came to the effect of the game on students. The control group averaged above the others. Several elements might have contributed to this such as learning the game, physical surroundings, different groups to begin with etc. This is briefly looked into in chapter 5, but will require more research in order to define the real impact on the results.

Figure 15: Results after manipulation and re-testing

Estimated Marginal Means of Mathematics on Posttest(geometry)
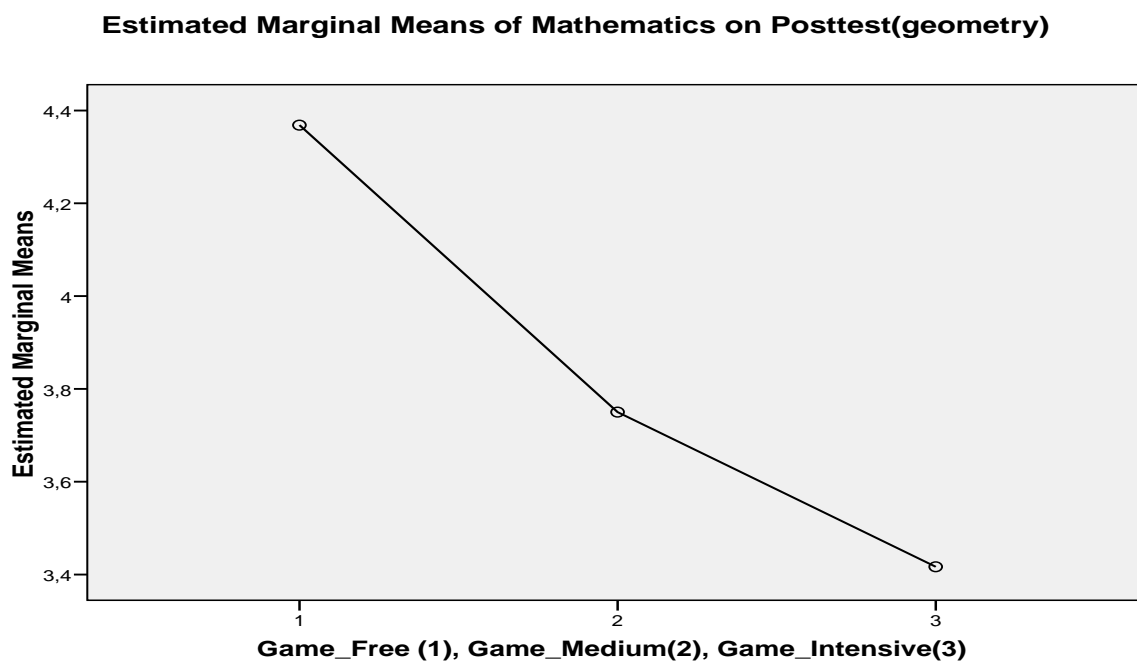
The one group that showed the best improvement using the educational role playing game was group 2. In chapter 2 I specify one of the key elements in a role playing game to be the collaborative effort. Looking at the 3 groups when it comes to social learners would then be appropriate. In figure 16, the variable that has the highest % of variance looking into social learners is shown. Looking at this graph, it is possible to argue that the improved results in group 2 can be related to the high number of social learners in this group.

Figure 16: Social learners in groups.
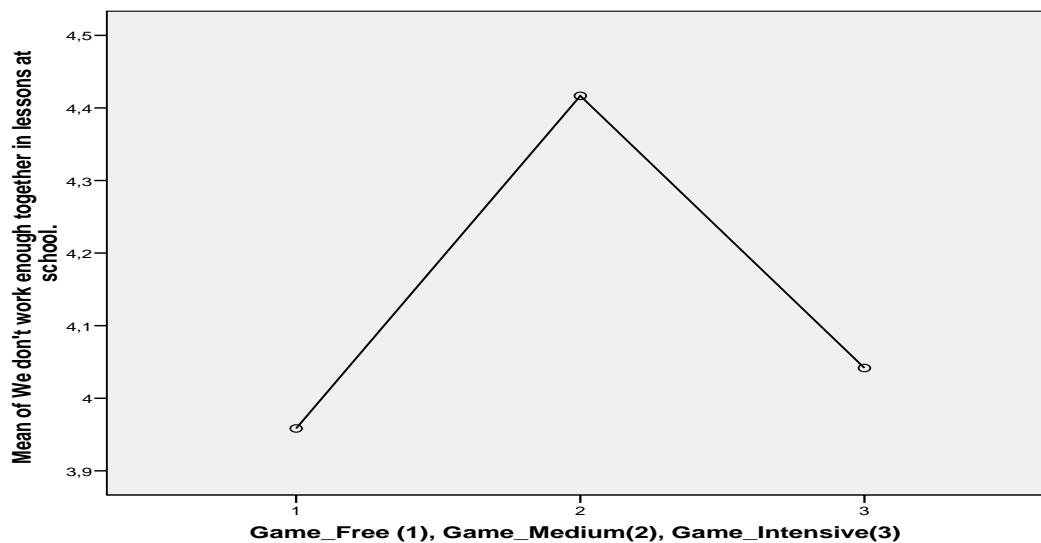
Earlier in this chapter, it is argued that female students in group 3 scored higher on the re-rest. Why this happens will be elaborated on in chapter 5, but it is possible to argue that because of the apparent large number of intrinsic motivated students in that group. Figure 17 also indicates this.

Figure 17: Extrinsic motivation variable
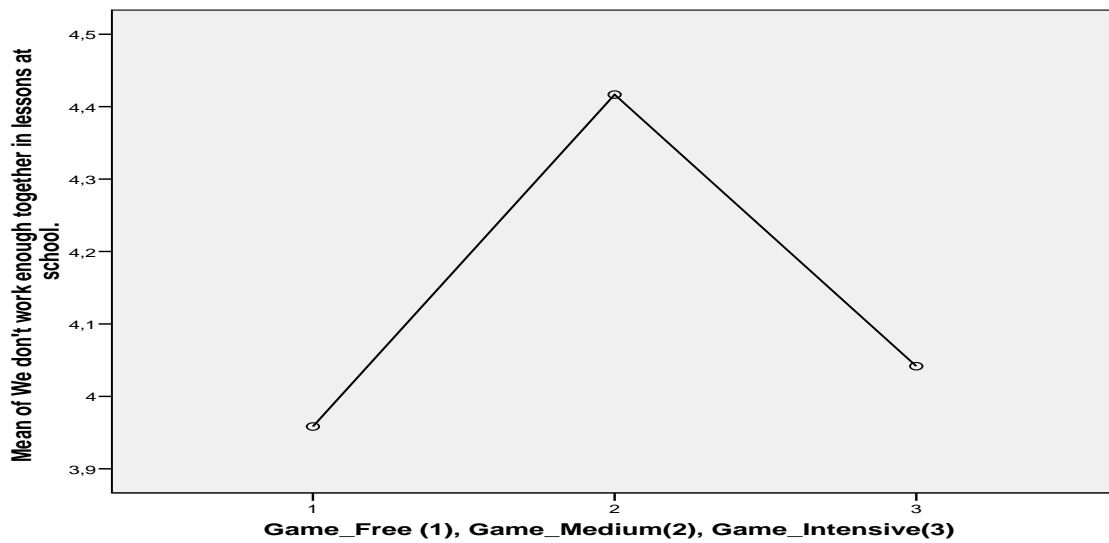
After ending the game sessions they scored higher on the re-test. Another consequence is their attitude towards the subject Math. As shown in table 25, the female respondent lost interest in the subject as well, while the male students got increased interest. Why is this? This is discussed in further detail in chapter 5.

## Table 25: Mean for attitude towards Math based on gender.

	Sex	Game_Free (1), Game_Medium(2), Game_Intensive(3)	Mean	Std. Deviation	N
I like math.PRE	1	1	3,67	1,658	9
		2	2,94	1,886	17
		3	2,92	1,553	13
		Total	3,10	1,714	39
	2	1	3,90	1,101	10
		2	3,00	1,225	5
		3	3,25	1,982	8
		Total	3,48	1,473	23
	Total	1	3,79	1,357	19
		2	2,95	1,731	22
		3	3,05	1,687	21
		Total	3,24	1,626	62
I like math.POST	1	1	3,56	1,810	9
		2	3,29	1,795	17
		3	3,15	1,281	13
		Total	3,31	1,608	39
	2	1	3,90	1,197	10
		2	3,60	1,140	5
		3	2,88	1,959	8
		Total	3,48	1,504	23
	Total	1	3,74	1,485	19
		2	3,36	1,649	22
		3	3,05	1,532	21
		Total	3,37	1,560	62

The last thing that is important to look into is whether the groups showed any improvements using the educational role playing game or not. It was first important to establish whether there was significance between the interaction between gender and educational role playing games when it came to the test results. In the first test, showed in table 26, it is possible to see that there is significance. The 0 hypothesis claims that there is no difference in scores based on gender. Based on the data gathered we can discard the 0 hypothesis and with a high grade of certainty claim that there is significant difference between the genders when it comes to the results using an educational role playing game. The significance is .032, less than .05. This is graphically shown in figure 19.

