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Games and simulations in workplace eLearning

"How to align eLearning content with learner needs"

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Preface

The report is our Master of Science thesis at the Norwegian University of Science and Technology, Institute of Industrial Economics and Technology Management. The thesis is mandatory to graduate. The work was performed from September to December 2000 in California, US and from January to March 2001 in Trondheim, Norway.

We have enjoyed writing this thesis as it has given us insight into the eLearning business and the pleasure of working with experienced and skilled people. This thesis would not have been possible to complete without help and inputs from individuals, and their willingness to share knowledge and discuss this topic. We would like to extend our gratitude to the following people:

First of all we would like to thank Eilif Trondsen, Ph.D. at SRI Consulting for inviting us to Menlo Park and for making us a part of his large network. We would also like to thank Marcelo Hoffman at SRI for thorough feedback on our work and Kristian Folkman at the Norwegian Trade Council (NTC) in San Francisco for very constructive advises, for sharing his insight with us and for inviting us to events at NTC. Secondly we would like to thank the Wheeler's for their hospitality during our stay in Fremont, and Kevin Wheeler for fruitful discussions and feedback on our work. Kristin Rothballer and Rea Inglesis deserve thanks for adding value to both our thesis and our stay in California.

It would not have been possible to write this thesis without case studies, and the interviewed companies have been very helpful by providing the needed information and generously taking time to help us – none mentioned, none forgotten. Finally we would like to thank Alf Steinar Sætre at the Norwegian University of Science and Technology for his efforts as a supervisor for our thesis.

Trondheim, March 9th 2001,

_____ _____

Rolf Ahdell Guttorm Andresen

Executive summary

The Internet is becoming natural and necessary for corporations as an efficient way of communicating with a geographically dispersed workforce. eLearning will reduce travel expenses and the time needed to roll out training programs. However, there are some problems associated with eLearning today. Content is often text-heavy with weak interactivity and many users find eLearning boring. This thesis is written based on a hypothesis that the use of games and simulations is one way of making learning engaging. We define eLearning as *"effective and engaging learning anywhere at anytime, developed and delivered using information technology".* Given time- and variety limitations, we want to answer two study questions:

- **How can you use games and simulations to create an effective eLearning product?**
- **How does the use of games and simulations succeed in offering the user an engaging learning experience?**

During our stay in California we conducted a market research of the US and Scandinavian market for games and simulations in eLearning. We developed a market map to categorise some players, and described trends and technological constraints and challenges, as well as potential drivers in this market. We found that there is a lack of quantitative numbers on learning effectiveness, mainly because it is difficult and expensive to obtain reliable figures.

Learning effectiveness and engagement

Our literature study focused on issues related to learning effectiveness and engagement in learning, according to the study questions. We arrived at certain factors that will influence learning effectiveness: *willingness to learn, expectations, content, learning design, engagement, mentoring* and *collaboration*. Engagement seemed to be crucial and therefore we looked closer at the ability of games and simulations to create engagement. Interactivity, flexibility, competition, reality, usability and drama elements are all features that will create engagement for the user of games and simulations in eLearning.

The three case studies

We chose the case study as research design for our qualitative research, and used our models as a basis for discussion. During the market research we established contact with several companies, and three of those responded positively to our request of using one of their products as a case study.

The Business Challenge (BC)

Involve Learning developed BC in co-operation with Electrolux, and the basic idea with BC is that employees at Electrolux should learn about the concept of value creation. In BC, the user will take the role as a key account manager and has to sell kitchen applications to a very important customer.

In terms of analysis there are no numbers on learning effectiveness in BC. Involve Learning thinks that engagement is very important, and both Electrolux and Involve Learning focus a lot on content and relevance as well. Those users who have completed BC said that they learned from it and that BC was engaging. Drama elements seem to be especially important for engagement.

The Monkey Wrench Conspiracy (MWC)

MWC is an action game meant to teach designers how to use a 3D-design program, ThinkDesign (TD). think3 is the company behind TD, and developed MWC together with Games2Train. We also interviewed Sun Design who has used MWC. The objective in the game is to infiltrate an occupied space station, and in order to do that the user has to fix mechanical parts with TD.

The learning effectiveness in MWC seems to be good, and the game has fulfilled users' expectations. Users have learned how to use TD while playing MWC and the need for support help is reduced. MWC engages users with competition, flexibility and interactivity.

The MoneyMaker (MM)

The MoneyMaker (MM) is a single-player scenario-based simulator for sales professionals developed by Intermezzon. The overall mission in MM is to sell a technical product to a big potential client, and the user must establish good

connections with five different managers. MM has 3 different levels, a test to map the user's knowledge, a guided training phase and finally a certification.

We interviewed Canon who saw a need for a mentor to really create engagement and to help the users get started with MM. This might be because MM is just partially relevant for Canon. It must be borne in mind that an improved and updated version of MM exists. Intermezzon and Canon agreed that engagement is very important for learning. The story and drama elements in MM create engagement, in addition to competition and flexibility.

Cross case analysis

There is a lack of numbers on learning effectiveness in all the three case studies. The feedback is usually based on "smile-sheets" and comments from users on whether they liked the product or not.

MWC differs from the other case studies because it is a loosely linked game, where the learning takes place outside the action game. MWC is also distributed for free and has marketing purposes as well as learning purposes. But given certain differences, all three case studies show that engagement is crucial for effective learning. Relevant content is also important to engage the user throughout the learning process. It is easier to create relevant content with hard-skills than with soft-skills.

All the case studies conclude that interactivity is the most significant contributor to engagement. However, the cases use interactivity in different ways. They all have a good degree of interaction, but the quality of the interaction varies. Flexibility is also regarded as one of the important engagement features, but the case studies seem to lack some flexibility.

The use of rich media has a positive effect on engagement, but at the same time raises questions in terms of reuse and delivery limitations. Storytelling as a drama element is particularly important in the soft skills products to involve the user in the experience. As of using other drama elements the cases have different formulas on how to find the balance between features. Two of the case studies describe

competition as important, and competition could induce engagement for certain user groups.

Conclusions

It is hard to find numbers that prove the effectiveness of different kinds of learning, not just for eLearning. However, we think there is a need to explain how and in which cases games and simulations can create effective learning. It is difficult to arrive at any definite conclusion on how effective these case studies are in terms of learning, but they all seem to engage the users, a condition for effective learning. Games and simulations can spark interest for learning and make a boring topic fun, and are well suited for learning content that requires practice. However, to maintain engagement throughout the learning process and ensure effective learning, relevant content and design is also important. Flexibility and storytelling are particularly important engagement features.

Even though games and simulations engage users, there is still a huge potential to add more interactivity and flexibility in products. Especially the quality of the interaction can be improved. It is not easy to create an optimally engaging learning experience, as some of the engagement elements will either demand a certain condition or restrict another element. A product that is optimal and engaging for some people might be the opposite for others. The use of media elements to create reality is particularly important in learning productions for soft skills, to align the product with experiences from real life.

We think that the market for games and simulations is likely to grow as a younger generation enters the workforce. Younger people are more used to playing computer games and to be engaged by the computer, and might be more open to try a new way of learning. Our case studies might not be "state of the art", but the maturity of the market and technology limitations taken into account, at least a couple must be said to be "state of the business" as of simulation games for corporate eLearning today.

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1 Introduction

As an introduction we will describe the background for this thesis and the structure of the paper.

1.1 Background

This report presents our final paper at the Institute of Industrial Economics and Technology Management at the Norwegian University of Science and Technology (NTNU) in Trondheim, Norway. We did most of the preliminary work from September until December at SRI Consulting-Business Intelligence (BI) in California, and completed the thesis in Norway by March 2001.