Table 26: Effect on gender and role playing game

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	22,979(a)	5	4,596	1,933	,101
Intercept	899,182	1	899,182	378,126	,000
Methode	17,212	2	8,606	3,619	,032
Gender	3,417	1	3,417	1,437	,235
Methode * Gender	3,338	2	1,669	,702	,499
Error	154,570	65	2,378		
Total	1137,000	71			
Corrected Total	177,549	70			

a R Squared = ,129 (Adjusted R Squared = ,062)

Figure 18: Graphical display of results on test based on gender and method

Estimated Marginal Means of Mathematics on Posttest(geometry)
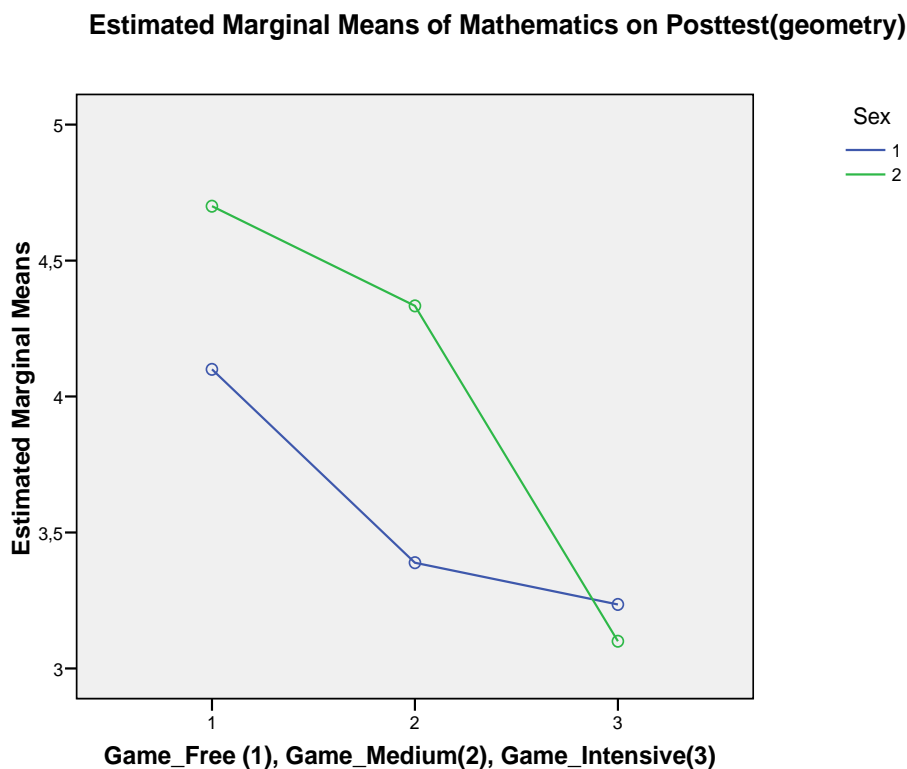
It will also be important to look at the students and their expectations based on their grades. In table 27 and 28 it becomes apparent that there is a big discrepancy between group 1's expectations and the experiment groups. Reasons for this are discussed in chapter 5.

Table 27: Correlations between expected grade and previous grade group 2 and 3.

|		What grade do you think you would have reseived if you were taught through a role-playing game	Mathematics on Posttest(geometry)
What grade do you think you would have reseived if you were taught through a role-playing game	Pearson Correlation	1	,559(**)
	Sig. (2-tailed)		,000
	N	48	48
Mathematics on Posttest(geometry)	Pearson Correlation	,559(**)	1
	Sig. (2-tailed)	,000	
	N	48	52

Table 28: Correlations between expected grade and previous grade group 1.

		What grade do you think you would have reseived if you were taught through a role-playing game	Mathematics on Posttest(geometry)
What grade do you think you would have reseived if you were taught through a role-playing game	Pearson Correlation	1	,125
	Sig. (2-tailed)		,598
	N	24	20
Mathematics on Posttest(geometry)	Pearson Correlation	,125	1
	Sig. (2-tailed)	,598	
	N	20	20

When looking at the correlations between expected grade and Math post-test in group 2 and 3, we can see an alpha of .559. This suggests a high reliability; this is not the case in group 1, the control group, where the alpha is only .125. It looks as the method used in group 1, traditional

teaching, seems to have disrupted the regular pattern. Something intervened or affected the link between expectations and actual success.

Finally it might be interesting to look at the development from their original grade through the test and re-test. Figure 19 shows that the mean of the 3 groups raised after every test. Earlier it has been shown that the experiment groups had the biggest changes. Although these changes are not statistically significant, it is possible to spot a visible effect of the educational role playing game.

Figure 19: Development from past grade through test and re-test

**Estimated Marginal Means of MEASURE_1**
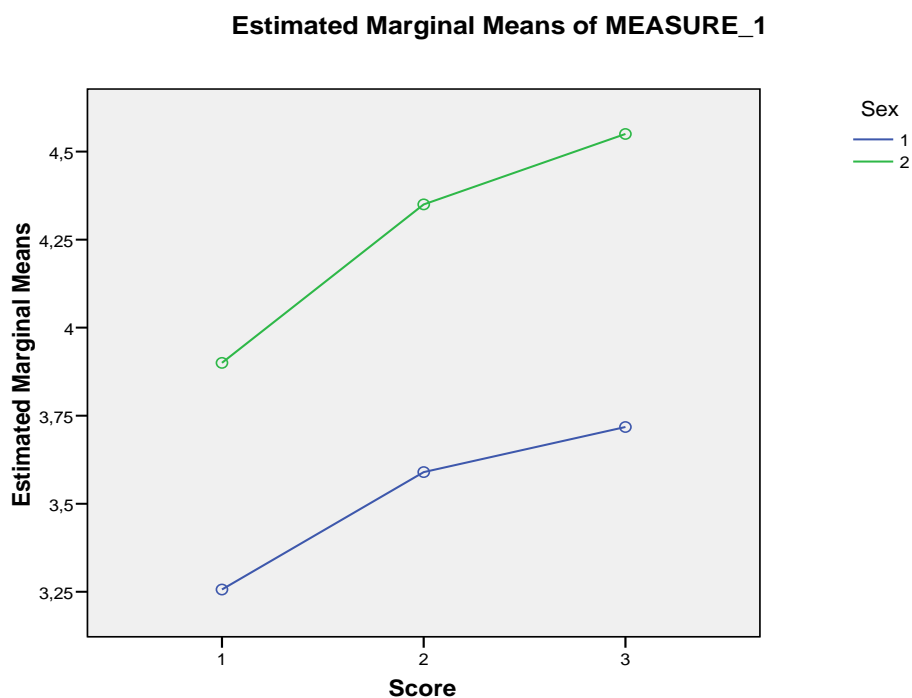
Now data has been presented based on the tests and research questions. When looking at motivation and collaboration, it is also important to look at the data concerning feedback from the respondents and see what they indicate. In figure 20 the respondents have been asked if an educational role playing game motivates them. As seen in figure 20 it is obvious that especially group 2 shows a definite positive curb. As table 26 shows, this is also a significant result (alpha 0.35).

Figure 20: Role playing games motivates me to work
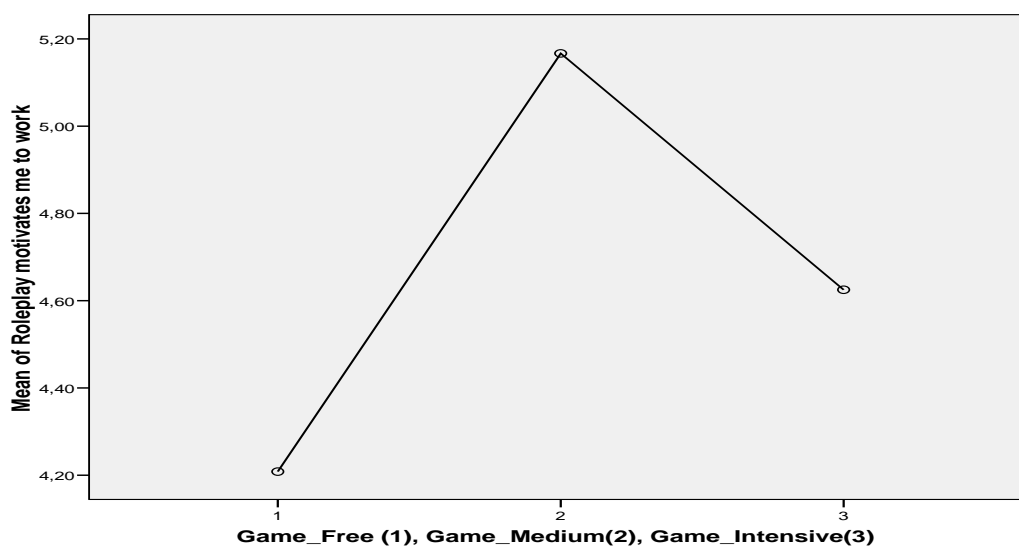
Table 29: ANOVA of role playing games motivates me to work.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	11,083	2	5,542	3,511	,035
Within Groups	108,917	69	1,579		
Total	120,000	71			

The control group scores low here as expected since they did not play any game. We see the same tendencies when looking at the means of whether the respondents wanted more use of role playing games in school. Figure 21 and table 27 shows respectively the plot chart and the ANOVA. The result is significant with an alpha of 0.32.

Figure 21: Mean of I wish there were more role playing games in school.
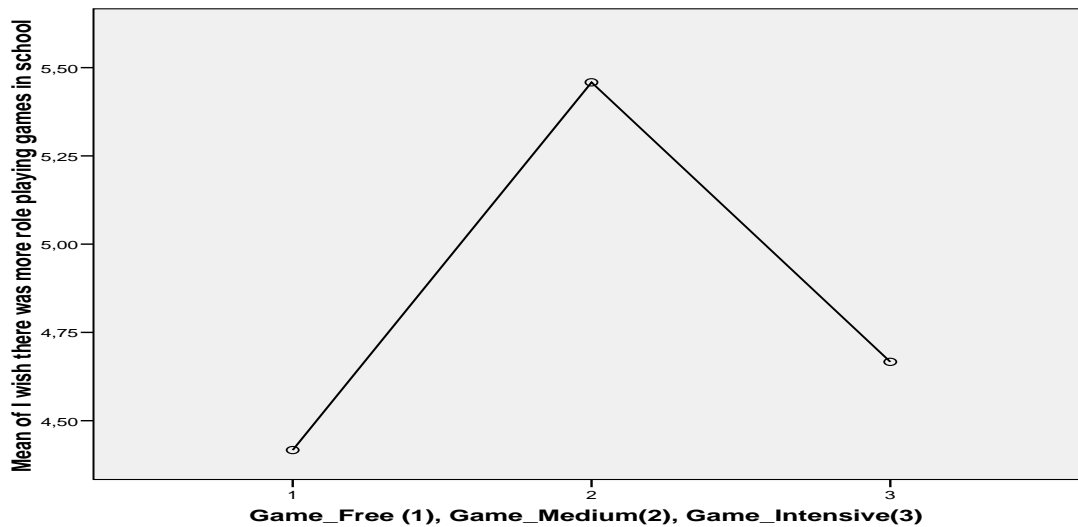
Table 30: ANOVA of I wish there were more role playing games in school.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	14,194	2	7,097	3,624	,032
Within Groups	135,125	69	1,958		
Total	149,319	71			

4.3: Summary

This chapter has displayed some of the data that is important when looking at the research questions presented. The data is discussed in further detail in chapter 5 based on the theory presented in chapter 2. All answers and conclusions are drawn in chapter 6. What has been presented is only a minor part of all the data gathered and in further research much more could be elaborated on and used.

Chapter 5: Analysis of the empirical data

5.0: Introduction

In the first four chapters the problem area, theory and research has been presented. In this chapter the results will be analyzed in greater detail and looked at based on the theoretical background presented earlier. The analysis made here will then lay the foundation of some of the conclusions made in chapter 6. This chapter will look into the research questions and try to analyze the data presented in chapter 4 together with theory in order to see if any answers to these questions are apparent. In chapter 6 a short summary of the answer to each research question will be presented as well.

5.1: A descriptive analysis of the groups

Before the experiment started it was important to look at the experiment groups to see if they had any differences. As showed in table 5 and 6 in chapter 4, it is apparent that the groups are different. The number of male and female participants are very unevenly spread and both mean and standard deviation shows clearly that the groups are different. Especially group 1, the control group, shows much better grades in math initially than both of the experiment groups. This is something that it is important to be aware of when looking more closely at the results of the experiment. It would have been possible to even the groups more by sorting out respondents from the different groups, but since the numbers of respondents are low to begin with, doing that would lower the validity of the results presented. The analysis of the data is therefore based on the fact that the groups were uneven to begin with and that this information needs to be remembered when looking at the results presented. It is the effect of an educational role playing game when it comes to intrinsic and extrinsic motivation, the effect on solo and social learners and the effect on recall. The first part of chapter 4 also contains a description of the results on the different tests performed in the experiment and the student's attitude towards Math. The attitude towards the subject has a greater impact in the two experiment groups. This was expected based on observations and theory. The prospect of a game element instead of traditional education will increase motivation for a subject. This is not because the subject necessarily became any more interesting or motivating, but because the game is introduced. As mentioned in chapter 2, we are speaking of a generation referred to

as the digital natives. This also includes games and such. So when a game is introduced, the attitude towards the subject increases.

5.2: Analysis of test data

As shown in chapter 3, the groups were all working with the same topic and tasks over the same amount of time. Group 1 had a small advantage since they didn't lose any time learning the method. After the period of work, they were presented with a Geometry test based on what they just had worked on. The results of this test are showed in table 7. There is a significant difference in the results on the test between the groups. Group 1, the control group, scores highest by far. This is as expected, based on the theories of contextualization and high fidelity learning. By involving students in a selected part of a game story and just adding different elements from their Geometry chapter, doesn't make students understand the use of the topic presented, and makes them unsure of what to do. Motivation, on the other hand, is high. This will be elaborated on later. The importance of shared background knowledge is discussed by Gumprez (1995), where focus is put on how lack of a common background easily leads to misunderstandings. There is reason to believe that something similar happened here. The manipulated groups didn't quite understand what they were doing. By being introduced to a story that has no resemblance to what they are supposed to learn might create a motivational setting, but not necessarily a learning effective setting. According to the theories of high fidelity learning mentioned in chapter 2, the use of a low contextualized educational role playing game doesn't qualify as high fidelity learning. One cannot just play a game and suddenly be an expert on the topic presented in the game. On the other hand, if the contextualization was high, the fidelity would have been higher and one might argue that the result of these results on recall manifested themselves. If one uses a game with as high fidelity as possible, the learning task is identical to the learning one is trying to achieve.

The scores on the test following the manipulation also show a difference between the two groups that used the educational role playing game. The game intensive one, where groups had to work with groups, sharing the same avatar, scored lower than the group where few people shared an avatar. There is a high chance that this can be related to the different types of learners that had to work together. If there are both solo and social learners in a group, results are bound to be affected by it. Especially solo learners will have big problems adapting to a setting which in its nature is so collaborative. The results shown in chapter 4 also indicate this. The manipulated group that had the highest scores in the re-tests was the same group that

seemed to have the highest number of social learners. This is elaborated on a little further down. On the other hand, the group that scored lower seemed to have a large number of solo learners with a high intrinsic motivation to begin with. Intrinsic motivation and solo learners are often linked together. It is not possible to look into all these results on the tests without having in mind that conditions were a bit different. As mentioned in the start of the chapter, the groups were different to begin with. The time they had to focus on different tasks varied. This was because two groups had to learn the rules of the game as well as the math issues. The groups also had student types that could affect the working environment in a class. So looking at the results shown on the test in chapter 4, needs to be done in light of conditions that were not ideal. This is also mentioned under the quasi experiment I chapter 3.

What is interesting to look at is table 8, the result of the retest. This test was done 6 weeks after the end of the project. All the groups have higher scores, but group 2, which have a much higher score than in the first test. I have explained part of it referring to the difference between social and solo learners as have described in further detail in chapter 2. There is also theoretical evidence that the game might have inspired to remember math elements based on the game played (Malone & Lepper, 1987). The game inspired them to the point where they actually remember what they have learnt. This is also backed up through the data presented in figure 6 and 7. Group 2's attitude towards Math as a subject is very low. There is hardly anyone that reports that they like the subject. However, after the use of an educational role playing game, their attitude towards the subject has improved not only grades, but also attitude in general. This is an important finding that needs to be reflected on in view of motivation theory. The game has triggered the intrinsic motivation for the subject in general. The reward doesn't necessarily lie in the grade anymore, but in the notion of accomplishing something that later again can be manifested in a game. Another important analysis to make is results based on gender. Figure 13 and 14 indicates that the girls in group 3 scored higher on the re-test. Girls often being social learners might make it possible to argue that when they are released from the grip of the solo learners, they perform better. That means that while they were in the game, they were held back by the majority of solo learners, while after the game they flourished and scored higher in the next text.