Our study combines the disciplines economics, management and computer science. We wanted to write a thesis in which we could combine knowledge in both organisational development and technology, which would build upon our background. Through our institute we received an invitation from SRI Consulting-BI in California, to host us for 3 months, while contributing to research on eLearning. We both found great interest in the subject and were chosen after a selection process.

SRI Consulting-BI is a subsidiary of SRI International (formerly Stanford Research Institute). One of many programs at the BI centre is the Learning-On-Demand program (LOD), where Eilif Trondsen, Ph.D., is the director. Eilif has been doing research on eLearning under the LOD-program since late 1998, and is one of the most experienced persons within this field. He has built a large network with leading companies in the US and the Nordic countries. His connection to NTNU was through Alf Steinar Sætre, Ph.D., who agreed to supervise our thesis. Based on Sætre's competence in organisational development, and Trondsen's experience and industry knowledge in eLearning, we had two supervisors with expertise to guide us.

We contributed to a SRI-report on the use of games and simulations in eLearning. It described the market, its key players and their products and business models, as well as trends in terms of costs, growth and potential. We interviewed developers, tested products and attended forums. We also had regular meetings with Eilif and his colleagues to discuss issues related to our common research.

1.2 Structure of the paper

This thesis has both a theoretical and a practical part. The theoretical part will describe concepts for effective and engaging learning, and also explain our research strategy for this report. The practical part consists of a market research and analysis of case studies. Figure 1 presents the structure of this report.

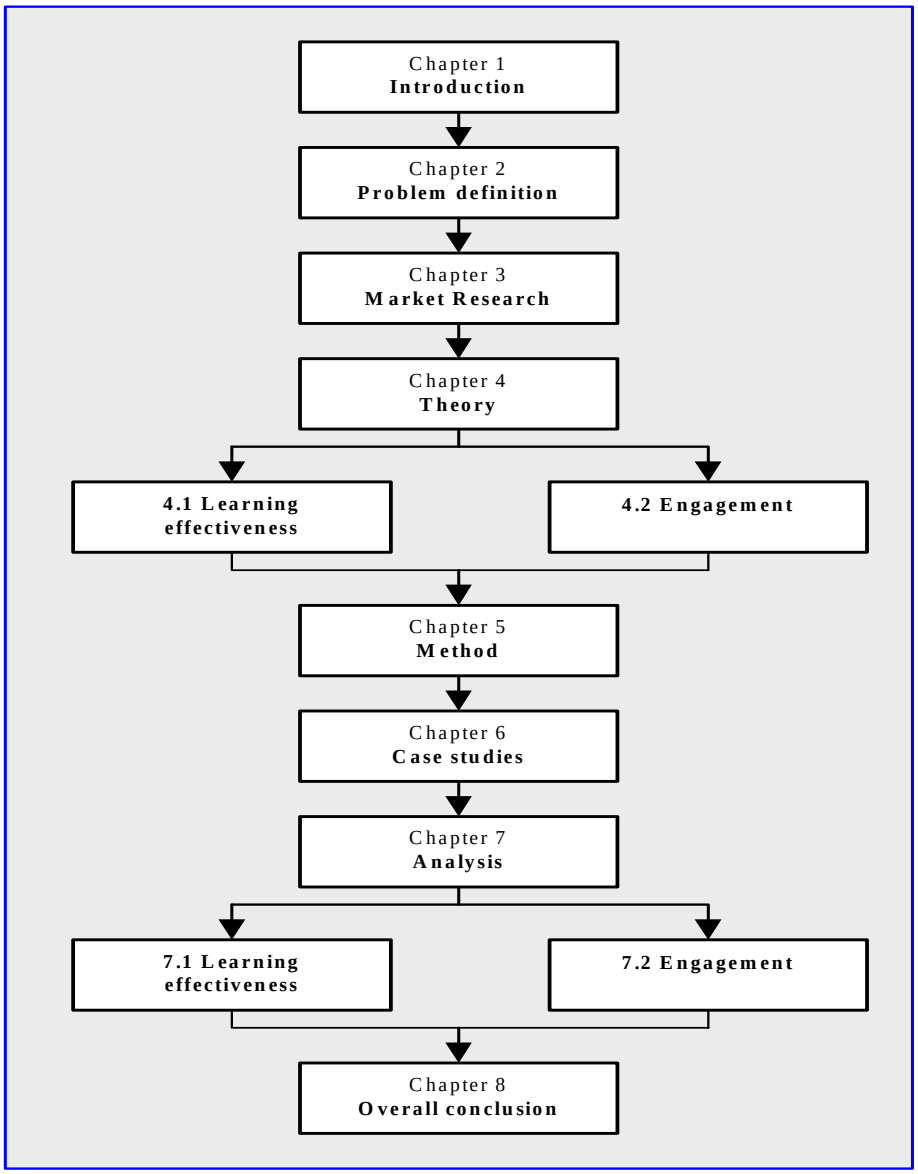

Figure 1: Structure of research thesis

In chapter two we describe the eLearning arena as a background for our problem definition, and we present our study questions with assumptions and limitations.

Chapter three is a summary of a market research conducted during our stay in California. It shows the characteristics of the US and the Scandinavian market for games and simulations in eLearning and lists some key players.

The next two chapters form the theoretical fundament in our thesis. Chapter 4 discusses theory on adult learning, particularly focusing on engaging learning experiences. We developed one model for learning effectiveness and one model for engagement in learning in a summary of our literature study.

Chapter 5 describes the research design and methodology used in this paper. We explain the choice of method, how data is gathered and the strategy used to perform an analysis of the data. This chapter also contains comments on the quality of our data.

The case studies are presented in chapter 6 and they are analysed in chapter 7. The analysis first looks at each case study separately, then combines them and draws conclusions according to the two study questions.

Chapter 8 is our overall conclusion where we look ahead and try to put our thesis in a broader perspective. We also point out ideas for further research.

Chapter 2

Problem definition

"We don't stop playing because we grow old. We grow old because we stop playing."

Oliver Wendell Holmes

2 Problem definition

The following chapter will describe the field of research and present the problem definition on which our research is based. In a last section of this chapter we will define our study questions and limit and explain our focus.

2.1 The eLearning arena

Creating learning organisations has been a desired goal for many companies in the last decade, as industry focus has shifted towards knowledge workers. Human capital has become the most important asset of today's corporations. Hence, providing learning opportunities for employees is crucial for companies. In the growing complexity of today's corporate world, employees must make quick decisions, have an ability to change fast and continuously improve themselves. These characteristics require faster learning, larger knowledge bases for decisions, more teamwork and reuse of existing knowledge and best practices. At the same time, the shelf life of knowledge has dwindled to the point that a four-year engineering degree is obsolete in, well, about four years.

The latter is closely related to the enormous development in technology that is taking place, with computers and the Internet becoming a natural, and for some people a necessary part in their everyday life. To continuously increase knowledge is crucial in order to stay updated, both from an organisational and technology perspective. Trade barriers are falling, global competition is intensifying, and complex world-wide corporations seek more efficient ways to deliver training to a geographically dispersed workforce. Many companies are using eLearning to cope with some of these challenges, and the demand for eLearning is likely to grow fast according to research reports. Merrill Lynch estimates the size of the US eLearning market to be $4 billion in 1999, growing at 40% annually[1]. John Chambers, CEO of Cisco Systems claims:

"Education over the Internet is going to be so big, it is going to make e-mail look like a rounding error."

[1] Reference from Internet-page: www.internettime.com

2.1.1 What is eLearning?

eLearning extends so-called computer-based-training by connecting computers using network technology. The learning content is delivered to many users through different media, mostly over the Internet or on Intranets. Some claims that the *"e"* in eLearning means *electronically* delivered learning. However, we think that electronic is not a sufficient definition of the *"e"* in eLearning. In order to exploit the true potential of eLearning, the *"e"* must also imply effective and engaging learning. This means effective for the buying organisation and engaging for the many users inside those organisations, relative to other ways of learning. For the purpose of this report we define eLearning as:

"Effective and engaging learning anywhere at anytime, developed and delivered using information technology".