The boxplots presented in figure 8 and 9 elaborates on the results of the test and retest. In table 15 and 16 an ANOVA has been run on the test and retest with the different groups, and it is obvious that there is a significant difference in results on a 0.05 scale (0.032). Especially

the re-test shows this. It is important to remember that this significance counts for the results between tests and re-test. When looking at the groups as a whole there were no significant difference between the scores they had from before and the tests, although there was a higher mean on the test that their previous grade. But from the test performed right after the manipulation and the test following 6 weeks later, there is significance. This might have connection with the element of motivation. In order to be able to do this, it is important to look into what kind of questions defines the same main group of variables. I made my questions on the basis of a pilot test performed at a high school in a different county than the experiment school but using the same age group.. We ran an analysis of reliability on the questions and discarded the questions which had an alpha of less than 0.7 . In table 13, the different questions have been given a code for use. The data has been reduced through a factorial design trying to make several questions part of the four main clusters in order to try and answer the research questions. The variables have also been indexed to show how large percentage of the variance they represent. Based on this, I have chosen the primary variable in each construct to represent the construct. This might lower validity, but it gives an indication. The reason for doing this was to look into the research questions in more detail. As shown in chapter 4, there are several interesting findings, many of which confirm the elements that have been brought forth in chapter 2. It is important to relate the findings to research or theory in the field.

The mean, as shown in table 31, is over 4 in every group. The highest score is 6. This shows that all students are motivated positively by games as educational tools. This is also showed in many research reports on the subject games and education. Nobody questions the motivational factors of a game; it is whether it has any effect on learning or transfer of learning that is the important question. As mentioned earlier, there is an improvement from test to re-test in the experimental groups, maybe that indicates that a certain internalization of knowledge has taken place.

Table 31: Mean, motivation for school

Game_Free (1), Game_Medium(2), Game_Intensive(3)		School is a place I enjoy being.PRE	School is a place I enjoy being.POST
1	Mean	4,09	4,42
	N	22	24
	Std. Deviation	1,109	,776
2	Mean	4,00	4,08
	N	24	24
	Std. Deviation	1,414	1,316
3	Mean	4,15	4,17
	N	26	24
	Std. Deviation	1,317	1,007
Total	Mean	4,08	4,22
	N	72	72
	Std. Deviation	1,275	1,051

The mean from this data, argues the fact that students like games, it motivates them and they work together. My experiment did not show a significant correlation between games and learning effect. But there were indications that this might be the case. Both experiment groups scored higher on their tests and re-tests than they initially scored in the subject overall. There was a strong correlation here. One could also see learning of cognitive skills, higher motivation, recall elements etc, but very seldom any direct effect on learning or transfer of learning.

When looking at gender and the differences, there are a few interesting things to look at when it comes to motivation for the subject math based on the game and the level and motivation. It seems like female respondents shows the best results in the game, while male respondents tend to like the game best and get inspired by it. This is also according to research. The male players tend to like the game elements, while female players tend to be drawn towards the more theoretical challenges. It is also the male respondents that are more likely to get an improved attitude for the subject in general. So based on the findings in this data, it is possible to argue that there is an increase in motivation in the groups, but if it is the game or the fact that the educational situation changes, is hard to say. But it is undoubtedly a motivational effect in the game. The majority of the respondents reported that back in the post-test. The motivational effects are shown clearly. The groups that have been using the role playing game shows a significant result when it comes to the motivational aspect and when it comes to the

extended use of role playing game in their education. This is exactly as shown in chapter 2. Malone & Lepper, Prensky, Linderoth et.al all states that the game itself is motivational and that players will prefer that over other educational elements such as traditional classroom education.

When looking at the motivational aspects of the educational role playing game's effect on a learner's will and ability to collaborate and cooperate. It must be that the very nature of a role playing game is collaboration. Everything is centered around this fact. In the data gathered there are evidence pointing that this is true. It seems that the group that has the largest number of social learners also scores the highest in the tests looking at Group 2 and 3 and they clearly wants to work more together in school after the experiment. That games in general, and role playing games in particular, have an effect on collaboration and cooperation has also been shown in the article mentioned earlier in this chapter and in chapter 2 by among others Linderoth et.al. In the article they say:

> *Collaboration can initiate an increasing awareness of ideas and concepts that pushes the child's process of knowledge forward. It is not the cooperation in itself that is of importance but the potential for development and learning in this process.*
> (Linderoth et. al, 2002)

The potential for learning is apparent in this type of game. The initiative towards collaboration will come as a natural consequence of playing the game. Scores and mastering of the game will suffer if collaboration is not initiated. To learn in a collaborative surrounding might have a positive effect on the transfer of knowledge. To work through elements of a subject with someone, broadens the memory base in which the knowledge lies. Everyone has part of the knowledge and develop strategies for applying this knowledge when needed. There is evidence in my data material to support this. Both experiment groups scored better in the re-test six weeks later, but group 2, most positive towards collaboration, scored the highest. Also several of the research reports mentioned in chapter 2 states that games in general increases collaboration unless the game is strictly individual in its nature. In their work on solo and social learners Salomon and Perkins (Salomon & Perkins, 1998) also put focus on the positive learning effects based on social learners collaborating. Data from this research indicates that this is true here. Data shows that the experiment group with a large number of

solo learners scored lower in the tests and challenges made in the game, but improved their scores when returning to traditional education. They also developed a lower attitude towards the subject Math in general. This was the opposite in the group with social learners. They improved their scores and also their attitude towards the subject. They also very strongly indicated a wish for more educational settings such as this one and an increase motivation based on this setting. So one might say there are evidence pointing towards the notion that an educational role playing game has an effect on both the initiative and the will to collaborate. However, it is important to remember the term interdependency brought up in chapter 2. One reason for the increased collaboration might lie in the fact that the students benefited in gameplay if they worked together. This might have caused this. There are data that will support this. The group where more people shared an avatar scored lower. There was no strong incentive to collaborate since the relationship to the avatar was too distant. The group who controlled the avatar themselves enjoyed the collaborative effort since it made their avatar more powerful in the game later. The same issues are also brought up when it comes to contextualization and fidelity learning. When running all the key variables on collaboration (CSOC) they indicate; the experiment groups are more positive towards collaboration on the post-test. This is also consistent with the theory shown in chapter 2.

It was hard to prove a difference between solo and social learners. I separated the respondents in solo and social learners based on their answers on CSOC and CSOL. This indicated that they were evenly spread in group 1, but group 2 had a majority of social learners and group 3 a majority of solo learners. Theory indicates that there is a link between intrinsic motivation and solo learners and vice versa when it comes to social learners and extrinsic motivation. A game in itself is often used as extrinsic motivation and therefore also responded to by social learners in particular. The data gathered in this inquiry suggest strongly that educational role playing games have an effect on social learners, undoubtedly because of the games collaborative nature. The effect on solo learners is often the opposite since this type of learner does not believe in the effect of collaborating in order to solve problems presented to them.

An important issue in this inquiry was to see if it was possible to look at recall and transfer. The first element to look at would be the difference between perceived grade on the recall test and the actual grade. As shown in table 24 and 25, the control group had a very low correlation between their expected score and their actual score (0.125). This, on the other

hand, was different in the experiment groups, which had a correlation of 0.559. It seemed like there could have been a mismatch in what was expected. They believed that things would proceed as "usual", and that their grades would reflect that. It might be possible to argue that it in this case seemed to be better to use the game as a facilitator. This might also be due to the topic studied. This might also be able to trace back to theory on motivation. The experiment groups were highly motivated and willing to make the effort while the control group expected things to run as usual. They met a totally new subject that hit them of guard. The gaming groups expect new elements because of the nature of games in general. One can also see differences in means between test and re-test and between the groups. Especially group 2 shows promising results both on the tests and on their attitude towards collaboration and Math in general. It is hard to show any significance based on the data gathered, but it is important to remember the difference in the groups to begin with. The results might have been clearer if the numbers of respondents were higher, the groups more alike etc.

There is however very little that indicates that any group learned significantly more than the others regardless of method. By using a low contextualized scenario, it was expected that it might have a little effect on recall on test and re-test, but little or none actual learning effect. Much research done in the field has shown that the use of games itself, just as the use of ICT alone, does not improve learning skills, learning effects and so on. In figure 15 it is easy to see that the scores on the tests were higher in the control group. It is however important to remember that the control group also had higher means in the start of the project. This did not have any impact on this though. All the data suggested that there were no significant effect of the use of the educational role playing game in this context when it came to learning effect. Large impact on collaboration and motivation though. So it might be possible to argue that based on increased motivation and collaboration one might expect results to improve, but there is no empirical evidence to back that suggestion in my data. The findings are also consistent with the theory surrounding the two types of games mentioned earlier. It would have been possible to expect a high effect on learning if the game in question were a simulation game. A high fidelity game where the students were brought into a close to identical situation as in real-life would have had a greater impact on the learning effect. The game used in this experiment is an event based role playing game. Event based games are more focused on gameplay; therefore fidelity will be lower and also contextualization. This

might lead to lower learning effects, but still maintain the effect on motivation given by the nature of the game itself. My data indicates this as well.

The hardest part is to see if any transfer had taken place. The fact that they had the re-test six weeks later in a different context (not in Math) and without warning might indicate a small amount of transfer. The important finding then was that the groups scored higher six weeks later in the same subject matter. This does not necessarily prove any transfer. The re-test might be considered a repetition of the same activity, thereby being a situated activity. To look for transfer the re-test should have been given in a different form based on the same key elements.

It was apparent that most students were comfortable in the game activity, but only a few seemed to understand the framework in which they were part of. This will be elaborated on in 6.3 when the need for further research is debated.

The data shows clearly though that motivation for learning is high when using games, games increase the attitude towards the subject where the game is used and the level of collaboration increases. There is also evidence that might indicate that solo learners are able to work in a more collaborative manner in this setting. The data also seem to point in the direction of using an educational role playing game as an extrinsic motivation, a reward, increases the intrinsic motivation for the subject.

5.3: Summary

The experiment intended from the start to look at different didactic elements in role playing games that would lead to better effects on motivation, collaboration, recall and transfer. As shown in this analysis, much light have been shed on both elements that works as intended and elements that don't work. Based on these findings it will be possible to create a new system that will have a higher chance of creating the desired results. This is elaborated on in chapter 6.

Chapter 6: Summary and conclusions

6.0: Introduction

This chapter attempts to sum up the information presented in the first chapters. It is divided into three main sections. The first section deals with the summary of the data presented in the thesis, and conclusions based on this data. The second section debates didactic challenges in making of educational role playing games and the last section debates future challenges in research. All of these three sections will give a glimpse into the field of research that opens when we look at games and education. This thesis only scrapes the surface of a field so vast that the opportunities as well as the failures are just waiting to be found. This study had to be modified and restructured several times due to the complexity of the data gathered. And it opened up many new areas for further research.

6.1: Summaries and conclusions

In chapter five the empirical data was looked at in light of the research questions and theory in the field. It is hard to come with any absolute conclusions when dealing with pedagological research. I have however attempted to conclude on a few things and leave some questions open for future discussions. First I will present the research questions with answers found in this inquiry. After that, I will elaborate more on important elements from the answers found. The first research question was:

Is it possible that the use of an educational role playing game can lead to increased extrinsic motivation or intrinsic motivation compared to traditional teaching[48] for the performance of the tasks presented?

All collected data and observations points towards the same conclusions when looking at the motivational elements of a game. The use of games in education is highly motivational. Research in this field has proven that. It is also very clear from the research data that is gathered in this thesis that motivation was high for using this kind of educational tool. On direct questions relating to the use of role playing games as motivational the mean of the all

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[48] By traditional teaching I mean the classical classroom situation where a teacher lectures and students listen and makes notes.

three groups were more than 4.5 out of 6 table 32), a number which indicates high
motivational factor in games and the wish to continue using this type of educational tool.

Table 32: Mean of role play motivates me to work

	N	Minimum	Maximum	Mean	Std. Deviation
Roleplay motivates me to work	72	1,00	6,00	4,6667	1,30005
I wish there was more role playing games in school	72	1,00	6,00	4,8472	1,45020
Valid N (listwise)	72				

When looking at only the experiment groups, the ones that actually used the game, the
numbers are even higher (table 33).

Table 33: Mean of I wish there were more role playing games in school

	N	Minimum	Maximum	Mean	Std. Deviation
Roleplay motivates me to work	48	2,00	6,00	4,8958	1,15297
I wish there was more role playing games in school	48	1,00	6,00	5,0625	1,34332
Valid N (listwise)	48				

Looking at the motivation variables and constructs in chapter 4 and 5 also shows the same
motivational aspects. Nothing new here, but this inquiry has also proven the motivational
aspects the game. It is however important to look at the facts presented in this thesis. There is
no strong evidence or correlations between motivation, learning and transfer that can be
spotted. This might have happened for a various number of reasons such as the process of
measure was bad, the measures was invalid or measures were understood as to look into
playing the game, not learning. So it is possible to say that while a game in itself may be
highly motivating, it needs to relate directly to the learning material. This is also shown in
chapter 2 when speaking of high fidelity and contextualization. If it doesn't relate directly to
the topic at hand, it might be a lot of fun to play but it fails to teach. *Learning requires the
investment of mental effort in the learning process, and playing the game may misdirect the
effort to playing, not to learn* (Salomon, 2008).

The next two research questions intended to look into elements of collaboration and types of
learners. They were as follows:

Does an educational role playing game affect the learner's will and initiative to collaborate compared to traditional teaching? And:

Are there any significant differences between solo learners and social learners when using an educational role playing game?

This experiment showed clearly the effect on collaboration. The game itself being collaborative in nature should have an impact on the students using it. The data strongly suggests that this is the case. The attitude towards working together rose in the experiment groups but there were differences between the solo and social learners. This was to be expected when solo learners tend to rely on their own skills rather than the skills of a community or group. The social learners seemed even more dedicated to such a form of working after the experiment, while even the solo learners were positive towards collaboration towards the end of the experiment. Based on this it might be possible to conclude that the use of educational role playing games increases the attitude towards, and use of collaboration in school. This of course has to be researched in greater detail. These are the two major conclusions that are drawn out of the data. None of them does anything but prove what already has been shown in other research reports etc.

However, the research was done in school based on an educational role playing game designed for classrooms without a full version computer game to support it and as a prototype. The positive experience, in terms of motivation and collaboration, was very promising both for teachers and students. The game seemed to work as intentioned, building a bridge between the academic world of the teacher and the digital world of the student. It was motivating for both parties, and gave the students a more positive view of the subject math. Just this was a very good result according to the teachers. This leads to the last of the research questions that dealt with recall and transfer.

Does the use of an educational role playing game have a stronger effect on a learner's recall of knowledge taught and its applications in different contexts compared to traditional teaching?

To see any significant learning effect based on the use of the method though was hard, even though the means on the different tests rose from time to time. This might indicate that it has an effect, but still too low to detect by the tests. In the version of the role playing game I used, the contextualization is practically non-existent and the fidelity is very low. The focus was mainly to get them started and motivated for using this kind of learning tools. This supported the theory on contextualization and high fidelity learning. Hopefully by using more contextualized scenarios and high fidelity learning, the effects will be significant. This will then also lead to greater transfer of learning. If one thing is taught in class and later acted out in a game setting or in a live setting, it is safe to argue that learning has been moved from one context to another and put to use. A transfer of learning has occurred. Because of the limited time available for the research I had to discard this way of testing for transfer. The plan was to use a scenario a few weeks later that had a story that implemented all the formulas that had been taught in the experiment. The goal was to make the scenario in a different subject and see whether the learners recognized the elements asked for. If they did, and could put them to use, then that would have been proof of transfer taking place. This was not done because of the timeframe I was working after. I do however suggest that this is done in the future under future research in the field. To use a repetitive research model with a higher grade of contextualization each time, might lead us to the point where game and education merge and can be used efficiently.

This research showed that a lot can be done just by changing the educational setting. By increasing motivation in the groups, the chances of learning are already higher. As shown in chapter 2, motivation is vital in order to be able to work on an activity and maintain in this activity until the wished for result is achieved. The situated parts of the game are clearly proven. They work well within the setting of the game. The question that remains is whether they developed any cognitive skills or learnt something that can be used outside the activity of the game. Unfortunately there were no indications of this in this research, but I believe that has to do with the contextuality of the system, the lack of high fidelity systems and the fact that a fully operational ICT based game is not yet up and running. ICT is an extremely valuable tool in a setting such as this. It facilitates many of the processes that take time from the actual activity. This again leads to impatience among the players and uncertainty among the teachers. If the teachers could teach within this framework an add scores into a game that students could play outside school or add challenges into practical settings where students

would have to put their abilities at work, then it is my belief that effects of learning would rise and that in many more cases transfer of learning from one context to another would occur.

I presented all my data for the teachers involved after the experiment. This was done in order to confirm my findings. When the results were presented, they were amazed. They confirmed the major assumptions made in this thesis. The teacher in group 2 reported a large majority of social learners just as indicated in my data, while the teacher in group 3 reported a large majority of solo learners as indicated by my data. The motivational aspect was enormous. All teachers reported that the students were enthused by the game and wanted to use it more. Even the teacher in the control group reported of students being really angry because they were left out. Teachers can still use the game and their avatars as motivational artifacts even if they don't have any game sessions at the moment.

6.2: Didactic challenges when making educational role playing games

More than anything this small venture into research has shown the immense didactic challenges that appear when working on an educational game which has intentions outside the motivational area. To make a game meant as rewards for games or as drill for tasks are not difficult neither for video games or regular games. Squire writes in an article that drill and practice games can easily be integrated into traditional curriculums etc. but the effectiveness of these games are questionable (2005). When making the first version of Lærelyst, the main focus was to grab student's attention. If that was managed, I believed that the learning process would come practically automatically. This did not happen. The need for research into the field became obvious. I decided to look at what I was doing in a formative way. By doing this, it was possible to find key elements that could be embedded in a new version of the game and tried out in a similar experiment. So the main goal was not only to look into the research questions, but also look at what worked and what didn't. To do things this way would help improve the design of the method/system and create basis for the complete online version planned ahead. The results are shown in this thesis; higher motivation for actually going to school, motivation for schoolwork, more collaboration, attitude towards a subject etc. But the effect on learning was minimal. Of course grades improved because of the extrinsic motivation created by the game, but over time it was not possible to see any transfer effect. When introducing games in education it is important to have in mind the reason for doing so.