2.1.2 What do you learn with eLearning?

Corporate learning today can broadly be divided into two categories, hard- and soft skills. Soft skills are typically business skills involving human interaction, for instance leadership, communication, teamwork, sales and marketing. Hard skills could be practising the use of tools, equipment or applications. Much of the hard skills training in eLearning are IT training, and IT training is the largest segment in eLearning today. Between 1997 and 1999 the IT online training market outpaced soft skills fourfold. However, the soft skills market is now growing twice as fast as the IT segment, and will surpass IT training by 2003 in the US (WR Hambrecht, 2000). These numbers are illustrative figures, it must be borne in mind that hard skills training includes more than just IT training.

2.1.3 What benefits can eLearning give?

eLearning opens up many opportunities, and has clear benefits if implemented properly. Some of these benefits include:

- **Anywhere, anytime**

  Training delivered using Internet technology will be accessible anywhere with a connection to a network. The users can access programs from home or when travelling. Learning will be available 24 hours a day, 7 days a week all around the

world. Critical information and training can be delivered to multiple locations at the same time.

- **Cost savings**

  Examples of this include reduced travel expenses, hiring trainers and consultants, providing facilities and taking people away from their jobs. IBM reports that it avoided over $80 million dollars in travel and housing expenses during 1999 by globally deploying online learning (Forrester, 2000). However, the costs of developing different types of learning must be taken into account when comparing types of training and estimating cost savings.

- **Just-in-time education on updated information**

  eLearning can put valuable resources at the employees' computers just when they need them. Firms can react more quickly to changes in the competitive environment without booking facilities and scheduling training. Information can be updated at one location and spread quickly and conveniently to everyone simultaneously.

- **Fast Deployment**

  Time required to roll out a new training-program can shrink dramatically.

- **Personalised learning**

  eLearning can adapt to a person's learning style, so users could learn whatever they want in their own style at their own pace. The learner would get more control of their learning process.

- **Feedback provides continuous improvement**

  eLearning management tools let companies track and monitor employees and gather feedback regarding the effectiveness of programs.

2.1.4 Problems with eLearning

There are however many problems associated with eLearning today. Examples include:

- **Boring, text-heavy content**

  One of the roadblocks in online training is static content with weak interactivity (Forrester, 2000). Much eLearning is where eBusiness was 5 years ago, but instead of vendors creating online catalogues, trainers are now developing online textbooks. Much of today's eLearning implies scrolling text-heavy HTML-pages.

- **Effects are hard to measure**

  The overall impact of eLearning remains uncertain because managers fail to measure effectiveness. 77% of the respondents don't track the number of employees who take advantage of online training, and two-thirds don't measure the effectiveness of their net-based programs (Forrester, 2000). It is very difficult and time-consuming to measure effects quantitatively, and therefore many companies only use qualitative feedback instead.

- **Underuse**

  Epic Multimedia in United Kingdom has experienced the problems associated with underuse of eLearning. Underuse means that the use of eLearning systems often drops off after a "honeymoon period" immediately after launch. For vendors, continued underuse and unsuccessful initiatives could threaten the market for eLearning systems (Trondsen, 1999). This is also supported by others (Forrester, 2000), which conclude that some online courses suffer from dropout rates as high as 80%. However, this research does not compare dropout rates relative to other types of training.

2.2 Background for the problem definition

Given the problems with eLearning, a major challenge is to make it more engaging. This thesis is written based on a hypothesis that the use of games and simulations is one way of creating engagement. We want to explore how and to what extent games and simulations can be used as elements for presenting eLearning content. The main focus is to highlight whether games and simulations can solve some of the problems associated with eLearning.

2.2.1 Study questions

These are the overarching question to answer throughout the thesis, and should cover all the main topics of the research paper. The difference in focus between the developer and the user is likely to be important to our findings, and we have used both study questions for each:

- Study question 1:

How can you use games and simulations to create an effective eLearning product?

- Study question 2:

How does the use of games and simulations succeed in offering the user an engaging learning experience?

2.2.2 Unit of analysis (delimitation)

The core of our focus is the content in games and simulations in eLearning products. Development, delivery and use of content raise both technological and economical questions. This thesis describes the current situation. Technology for development and delivery will be discussed to set the context in which our findings will be analysed. Due to limited resources, we will base our analysis on these pre-defined constraints without discussing possible scenarios when external conditions changes.

2.2.2.1 Time limitations

Due to time restrictions we focus on the software content in actual use for training in organisations, and the effects derived from its use. We will try to describe which content attributes create the effects, and compare results with intended effects as presented by developers.

- **The implementation of products is not our main focus**
  We will not explore the implementation phase in detail, however we expect that appropriate implementation is a crucial factor for organisations to succeed with eLearning. Because of time limits, we will not focus on implementations in this paper.
- **We use qualitative data**
  Because of limited time we could not interview a large enough number of users to allow a statistically valid survey. We have been limited to speak with the training manager, HR manager or equivalent on the user side and to discuss their experiences with game and simulation products. Because of this we are using qualitative data to support our findings.
- **We will not try to predict long-term effects**
  Our case studies look at companies, in which the eLearning products have been used recently. Hence, the long-term effects, if any, are not clear yet. We will not predict long-term effects, but instead focus on results available so far.

- **We are mainly looking at the situation today**

  We want to describe best practises and products in the market today, and are not focusing on future trends, even though this could be drawn from the conclusions.

2.2.2.2 Variety limitation

With many simulations developed for education and training, there is a need to be more specific on which products we will include in our analysis.

- **We analyse corporate learning**

  Our focus is eLearning for corporations, and we are hereby excluding products made for children and for students in higher education. We focus on corporate users and buyers, even though the products might have been developed by an educational institution. The skills trained could be both hard skills and soft skills.

- **We analyse web-based or CD-ROM based products for PCs**

  We ignored simulations and games that cannot be delivered on a Personal Computer (PC). Given this limitation we exclude, for instance, flight simulators, and large simulations presented in virtual rooms, or on big screens. Examples of these are simulators used in the military and by oil companies training drilling procedures. These are important uses of simulations, but they require special facilities and fall outside our definition of eLearning delivered through a corporate network.

Chapter 3

Market research

"Personally, I'm always ready to learn, although I don't always like being taught."
Winston Churchill

3 Market research

As a contextual background for our thesis, we want to look at a number of players in the current eLearning market. More specifically, we will examine and analyse different companies that use games and simulations in *corporate* eLearning. This initial market research will hopefully give some insight into the marketplace as to what kinds of products exist and help us determine which companies we should select and use as best-practice case studies in our thesis.

The material for this research comes from several sources. We examined a large number of web-sites, trying to select those developers that appeared most interesting for our thesis. However, the interviews with staff inside selected companies represent the most important, useful and reliable source for us. We have been able to get experienced views and ideas from a number of US and European eLearning companies. We are very thankful for the great openness and willingness to share knowledge shown by everyone we have interviewed. During our research we also found other interesting companies, but due to time limitations we did not follow up with all of them. An extended research should include some of these companies.

3.1 Defining the market

eLearning in itself is a global market, and that also applies for games and simulations. Our main focus has been the Nordic region and the US market, where a majority of the developers are located (see Company list in Appendix A), even though they might sell their products in other countries. The US market is the biggest in terms of the number and size of potential customers, while Scandinavian countries are interesting because of high Internet penetration rates, broadband initiatives and many new eLearning start-up companies.

Developers of games and simulations for corporate eLearning range from large corporations to very small companies, such as the Swedish company ELD. Quite a few players have fewer than 30 employees, while some larger ones employ thousands of people. The latter are often doing games or simulations as a relatively small part of their overall business. For instance, Andersen Consulting (now Accenture) has a much broader range of competencies than smaller businesses that might have their core competence in a particular niche or technology. Powersim,

which sells a system dynamics engine, could serve as an example of a type of speciality firms.

3.1.1 Hard to get an overview

Currently there are multiple players creating many different products. Some of them are testing out ideas to find out where the greatest opportunities will be in the future, by answering the question: *"How should games and simulations (G&S) be designed and what are the most important features and elements for a given target market?"* There is also a dearth of empirical research on the role and effectiveness of G&S in adult learning, although most analysts feel G&S could potentially be very important by providing more engaging learning experiences.

Due to the variety of products that exist, it is difficult to classify the products in the market and to provide a valid overview. We will present some ideas and outline a tentative framework for how to categorise some of the players in the market. It is important to stress that this is NOT a ranking of companies or some kind of quality measure. It is NOT necessarily a view of the competitive landscape either, since within some of these categories there are totally different business models, focusing on different segments or niches, with different technologies. However, by outlining a few categories for the products we have seen so far, we are able to describe trends, challenges and uses within each category. Also, some companies could be placed in more than one of these categories, and some are trying to build up a broad range of competencies that enable them to play in different market segments.

3.1.2 Classification

The following definitions, that we will use later, come from American Society for Training and Development (ASTD, 1987):

- *Game* – a structured activity in which two or more participants compete within constraints of rules to achieve an objective. One of these participants can be a computer.
- *Simulation* – An operational model, using selected components, of a real or hypothetical process, mechanism or system.
- *Simulation game* – Combines the characteristics of games and simulations.

In between a pure game and a simulation we have the simulation game category, in which we have seen products like the "MoneyMaker" from Intermezzon and “The Business Challenge" developed for Electrolux by Involve Learning and BTS. Some call this a “grey-area”, since it is hard to define how much is “simulation” and how much is “game” in such products. That is not the important issue, because simulation games have a huge potential. The key is to combine the characteristics of both games and simulations to engage the user, where the mixture of those two might vary depending on user preferences and the purpose of the product. Elliot Masie says:

“You can have a game that's not a simulation and a simulation that is not a game, but when you get one that does both, it's a real kick-ass situation.”

Simulations and games are used for teaching hard skills and soft skills as well as facts and information:

- **Hard skills** can imply learning how to use a tool or an application, or learning a specific skill like finance. We feel it is useful to separate at least two different types of hard skills:
  - Complex skills relate to *system dynamics*. The central concept of system dynamics is to understand how objects in a system interact with one another, as well as the system as a whole. A user interacts with objects or variables in a system dynamics simulation through feedback loops, where a change in one variable affects other variables over time, which in turn affects the original variable. The number of variables the user can affect decides the complexity in a system dynamics model. System dynamic models should reproduce behaviour seen in the real world. System dynamics is often used in finance, and BTS and SMGnet use them in business performance training. Powersim has developed a system dynamics engine that it sells to interested companies, who might customise the engine to their needs. An example of a simple feedback loop is the process of adjusting the water tap to reach a desired temperature. You turn the faucet, feel the temperature, and compare it to the desired temperature. You continue to adjust the water, with smaller and smaller adjustments, until you reach the desired temperature.

- Specific skills: Simulations and games are also used in training specific skills. In this category it is easier to set learning objectives, and design the program based on those. A typically program in this category will be a course where the simulation could visualise a mechanical movement. Simulations have been used for a long time for this type of troubleshooting and skill training. An example of this application involves simulations for operations by a mechanic on a truck, as developed by former Allen Communication, now Mentergy. The use of simulations for visualisation also extends beyond our focus in the thesis, since some are not PC-based, but require supercomputers and large visualisation rooms with huge 3D screens. Virtual reality rooms and simulations also come into this category outside our focus.

- **Soft skills** are more complex to define, train and measure. Soft skills involve human interaction, and typical examples are negotiation, decision-making, communication, motivation and leadership. The level of interactivity varies, from basic tell-test training[2] with video-clips and questions, to products were the user is more involved in the action. Most of the soft-skills simulations today involve dialogues with characters based on a scenario-tree within a story. The user will interact with the program by choosing from listed alternatives of what to say in conversations. Based on the chosen alternatives, the user will move along a path in the scenario-tree. This is so far the only alternative we have seen in terms of using simulations and games in soft-skills training. There are indications that complex system dynamic models might be used as an underlying engine in soft-skills training. However, such use would require the development of a much better user interface than what is available for most system dynamics models today.
- **Facts and information** are meant to increase the learners' knowledge and spread information about a certain issue. This could be an introductory game with company or industry information, or facts about laws and legislation, for instance sexual harassment. Instead of letting people read paper-based manuals, they can play a game and find out more about this particular issue. An example derives from Sweden, where the government now requires every adult to choose his or her own type of pension-plan. This has resulted in a great need for materials to

[2] Tell-test training is an expression for telling information and then testing if the message went in, and regarded not as engaging as learning with games. For a further discussion of tell-test training, see "Digital Game-Based Learning" by Marc Prensky (2001).

inform people about the new pension law, teaching the basics of investment, and what choices they have (given the person's risk preference and so on). Involve Learning and ELD have made productions for organisations on this topic. Leading edge companies are using these simulation games outside their own organisation, educating both suppliers and customers along the value-chain. Games are well suited to present what would otherwise be boring information. Some companies use these games in pre-training preparation and in post-training practice to reinforce learning.

Based on these and other characteristics, we present below an initial mapping of various companies and the types of programs they produce.

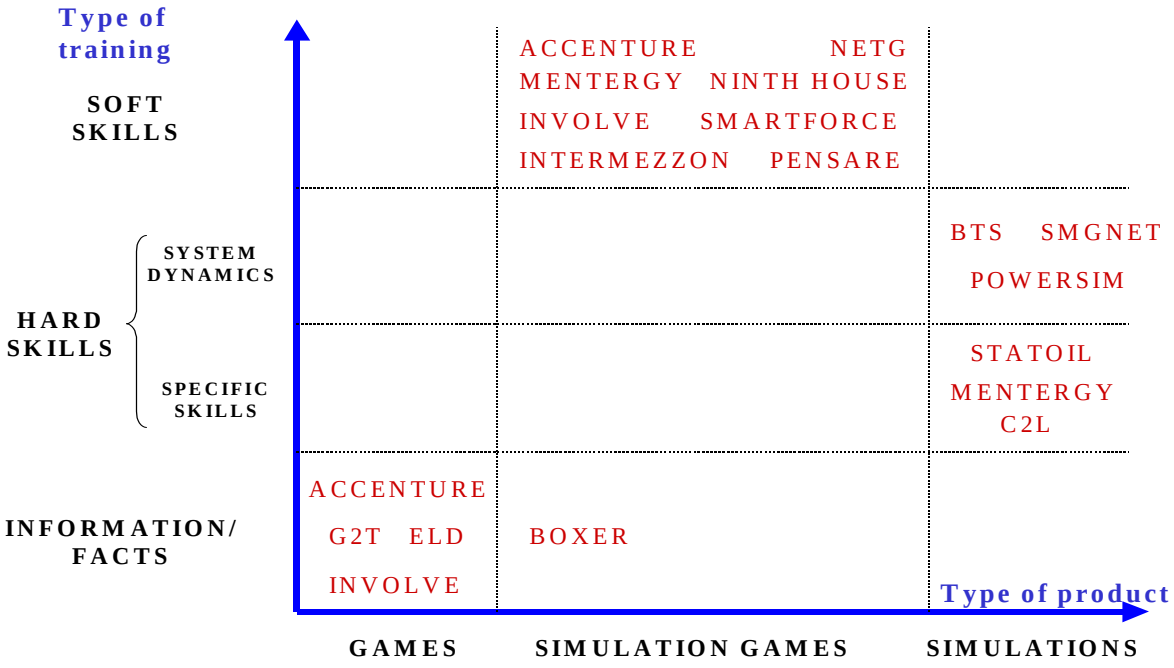

Figure 2: Market map

3.1.3 More than the corporate market

Although our thesis focuses on eLearning for the corporate market, it is necessary to emphasise that many interesting things are happening in the field of games and simulations in other segments. Examples are the US military (which has long experience with the use of G&S) and educational games both for pre-students and

students. Given the large markets that currently exist for both military-focused G&S and those for children's educational and entertainment games, these segments are more likely to be on the leading, or bleeding, edge of technology for G&S applications.