If it is only to reward students for excellent work or as a leisure activity, then the challenges are relatively easy. Then the challenge lies in an exciting game play and the action elements. A game made for rewarding needs to be exciting, relatively easy and possible to play in both short and long periods. There must also be renewal of scenery. Nobody wants to play the same game over and over, so one of the greatest challenges in this type of game will be the story and game play itself. But if this is the goal, then you don't need an educational game at all, then any game will serve the same purpose. The main element in an educational game will have to be a sense of learning or the hope for an effect on learning of some kind. Here it also depends on the kind of game that one wants to create. I have listed up three different approaches that are possible when thinking of educational games and a few key elements that will be the challenge in making them work. These challenges are based on experiences made in this experiment or theory related to the experiment.

➢ Drilling games made to check facts and similar elements. The main challenges here will be to implement as many of these tasks as possible in a game which doesn't necessarily have an extensive game play. Effective for short periods of time, but will mainly have an effect on recall, although some cognitive processes might benefit from it such as study techniques, problem-solving, practical reasoning etc. In the long term these kinds of games will not work as an integrated part of a learning system.

➢ Decontextualized role playing games made to integrate different tasks and subjects into stories which do not necessarily have any link to the subject matter. Lærelyst 1.0 is an example of such a game. It can be used over longer or shorter periods of time and in every subject. It increases motivation and enhances the use of collaboration. It is also possible to see a small impact on the level of recall and other cognitive strategies such as problem solving, practical reasoning, inductive reasoning etc. The greatest challenge here is to initiate a learning process that will facilitate high road transfer. It is also hard to maintain structure in a game such as this because of it openness to different themes and subjects.

➢ Fully contextualized educational role playing games. These games will be made in a way that every scenario focus on a theme in a subject and several scenarios cover different fields of the curriculum. In this type of game, the scenarios are just a prolonged arm of the traditional educational setting with game elements. When introducing new elements in a subject, this is then what students will experience the

use of in the game. All challenges and tasks in the scenario will then be based on the desired subject to learn. To do this is not the didactic challenge here. To make a story about a subject with tasks integrated or hidden is not very hard. The didactic challenge here will be to maintain the rule system and the enjoyment of play.

All these three models of educational games have their advantages when it comes to learning. Looking at the research done in this experiment though, it is my belief that only a fully contextualized system with the game elements intact will have a definite impact on the effect of learning. This experiment revealed the weaknesses of the first version of the educational role playing game Lærelyst and initiated the process of version 2.0. In the beginning of August the new version is ready. The attempt then is to create a fully contextualized role playing game based strongly on the curriculum but presented in game form with avatars playing in a virtual world rewarded with experience points based on their level of competency in different subjects. In addition to this, it also became apparent that the need for certain ICT tools are very important in order to effectively maintain avatars and create the game play. So even though a game can be played in the classroom without the use of ICT, ICT facilitates the process and makes it easier to use. Another important thing is that when ICT tools are introduced after implementing the game for facilitation purposes, it is easier to make everyone understand their use and the necessity for them. If something can be done easier, why do it the old way?

6.3: The road ahead, further research

It is my belief that this small experiment only scraped the surface of an enormous territory to research. The use of games in education has been on the agenda for decades, if not centuries. But after the introduction of ICT and the explosive development of video games, learning platforms etc, it has become more and more important to look into this field and get an understanding of the different elements embedded in this. The motivational aspects have been researches over a long period of time, there are still elements that could be elaborated on here to, but in general everyone agrees that games are motivating both for educational purposes and basically any other purpose. The same has been done when it comes to collaboration. Role playing games in particular are known for their collaborative nature, so any research

within this field would often conclude with the notion of increased will and initiative to collaborate.

In the future research needs to focus on the elements of contextualization and high fidelity learning connected to a gaming structure. How can we make games as close to reality and teach what needs to be taught in a way that makes the learner enjoy the process? How can game and curriculum link together as some sort of symbiosis? In my research I used few respondents, too few to make a huge impact on earlier work. But with a larger survey on the same elements as here it might be possible to explore the learning effect of a low contextualized game and compare it to a similar study with contextualized games. The interesting thing would then be to see in what grade transfer of learning took place or if games in their nature were strictly situated. It is my belief that they are not. Sfard speaks of the two metaphors and the danger of choosing just one (1998). Further research might reveal that in a game setting it might be possible to let both perspectives exist simultaneously.

Another area to research further is the game's effect on social and solo learners. In this research it has hardly been looked upon, but the differences in learning types will also have an effect on how to organize education in the future. The need to develop different strategies to deal with different types of learners will be important. In a game setting there is room for all types, it is however important to learn to know the different types before sending them into a game setting.

6.4: Closure

So is it possible to say that game based learning is better or more effective than traditional learning? Based on my findings the answer will have to be no. I found no significant evidence to support this. I did see small evidence of movement towards improvement though. I made a statement following my research questions In chapter 1: The use of an educational role playing game will have a positive effect on motivation, collaboration and recall, and facilitate low road transfer. I will argue this statement was right. The game did have a positive effect on motivation for learning and attitude towards the subject they worked on. It also had a positive effect on the level and initiative for collaboration. There was an increased mean when looking at the grades from their initial grade through the test and re-test. The way the re-test was conducted might also suggest that low road transfer occurred. Based on this I would say that

the use of an educational role playing game had a positive effect on education. If it had any long term effect remains to be seen.

This research helped in the work on designing a new generation of educational role playing games more focused on the learning process but with the same key motivational effects intact.

Finally I would close with a few words from Papert quoted by Schaffer in an article published in Nordic journal of Digital Literacy:

> *Seymore Papert wrote that when it comes to learning, what **can** be done is a technological question, what **should** be done is a pedagological question, and what **will** be done is a political question. So in the end the future of education will depend not only on whether epistemic games work, but on whether we have the will to change how we think about thinking and learning in a changing society.*
>
> (Schaffer, 2008, p.74)

Appendix-list

Appendix 1: Lærelyst – Veien til Motivasjon (Joy of learning – the road to motivation)

The educational role playing game used in this experiment is called Lærelyst – Veien til Motivasjon (referred to as LL). It has no English title yet, but it will come. It was developed by Rune Andersen in the period from 1999 – 2004. After that a revision has been made and Lærelyst v.2.0 is ready for release August 2008.

LL is based on traditional role playing systems like Dungeons and Dragons. Each player plays an avatar which is put into a virtual world to solve problems, tasks, challenges etc. This avatar is weak and helpless to begin with, but gathers strength, abilities and items as the game proceeds. The only way to increase abilities in the avatar is through the gathering of experience points and the only way to gather experience points is through school work. The teacher awards the students with experience points for work done in class or at home that are related to the subject their working on.

One element which differs from the regular grade system is the fact that students receive experience points based on their level of effort and competence. This means that the teacher evaluates each student and awards them according to a three part scale: Lower effort than expected, as expected and better than expected. This means that a student can answer all questions correctly and just throw the answers to the teacher on a piece of paper after just a few minutes. Since all the answers are correct, the student receives an A as his grade. However, the teacher knows that this task was too easy for the student, and the student does not attempt to work more with the subject, ask for greater challenges, do an effort with the work etc. This makes the teacher put him in the lower than expected category this time and he might only receive 300 points in the game. Another student might work hard on the tasks. The student only gets 4 out of 6 tasks correct, but has worked harder than ever, asked for help, tried as good as possible to do the best based on his abilities. The student might only receive a C as his grade, but 500 points in the game since he performed better than expected from him. By doing this, even students with low competence or problems of other kinds can be rewarded on a scale which considers their starting point and not necessarily their academic level. However, the grade scale still is in use to measure the academic level.

The game is based on scenarios that the avatars go through. The scenarios can be contextualized and work directly with a topic they're working on. It might also be completely decontextualized, meaning that the teacher receives a story and adds his or her tasks randomly in the scenario. There are several ways to play the game and different environments. It is possible to play fantasy, real time, historic time and future time. This is done in order to make teachers comfortable with the setting.

Students can gather points in every subject throughout the week and gather the points and transfer them to their avatar for an hour game play every week. By doing this, the game remains the motivational factor for the students. Teachers don't have to change their educational practice and students feels that they have been noticed. The students are familiar with the digital era; they are digital natives (Prensky, 2003). This game takes the best from digital games and puts it in a form that teachers can familiarize with and use without the threat to their ways of working. LL has as its intention to create a bridge between the digital world and the analogue world in which everyone can find elements that motivates and creates a good and lasting learning environment.