3.1.4 Maturity in the market

Although no metrics currently exist on the use of G&S in learning and training, there seems to be greater acceptance for using simulations than games in the corporate market. This might have to do with corporate culture and also that older managers and CEOs may not want their employees to play at work. For this reason, many simulation games are simply called simulations. However, creative companies see the need for engaging eLearning and use game features to a greater extent. Only a few products use the game features extensively, and tools to incorporate the learning content to the entertainment game world are not developed yet.

Many developers say that the market has matured substantially in the last year; buyers now know more about eLearning in general, about the costs of developing games and simulations and about potential benefits. Companies are gaining interest in using games and simulations for learning—especially as a growing number of studies report very high drop out rates in many eLearning programs (as the content often does not engage the learner). So far there has been enough business for most of the companies in the market (as both supply and demand have been relatively small), however the competition is increasing with many new start-up companies entering the market. Since the market is growing, many companies haven't faced tough competition yet, and it will be interesting to see who survives when competition intensifies. Key players claim they are competing more and more on quality, as the market has become more educated, and because much of the content in the market is just very boring HTML-scrolling with some questions in the end (tell-test education). Developers fear that there will be a backslash in the eLearning market due to boring training programs and unfulfilled expectations. The use of games and simulations in learning might reduce the big shakeout that would follow a backslash. But games and simulations have to be good, and developers think that potential buyers have a hard time finding out what quality means in terms of eLearning, and that companies are likely to buy brand instead. According to vendors, the entertainment game industry influences the perceived quality of eLearning

products. Learners are used to playing games with rich graphics and good interactivity, and this raises the expectations for educational games as well.

3.1.5 Drivers in the market

Figure 3 notes some of the key players that will influence the future market for G&S—but the role of each will vary from market segment to market segment and from country to country, which the size of the arrows is supposed to illustrate.

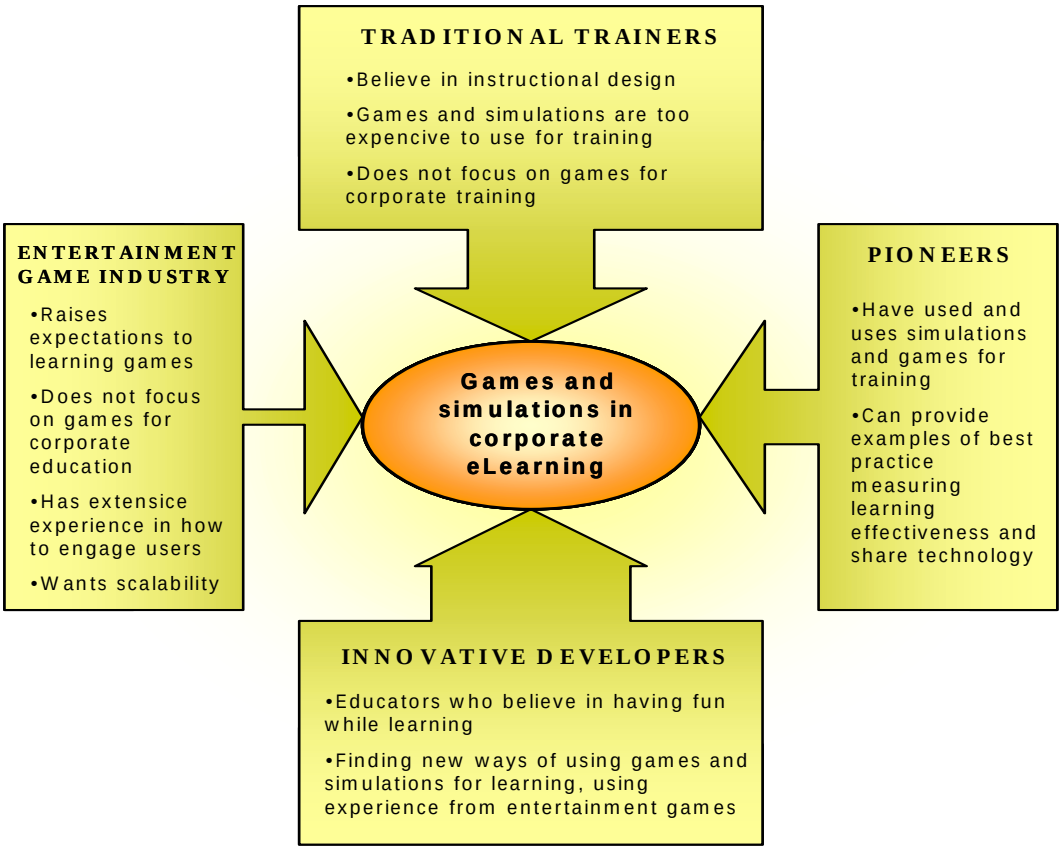

Figure 3: Drivers in the market

As we noted earlier, some of the pioneers in the G&S field are found in the military and the oil industry. The former have developed flight simulations, battle-simulations, simulations in hard skills courses and war games, as well as games for training soft-skills. The oil industry has developed large visualisation rooms for complex technical processes, as well as simulations of emergency situations to train employees to handle those. Many of these productions are very expensive, but at the same time the huge cost savings could justify them, if people make fewer mistakes

or even no mistakes at all. Preparation training before using expensive equipment is therefore important in many industries—thus justifying the use of G&S.

The traditional training industry has not used games and simulations to a large extent. However, some examples include complex financial simulations, often used in addition to classroom training. Traditional trainers think in terms of instructional design, linear learning with planned progression, closely aligned with specific learning objectives that are tested at the end of the program. This will likely change however, especially as younger instructional designers are expected to experiment more with innovative designs and particularly for the online environment.

The entertainment game industry is definitely influencing the use of educational games and simulations. The very interactive and graphic-rich games are increasing people's expectations to educational games. But the game industry has very little if any interest in the educational market, due to a variety of financial and other reasons. When developing a game for learning specific skills, the developer has to limit his possibilities, since he has to embed chunks of learning and keep the user engaged at the same time. This compares to a situation in the entertainment game-world, when creating a game and only thinking of making it engaging for the user (and with much greater budgetary resources). Also, the entertainment game industry focuses on consumer markets where the games are very expensive to develop and they must sell a lot of them. Developing a good educational game also takes much time, and it might have to be customised to meet the needs of the users. But with customisation comes a loss of scalability—thus making the financial payoff more difficult.

Innovative eLearning companies are those that want to be effective teachers while at the same time let the users have fun while learning. They use simulations or games, and pick up experience from the entertainment game industry. They try to look at learning as something that must align with the younger generations' experiences in using computer games. However, it is just as hard and time-consuming, if not harder, to create a good educational game than a good entertainment game.

3.2 Technology

After defining the market, it is important to look closer at those factors enabling and limiting the game and simulation products. For this purpose we have divided technology in three categories: delivery, tools and reuse.

3.2.1 Delivery

Up till now, the limitations in delivery capacity seem to be the most focused area of both concerns and expectations for many eLearning companies. The broadband infrastructure is still to be rolled out to the mass market. The Scandinavian market and selected Asian countries (such as Singapore, Taiwan and Korea) have very ambitious plans for rolling out broadband to the bulk of the population—maybe resulting in higher broadband penetration than is likely to be seen in the US for a number of years.

3.2.1.1 From CD-ROM to web?

Most eLearning companies claim that the productions had better quality in terms of interactivity and reality when they used CD-ROMs—and for that reason some of them continue to use CD-ROMs even as they migrate more of their productions to the web. Developers are just waiting for improved networks, e.g. broadband, which will enable them to increase the features in and the quality of products. However, these developers claim many buyers will rather have the benefits of a web-based product, and thereby accept a simpler functionality. For instance, some now use still-pictures in sequences for their web-based productions where they used to use video. Many also use less audio although this is less demanding on bandwidth than is video. Big multinational companies with a dispersed workforce have a need to update content and spread information quickly, and want web-based programs.

However, some multinational companies have had poor experiences with the use of web-based training, according to ELD Interactive. The web is undermined with unstable connections, and also demands extensive use of plug-ins and configuration work. These companies need to be convinced that the web actually works as a delivery media, and at the moment they prefer CD-ROMs, even when the administration costs (and more difficult tracking of the learners) are taken into account.

The military and some oil-companies have users in remote locations without land-based network connections, or with a low-speed shared connection that cannot handle heavy traffic. In those cases the CD-ROM still is the best way to provide training. Also, web-based training is a safety issue for many companies, as they don't want users outside the firewall to connect with their networks.

In the educational game market, the situation is changing from using CD-ROM to developing more and more for online gaming. The eLearning game "Monkey Wrench Conspiracy" produced by Games2Train and think3 is delivered through CD-ROM, but new, similar games are developed for the web. The web enables tracking of progress, administration of users and easy update of content anywhere at anytime. Such tracking could, if integrated with Learning Management Systems (LMS), give strongly required data for measuring the users completion rates, progression in the program etc.

3.2.1.2 How important is broadband?

Many eLearning companies use "rich media" as an important part of the products. This is connected with the fact that many companies find it easier to generate engagement by using for instance video, animation and sound. Ninth House produces such "high end" eLearning titles, using company Intranets and media servers as substitutes for the lack of broadband. Other companies use hybrid models and claim that they will adapt their product delivery to the present capacity.

Other companies lower or adjust the media quality to be able to transfer their eLearning products over the web. A key issue for the eLearning industry today is partly about gaining critical mass for their products, and it is yet to be seen which approach will succeed – online deliverables without rich media, or rich media products with lower online scalability.

3.2.2 Tools

To be able to get new and more efficient technology many companies emphasise the importance of using internally developed (proprietary) tools. How these tools should be designed and what they should allow G&S to do, depends on many issues (customisation, core competence and type of skills learned).

3.2.2.1 Template tools

A number of companies in the market put significant efforts into developing tools that make the production of eLearning content easier, cheaper and more effective. A template is, according to Allen Communication, a “repeatable logic structure, design expertise and media elements captured in a reusable form”.

Usually a template tool has its background in the companies’ core competencies. Some use their tools internally only, while others sell them in the market. Intermezzon is, for instance, creating a template tool called IES, that will make it easier for companies to build up a simulation-based soft skill-training program. IES is based on the technology used in developing “The MoneyMaker” (a sales-training soft skill program).

Building template tools can require considerable investments. As well as providing the same technological environment as the products made for a specific customer, you have to link the tool to a user interface with both the usability and the flexibility needed to produce an engaging learning program.

Another issue we have seen in the market is whether the developed tools should be adjusted to certain standards or not. The lack of an overall accepted set of standards makes it difficult for developers to know what to align their products with. The Advanced Distributed Learning (ADL) initiative of the US department of Defence has helped bring about the Sharable Courseware Object Reference Model (SCORM) which is emerging as one of the leading standards. Together with AICC, SCORM seems to be the standard most developers are looking at and adapting to. Developing an agreed standard is likely to make integration across platforms easier and also alignment with LMS's.

3.2.2.2 Off-the-shelf (OTS) engines

There are a number of companies using previously developed engines to produce simulations and games for eLearning, buying these off the shelf. An example is Powersim’s system dynamic engine used by other companies to make it easier and faster to develop what they need. Another example is “The Monkey Wrench Conspiracy”, using a 3D-action game engine for the game part of the product.

These OTS engines have to be customised further to the specific eLearning simulation that is being produced. This is a trend in the market that seems to be increasing. ELD Interactive also believes that a lot of eLearning companies will be more specialised to particular market or technology niches in the future.

3.2.3 Reuse

Given the growing number of products being made in the field of G&S-based eLearning, the need rises for making them more cost effective. The best way of doing this seems to be to learn from previous experience, and thereby reuse different elements of production. These could be content, media, graphics, instructional design, logic structures or company knowledge. The amount and type of reuse varies and is driven by several different issues such as those noted below.

3.2.3.1 Is the level of customisation important?

The use of templates enables developers to make eLearning products more efficient and less expensive. According to Andersen Consulting (now Accenture), this makes it easier to concentrate on the really important issue - the content. With templates you don't have to worry about technology and interfaces; the constraints are already defined in the templates.

3.2.3.2 Focus on technology vs. focus on design and package

To be able to create these templates, the small Norwegian game-company Funcom emphasises the fact that the developers have to take some of the focus away from designers and the graphics. In some sense, this is somewhat the same as stripping away some of the most customised features in the product, and keeping the ones that are more generic.

3.2.3.3 Smaller learning objects

A lot of the products on the market today are big productions with several hours of content. Many of the companies we have spoken to believe that the learning objects will become smaller, which means it will be easier both to reuse and combine different "learning chunks".

3.2.3.4 Linkage with LMS and standards

A problem with G&S is the integration into LMS's. Many platforms exist today (both developers' and LMS's), and those platforms have more or less closed interfaces.

SABA and Docent have their own solutions and expect others to adjust to them, while some developers of simulations have their platforms, on which today's reusability and flexibility is based. It is important to adopt to a standard that defines an interface for sending and receiving data.

3.3 Content

Content is the basis for the learning experience that is offered through the eLearning product. This section describes different content issues, connected to level of customisation, engagement and the challenges for providing good content.

3.3.1 Customised or OTS?

The eLearning market consists of a growing number of users, and a major point is whether the customised solutions or the OTS products will dominate the market from now on. The trend is definitely affected by the cost of development, and the profitability for both the developers and the users. At this point, there are a few OTS products that seem to have been successful (i.e. "The MoneyMaker" and "Monkey Wrench Conspiracy"), relatively speaking. Still, the limitations around what kind of content you can use in such productions, are considerable.

Many web-sites have an impressing list of OTS courses when it comes to training and learning. These however, often fall into two categories. They are often too narrow in terms of content relevance. An example of this could be IT training of specific software that frequently comes in new versions (as new generations of the software appear). A second category would be described as too general, unspecified and unrelated to the user's needs. This could be exemplified with soft skill training that touches the subject of decision making without putting the learning objectives in a context or setting that makes the content relevant enough for the user.

OTS products also face the challenge, at least for soft skill training, that cultural aspects may not fit with the user's own culture. More specifically, the culture could either be a national or a company culture. This puts certain limitations to how much OTS-products could be distributed outside the cultural environment of development. Further on, this might make it difficult to get the level of involvement and motivation necessary to succeed when it comes to learning.