Short summary:

- Table top game
- ICT supported (optional)
- Avatars
- Virtual worlds (scenarios)
- Experience points given for academic work (only way to increase avatar abilities)
- Items gathered in game play
- Collaborative (the number of avatars starting a game has to finish it)
- Scenarios built on collaboration
- Points awarded based on the student's level of competency
- Including
- Easy to prepare and maintain

Appendix 2: Pre-test questionnaire

Spørreskjema Lillesand Ungdomsskole uke 48.

Nummer:_____

I denne undersøkelsen vil du bli presentert med en rekke spørsmål. Alle spørsmålene skal besvares med kun 1 (ett) kryss. Skal noe annet gjøres vil det bli gitt beskjed om i spørsmålsteksten. Alle svar blir behandlet anonymt.

Kjønn

Jente		Gutt	

Siste standpunktkarakter i matematikk

1	
2	
3	
4	
5	
6	

Har du noen gang spilt rollespill?

Ja, spiller ofte	
Prøvd det noen ganger	
Vet hva det er	
Aldri prøvd det	
Vet ikke hva det er	

På de neste spørsmålene får dere en del påstander. Dere skal på en skala fra 1-6 si hvor enige eller uenige dere er i påstanden. 6 vil være helt enig mens 1 er helt uenig. Sett ring rundt det tallet som ligger nærmest det du mener. Skalaen vil være som følger:

Helt enig	6
Enig	5
Delvis enig	4
Verken enig eller uenig	3
Uenig	2
Helt uenig	1

1. Skolen er et sted jeg trives.

      1   2   3   4   5   6

2. Jeg blir engasjert av skolearbeidet.

      1   2   3   4   5   6

3. Jeg liker matematikk

      1   2   3   4   5   6

4. Skolen motiverer meg til å jobbe bra.

      1   2   3   4   5   6

5. Jeg liker og jobbe sammen med andre.

      1   2   3   4   5   6

6. Oppgaver løses best alene.

      1   2   3   4   5   6

7. Det kommer an på oppgaven om jeg velger å gjøre den alene eller med andre.

      1   2   3   4   5   6

8. Skolen har for lite samarbeid i timene.

      1   2   3   4   5   6

9. Skulle ønske vi kunne jobbe mye mer sammen om å løse oppgaver.

      1   2   3   4   5   6

10. Jeg liker best å løse oppgaver alene.

      1   2   3   4   5   6

11. Når jeg skal samarbeide så velger jeg venner å jobbe sammen med.

    1   2   3   4   5   6

12. Når jeg jobber med andre liker jeg at vi får oppgaven og fordeler arbeidet. Så jobber alle hver for seg og setter sammen resultatene til slutt.

    1   2   3   4   5   6

13. Når jeg skal samarbeide velger jeg noen jeg vet kan det vi skal jobbe med.

    1   2   3   4   5   6

14. Alt går senere når en må samarbeide

    1   2   3   4   5   6

15. Jeg tror resultatene mine blir bedre av å samarbeide med noen.

    1   2   3   4   5   6

16. Når jeg skal jobbe sammen om en oppgave liker jeg best å løse hele oppgaven samlet. Ikke del for del hver for oss.

    1   2   3   4   5   6

17. Det er motiverende å jobbe sammen

    1   2   3   4   5   6

18. Skolen engasjerer meg faglig.

    1   2   3   4   5   6

19. Hvis jeg hadde fått jobbet alene hele året tror jeg at jeg hadde fått bedre karakterer.

      1   2   3   4   5   6

20. Skolen utvikler virkelig mine sosiale evner

      1   2   3   4   5   6

21. Jeg synes venner er viktigere enn skole

      1   2   3   4   5   6

22. Jeg jobber best om jeg får belønning for det jeg gjør.

      1   2   3   4   5   6

23. Å få til noe i et fag er belønning nok for meg.

      1   2   3   4   5   6

24. Hvilken karakter tror du at du får til Jul 2007.

1	
2	
3	
4	
5	
6	

25. Min holdning til skolen er:

Veldig motivert for skolen	
Trives på skolen	
Greit nok	
Verken motivert eller umotivert	
Umotivert	
Mistrives	

26. Min holdning til samarbeid på skolen er:

Jeg vil helst samarbeide hele tiden	
Samarbeider nå jeg ser nytten av det	
Samarbeider når oppgaven krever det	
Samarbeider om jeg blir bedt om det	
Samme for meg	
Liker ikke samarbeid	
Vil ikke samarbeide i det hele tatt	

Appendix 3: Post-test questionnaire

Spørreskjema Lillesand Ungdomsskole uke 5.

Nummer:_____

I denne undersøkelsen vil du bli presentert med en rekke spørsmål. Alle spørsmålene skal besvares med **kun 1 (ett) kryss**. Dette er utrolig viktig. Er du i tvil så kryss der du emner du er nærmest. Skal noe annet gjøres vil det bli gitt beskjed om i spørsmålsteksten. Alle svar blir behandlet anonymt.

Dette skjema er nesten identisk med det dere hadde før dere prøvde Lærelyst. Tenk på dette når dere svarer og svar med kun et svar på hvert spørsmål. **Det er viktig at ALLE svarer på alle spørsmålene.**

På forhånd tusen takk, hilsen Rune

Kjønn

Jente		Gutt	

Har du noen gang spilt rollespill?

Ja, spiller ofte	
Prøvd det noen ganger	
Vet hva det er	
Aldri prøvd det	
Vet ikke hva det er	

På de neste spørsmålene får dere en del påstander. Dere skal på en skala fra 1-6 si hvor enige eller uenige dere er i påstanden. 6 vil være helt enig mens 1 er helt uenig. Sett ring rundt det tallet som ligger nærmest det du mener. Husk 6 er helt enig 1 er helt uenig. Skalaen vil være som følger:

Helt enig	6
Enig	5
Delvis enig	4
Verken enig eller uenig	3
Uenig	2
Helt uenig	1

1. **Når jeg jobber med andre liker jeg at vi får oppgaven og fordeler arbeidet. Så jobber alle hver for seg og setter sammen resultatene til slutt.**

       1   2   3   4   5   6

2. **Alt går senere når en må samarbeide**

       1   2   3   4   5   6

3. **Hvis jeg hadde fått jobbet alene hele året tror jeg at jeg hadde fått bedre karakterer.**

       1   2   3   4   5   6

4. **Skolen har for lite samarbeid i timene.**

       1   2   3   4   5   6

5. **Skulle ønske vi kunne jobbe mye mer sammen om å løse oppgaver.**

       1   2   3   4   5   6

6. **Jeg liker å jobbe sammen med andre.**

       1   2   3   4   5   6

7. **Når jeg skal samarbeide så velger jeg venner å jobbe sammen med.**

       1   2   3   4   5   6

8. **Jeg tror resultatene mine blir bedre av å samarbeide med noen.**

       1   2   3   4   5   6

9. Jeg jobber best om jeg får belønning for det jeg gjør.

      1   2   3   4   5   6

10. Jeg får en belønning for alle gode karakterer jeg oppnår.

      1   2   3   4   5   6

11. Det er mye mer motiverende å jobbe når en vet en får noe for det.

      1   2   3   4   5   6

12. Skolen er et sted jeg trives.

      1   2   3   4   5   6

13. Jeg blir engasjert av skolearbeidet.

      1   2   3   4   5   6

14. **Jeg liker matematikk**

      1   2   3   4   5   6

15. Skolen motiverer meg til å jobbe bra.

      1   2   3   4   5   6

16. Det er motiverende å jobbe sammen

      1   2   3   4   5   6

17. **Skolen engasjerer meg faglig**.

      1   2   3   4   5   6

Min holdning til skolen er:

Veldig motivert for skolen	
Trives på skolen	
Greit nok	
Verken motivert eller umotivert	
Umotivert	
Mistrives	

Min holdning til samarbeid på skolen er:

Jeg vil helst samarbeide hele tiden	
Samarbeider nå jeg ser nytten av det	
Samarbeider når oppgaven krever det	
Samarbeider om jeg blir bedt om det	
Samme for meg	
Vil ikke samarbeide i det hele tatt	

Hvilken karakter tror du at du får til Jul 2007 om du hadde brukt f.eks rollespill.

1	
2	
3	
4	
5	
6	

Rollespill motiverer meg for å jobbe ekstra.

1   2   3   4   5   6

Skulle ønske det var mer rollespillbasert undervisning i skolen.

1   2   3   4   5   6

Appendix 4: Geometry test

Test – 9. trinn   Klasse: ………………   Navn: ………………………………

Emne: Pytagoras og hans læresetning om rettvinklede trekanter

katet^2 + katet^2 = hypotenus^2

---

1. Skriv fem faktasetninger om Pytagoras (hvem han var, når han levde, hva han gjorde, hva han er kjent for, osv.)

   Skriv faktasetningene her:

   ....

   ....

   ....

   ....

   ....

   ....