3.3.2 Engagement

In the eLearning market today, there are more and more game and simulation products focusing on engagement, even though much of the content that now exists could still be considered boring by many users. Lets take a closer look at some of the features that make a game or a simulation engaging.

3.3.2.1 Interactivity

All the eLearning companies are talking about interactivity as important for the quality of the content. The user will easily get bored without active participation. In practice, only a few companies would have good interactivity, which involves realism, a sufficient number of choices, and sufficient *freedom of* choice. Today, interactivity in games is very often connected to conversation, which is a strong way of communicating.

3.3.2.2 Visualisation

The richness of graphics is important for how real the product actually feels. Some companies have developed 3D technology (i.e. Boxer), and use it as an important element in building up content.

3.3.2.3 Drama

The most frequently used element of drama in the game and simulation products is arguably humour. Involve Learning introduces the term “learning by laughing”, and the company has definitely emphasised this statement in some of their products. The use of real-actor voices is also a way of dramatising the product more to the user. Many products do so (i.e. “The MoneyMaker”, “The Monkey Wrench Conspiracy”, several of Involve Learning's products etc.), especially the ones for soft skill based upon conversations. Sound effects are also used to enhance the user experience.

3.3.2.4 Storytelling

All developers we talked to maintain that “the good story” is of crucial importance to make an engaging product for the user. This is a way of both getting the user to remember the learning objectives, as well as become a part of the story. The soft skill products usually have a high impact opening, for example, describing a business challenge and how the user of the product fits into this picture. The user often plays the role of the CEO, a sales person, or another important character. This way a lot of

the soft skill products use role-play as an important element in the storytelling (i.e. “The Business Challenge”).

3.3.2.5 Social context

A big issue to address for many of the products existing today is the lack of social context. Many companies claim learning has to be a social experience, and emphasise the importance of having a “live” mentor, to give precise feedback and tips. Good examples of use of social context include BTS and SMG Net, providing hybrid simulation products, using classroom training as crucial parts of the learning experience.

3.3.3 Challenges

To be able to label something as good content, there are still many challenges to overcome. Below we take a closer look at some of them.

3.3.3.1 How relevant is the content to the user needs?

Many companies buy content from subject matter experts to ensure that the learning content is regarded as high quality. The use of Tom Peters in Ninth House's productions is a well-known example of this, while other companies (i.e. Intermezzon) have content expertise in-house. This doesn’t necessarily mean that the content is relevant for the user needs. To be able to provide content that fits the situation in a company, developers like Involve Learning customise the game and simulation products to the user groups. Such customisation requires pre-development analysis of the buying organisation. The depth and amount of resources of such analysis probably vary between companies, but are crucial to the quality and relevance of the content. According to research from Allen Communications based on work for the military, 41% of the development time involves the time elapsed from analysing needs in the organisation, until the storyboard is finished.

3.3.3.2 Story line

As mentioned under engagement, the learning content in a game or a simulation needs to have a good story line. Adding war stories and jargon can make the story more realistic, and thereby more users will recognise the situations. For some of the soft skill simulations in the market today, the story develops through interactive dialogs. “The MoneyMaker” is a good example of this, where the user “creates” the story when trying to sell a product through conversations with the animated

characters in the product. Such content demands a good and natural dialog and this again requires a deep multi-path scenario-tree.

3.3.3.3 Hard skills and soft skills

Content focusing on technological and mechanical issues (hard skills), have the challenge of providing updated content. This is especially important when doing simulation training on software applications. These come out in new versions continuously, and demand “fresh content”. Time-to-market is therefore crucial for these developers.

Soft skill content presents a big challenge, as it needs to be both relevant and realistic to the user. To be able to provide content that focuses on human interaction and social processes, the dialog and interactivity needs to be as close to a real setting as possible. The decision tree structure that most companies use today has its limitations, making it hard to include more than 3-4 different alternatives of dialog per interaction. System dynamic expert Pål Davidsen (University of Bergen, Norway) claims system dynamic engines could very well be used for providing more realistic and complex human interaction, however this requires a much better user interface than those that exist today.

According to the discussion on technology delivery, it seems that it is easier to use CD-ROM for static content that doesn’t need to be updated frequently. Dynamic content providers, on the other hand, are using online delivery, given the extra work of getting new versions out frequently. This situation also sets the practical limitations on how different content should be produced in order to meet different kinds of delivery demands. The market today is adapting to this situation – an example is companies that used high-end 3D graphics before and are now changing to easier and lighter graphics to be able to meet the limitation barriers of the present web delivery capacity.

3.4 Learning effectiveness

We think of learning effectiveness as being the learning outcome for the users in terms of increased knowledge and improved skills, divided by the training costs.

3.4.1 Learning outcome

From our initial market research, we have found that not many companies are measuring learning effectiveness quantitatively, especially not effectiveness from soft skills training. The number one reason for this is that you usually just can't do it, and when you can, it costs too much and requires a great deal of administration. One thing is measuring what users have learned from the program. Another thing is finding out how the users apply that knowledge or those skills in their workplace, and how that improves the bottom line for the company. Most of the research in this area has been conceptual rather than empirical (and quantitative), and Kirkpatrick's work (1994) has produced the following four level of evaluating effectiveness:

- Level 1: Did the learner enjoy himself? (Ask)
- Level 2: Does the learner know what he learned? (Test)
- Level 3: Did the user change his behaviour? (Observe)
- Level 4: What are the results of the learning? (Measure)

Based on those levels, most measurements are now done at level 1 (so called "smile sheets"). Developers get feedback from the users that this was a good product, they liked it and felt they learned from it. If this leads to repeated business, developers are satisfied. The users are also often tested on level 2, with pre- and post tests. This does not capture any long-term effects of the training, nor is it an indication on what the users are doing when they go back to work. On higher levels, the lack of numbers shows that measuring is not regarded as worthwhile, for what we think are two reasons. First, it requires a lot of resources to track and measure employees' performance and skills, and in order to have a sample to compare with, one group will need to be trained while another is not. Secondly, there are many other factors that influence business results beyond training activity. Changing business environment, informal learning between samples (which increases the longer the measuring period is) changes in personal life, organisational changes, and so on. Since it is very hard to isolate these outside effects from training, and then to measure their contribution to profit measurements, most companies base their evaluation on qualitative feedback from users. One exception might be the military that has a long tradition for measurement and tracking progression.

3.4.2 Cost

Absolute cost is a big issue with games and simulations because they are usually expensive to develop. However, it is important to look at the opportunity costs and what the alternatives are. Games and simulations have the ability to make learning engaging, and can be less expensive than traditional classroom training (depending on the number of learners and so on). It is hard to determine whether overall costs are going up or down, since there are a number of factors pulling in both directions. Ceteris paribus, the costs of developing simulation games have gone down due to improved internal project management and the use of authoring tools, templates and re-use of content and technology. At the same time, the products are getting more and more sophisticated as buyers demand more features and improvements. An example of the former is taken from one of the companies we have been in touch with: 18 months ago it took 4-5 people 5 months to create one of the company's simulations, now 2 persons will create a similar simulation in 3 months.

A bulk of the cost in the development process stems from the first phases of the development, analysing needs, writing objectives, creating the story line and dialogues. The next phase is authoring and creating code through programming. Improvements in the first phases are due to experience and improved internal processes. In the last phases, efficiency comes from extended use of tools and templates, some of them developed internally.

The level of customisation also affects the costs. It is crucial that the content is relevant for the users, and to make sure of this many developers focus purely on customisation to specific companies. Even though experience, ideas and some content might be reused, there is no scalability in those types of productions, hence the one client pays it all. OTS-productions are usually cheaper, and can be sold to a broader range of customers.

The richness of an application very much affects the costs. The most important fact is to create something that is engaging. There are many ways to arrive at engagement, some focus a lot on graphics, while others use more humour and some competition. The lesson learned is that the flashiest, expensive productions are not necessarily the best ones if they are regarded just as "eye-candy".