2. Skriv "k" på de sidene som er kateter og "h" på de sidene som er hypotenuser:

a.

b.

c.
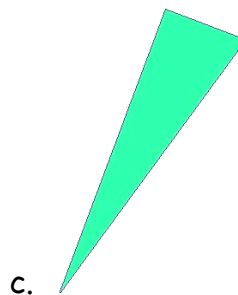
3. Regn ut lengden av den ukjente siden: (alle mål er i meter)

25

24
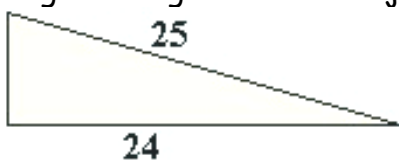
Vis utregning:

4. Regn ut lengden av den ukjente siden: (alle mål er i cm)
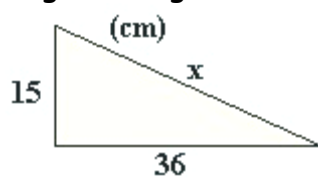
Vis utregning:

5. Regn ut høyden av flaggstanga:

7,4m

2,4m
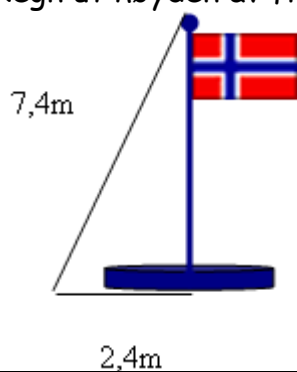
Vis utregning:

6. Regn ut arealet av denne trekanten: (alle mål er i cm)
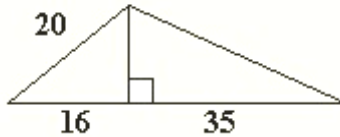
Vis utregning:
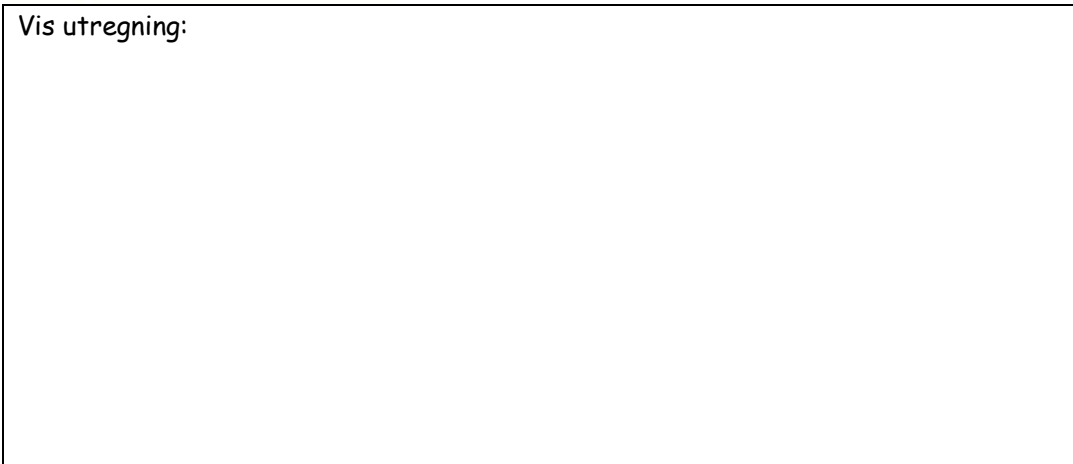
7. Hvor lang er diagonalen i dette rektangelet?
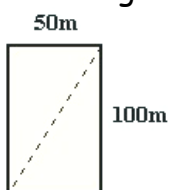
Vis utregning:

8. Hvor stor er omkretsen av denne husveggen?
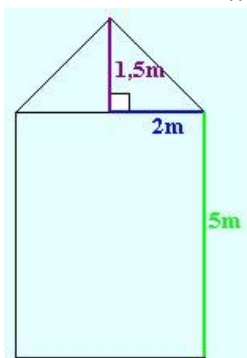
Vis utregning:

Appendix 5: First draft of communication with the school

Info om mulighet for å kjøre mastereksperiment i matematikktimene

ved Lillesand Ungdomsskole uke 48-51

Etter samtaler med Terje Pedersen og Glenn Langeland, er jeg av den oppfatning at det kunne la seg gjøre å kjøre et lite eksperiment til en masteravhandling i matematikktimene ved deres skole. Dette skulle la seg gjøre på 9. Trinn. Jeg har i dette skrivet forsøkt å skildre hvordan jeg kunne se dette for meg. Forhåpentligvis lar dette seg gjøre, skulle det by på problemer, så løser vi dem underveis.

Det jeg helst skulle vite var hvilket emne de skal jobbe med de siste ukene før Jul og eventuelle oppgaver de skal kjøre. Ut fra dette er jeg da også nødt til å lage en liten test som skal tas rett før avslutning og igjen 4-5 uker senere uten varsel. Målet med eksperimentet er å se om bruk av rollespill i undervisningen har en effekt på motivasjon, samarbeid og reproduksjon av kunnskap, samt om en kan se en overføring av læring fra en kontekst til en annen. Alle resultater vil bli behandlet anonymt og destruert etter analyse iht tillatelsen gitt fra NSD (personvernforbundet for forskning).

I første og siste fase vil undertegnede være med i eksperimentet, men ellers så skal dere gjøre som før med unntak av dem som skal kjøre det i spillform. To av klassene skal være eksperimentgrupper og en klasse skal være kontrollgruppe. Ingen må få vite dette før i etterkant.

Forslag til tidsplan med forklaring

Uke	Aktivitet	Forklaring
48	Pre-test	Alle elevene skal svare på et spørreskjema. Dette skjer anonymt. I tillegg vil jeg besøke klassene for å si noen ord om Lærelyst om dette lar seg gjøre. Dag avtaler vi.
49	Innføring i Lærelyst	Lærere og klassen får en innføring i metoden og hva de skal gjøre. De får også utdelt sine ferdige avatarer. Dette avhenger av modellen klassen skal jobbe etter. Hadde vært ideelt å få til dette mandag eller tirsdag, og så kjørt en vanlig spilløkt en times tid senere i uken slik at de fikk bruke det litt og at lærer føler at han har vært borti dette før selve eksperimentet starter.
50	Eksperiment	Elevene jobber med stoffet i matematikken. Alle gruppene skal jobbe, men to av gruppene gjør dette etter et scenario i lærelyst. Det ideelle her hadde vært å kunne samle det i to økter, men det er vel vanskelig å snu på timeplanen eller bytte økter. Hadde vi f.eks kunnet kjøre to

		økter a 3 timer hadde det vært perfekt. Hvis ikke må vi bare legge til rette ut fra de forutsetningene som foreligger. Det viktigste her er at oppgaver er på forhånd lagt inn i et scenario. Denne jobben tar jeg. Derfor er det utrolig viktig at jeg få de oppgavene som ønskes gjennomgått i klassene. Lærere blir bedt om å observere en av timene og notere på skjema.
51	Post-test og reproduksjons-test	Elevene får en kort test i det emnet de skal ha vært gjennom. Denne tar kun 20 minutter. Den gir poeng i Lærelyst og en karakter. Etter dette får de et spørreskjema igjen som skal besvares. Så er det hele over.
4	Ny test i reproduksjon	De får en tilnærmet lik prøve som i uke 51, men endret settingen noe. Denne brukes for å se om de har tatt med seg det de har lært inn i en ny kontekst. Jeg vil se om de har gjennomgått en såkalt transfer effekt.

Det å være med i eksperimenter innen utdanning er selvfølgelig frivillig. Det bidrar til å sette skolen på kartet og ikke minst kan det tilføre skolen kunnskap som de på annet vis kanskje ikke hadde fått så enkelt.

Håpet er at dette kan la seg gjennomføre. Håper på positive svar fra dere. Får jeg det, kan jeg anmode enhetsleder om tillatelse til å starte opp. Da er det bare for dere å gi beskjed om de dagene som passer best. Blir hektisk opp mot jul, men noen ganger er det et velfortjent avbrekk i en tid da en lengter til Jul.

Mvh

Rune

Appendix 6: List of abbreviations used for variables in SPSS

Abbreviation	Variable
CSOLO1	When I work with others I like the task presented and divided. Then everybody does their part and gathers to combine each part afterwards.
CSOLO2	Everything works slower when we work together.
CSOLO3	If I had worked by myself the entire year, my grades would have been better.
CSOC1	We don't work enough together in lessons at school.
CSOC2	I wish we could work more together solving problems at school.
CSOC3	I enjoy working with others.
CSOC4	When I am working together with someone I choose my friends.
CSOC5	I believe my results becomes better by working with someone
CSOC6	It is motivating working with someone.
CSOC7	My attitude towards working together at school
EM1	I work best if I am rewarded for what I do.
EM2	I receive rewards for every good grade I get.
EM3	It is a lot more motivating to work when I knows there's something in it for me.
IM1	School is a place I enjoy being.
IM2	Schoolwork motivates and engage me.
IM3	I like math.
IM4	School motivates me to work well.
IM5	School engage me on an academic level.
IM6	My attitude towards School.
Post test	The first geometry test
Re-test	The second geometry test

Figurelist

List of tables

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