3.5 Summary of market research

eLearning is a global market in which the US segment is the biggest in terms of the number and size of potential customers, while Scandinavian countries are interesting because of high Internet penetration rates, broadband initiatives and many new eLearning start-up companies. We found it hard to get an overview over the market and categorise companies and their products, but presented a market-map. The market for games and simulations in corporate eLearning seems to have matured over the last year, and we looked at how different forces influence this market.

The use of games and simulations is limited by technological constraints, and delivery capacity is slowing down the move from CD-ROM based to web-based applications. However, web-based eLearning has a lot of benefits in terms of delivering updated content to a dispersed workforce, and broadband initiatives are likely to speed up the migration to the web. Template tools and reuse of content and technology will make production of educational games and simulations easier and more efficient. Alignment with standards and linkages with Learning Management systems (LMS) has been a challenge with games and simulations so far.

There is a lack of quantitative numbers on learning effectiveness, mainly because it is difficult and expensive to obtain reliable figures. It is extremely hard to isolate the effects of training, and to observe to what extent students apply what they learned in a way that positively affects the bottom line. Feedback from users usually state whether they enjoyed the program or not, though some pre-post testing is done. Cost must be taken into account when estimating the learning effectiveness for organisations. Games and simulations are usually quite expensive to develop, but the use of templates, authoring tools and reuse of content will reduce development costs. At the same time the expectations to educational games are increasing because of graphics rich and highly interactive entertainment games. The level of customisation affects costs, as a customised product loses scalability but at the same time is more relevant to the users. Relevance is of importance as it affects the engagement along with factors like interactivity, visualisation, storytelling, drama and sometimes a social context. These are important characteristics with games and simulations.

Chapter 4

Theory

"Teachers open the door, but you must enter by yourself."

Chinese Proverb

4 Theory

Our education combines the three disciplines of technology, economics and management. Therefore, finding theories within the common boundaries of both technology and organisation was important to us. We feel that our problem-definition lies within the borders of both, since eLearning is both developed and delivered using technology, and learning effectiveness is crucial for organisations. We want to build up a theoretical basis throughout this chapter that will help us carry out and justify our analysis and findings.

This chapter is divided in two main sections. The first section is an introduction to corporate learning, and will discuss adult learning, motivation and learning effectiveness. Our conclusions on the effect of learning will set the thesis in a context and give us a basis for the analysis.

Section two will focus more directly on the use of games and simulations in eLearning and discuss which factors create engagement for the user. The theory in this section will be more closely aligned with dimensions we want to use in our analysis.

4.1 Section 1 - Corporate learning

In this section we are going to focus on adult learning and workplace learning. Industry leaders have stressed the importance of learning in today's fast-changing business environment. As mentioned in the introduction, creating learning organisations has been a target for many corporations in the last decade and the topic of many business books, e.g. "The Fifth Discipline" by Peter Senge. Finding better ways to learn will propel organisations forward, and strong minds will fuel strong organisations. Jack Welch, the CEO of General Electrics says: "An organisation's ability to learn and translate that learning into action is the ultimate competitive advantage."

We will focus on learning organisations by looking at the individuals in those organisations. How effectively workers will acquire knowledge and information is of great importance. We will find our answers to that question by exploring adult learning theory and research on learning effectiveness.

4.1.1 Definition of terms

Before we discuss adult learning in more depth, it might be useful to define some terms. The word “learning” can be defined as the act, process or experience of gaining knowledge or skills,[3] or knowledge or skill acquired by instruction or study.[4] Smith (1991) has a broader definition, and assumes that learning is (1) any increase in knowledge, (2) memorising information, (3) acquiring knowledge for practical use, (4) abstracting meaning from what we do and (5) a process that allows us to understand. Training is a more specific term than learning. Training is the skill, knowledge or experience acquired by one that trains.[5]

Huber (1991) looks at organisational learning in a broad scope and evaluates literature on the subject critically. He specifies the definitions above and says that: *"an entity learns if, through its processing of information, the range of its potential behaviours is changed"* (Huber, p.88). This entity can be both a human and an organisation, but when the entity is an organisation, these processes are frequently interpersonal or social. Learning does not necessarily increase knowledge, but could enhance a person's ability to apply that knowledge in new ways. Where organisational scientists often think about organisational learning as an intentional process directed at improving effectiveness, Huber highlights that learning need not be conscious or intentional. He says: *"let us assume that an organisation learns if any of its units acquires knowledge that it recognises as potentially useful to the organisation" (p. 89).*

4.1.1.1 Learning theories

The George Washington University web-site[6] presents over 50 different theories on learning, but based on our problem definition and educational background, we find it outside our focus to have an in-depth discussion of these theories. Ours is a more general discussion of adult learning principles, some of which are based on ideas from a broad range of learning theories, for instance problem-based learning. However, two theories are worth explaining as a context for adult learning, since

[3] Internet-page: http://www.learnativity.com

[4] Merriam-Webster’s Online Dictionary. http://www.m-w.com/

[5] Merriam-Webster’s Online Dictionary. http://www.m-w.com/

[6] Internet-page: http://www.hfni.gsehd.gwu.edu/~tip/theories.html

they are widely referred to in literature on adult learning, and also in articles on computer-based learning. These two theories are constructivism and socioculturism.

A principle in constructivism is to provide a context for the learner in order to teach him concepts of wholes.[7] The context should place the learner in a situation similar to the one in which he is going to apply the knowledge. Understanding is much more important than memorising facts. Open-ended discussions with peers and teachers should be provided. Lave (1993) argues that by constructing understanding and meaning, the learner interprets and acts upon the material being learned and thereby produces a better understanding of the material.

In socioculturism (Brown, Collins and Duguid, 1989) the central notion of learning is enculturation, the process by which the learners become collaborative meaning-makers among a group defined by common practices, language, use of tools, values and beliefs. The idea of effective learning involving the construction of understanding is quite consistent with the idea that context around the learning situation plays an important role.

It seems that both constructivism and socioculturism emphasise the importance of creating a context to the learning situation. The context is important both in terms of enabling collaboration between learners, and to make it easier for the learner to understand how to apply their knowledge in real life. Let's look more closely at how adults learn.

4.1.1.2 How do adults learn?

The word pedagogy is often mentioned in the same breath as learning. A general definition of pedagogy is the art, science, or profession of teaching.[8] A term used for adult learning instead of pedagogy is andragogy, initially defined as the art and science of helping adults learn.[9] Malcolm Knowles (1973) borrowed the term andragogy and asserted that adults require certain conditions to learn. According to the andragogic model, five issues should be considered and addressed in formal learning.

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[7] Internet-page: http://www.hfni.gsehd.gwu.edu/~tip/theories.html

[8] Merriam-Webster's Online Dictionary. http://www.m-w.com/

[9] Internet-page: http://www.learnativity.com

1. Let the learners know why something is important to learn.
2. Show learners how to direct themselves through information.
3. Relate the topic to the learners' experience.
4. People will not learn until they are ready and motivated to learn.
5. The former often requires helping them overcome inhibitions and beliefs about learning.

These characteristics of andragogy do not differ much from pedagogical principles, and Knowles himself concedes that four of andragogy's five principles apply equally for adults and children. The only difference is that children have fewer experiences than adults do and thus less to relate. Depending on their age, children are also less able to relate learning to experiences. Hartley (2000) supports Knowles in his discussion of adult learning in the new millennium. He claims that in addition to having rich experience bases, adults also have different kinds of experiences and different ways of learning. Adults need to be motivated and they need a social context for their learning. We will address the issue of learning styles, motivation and social context later on.

Hartley and Knowles both agree on another characteristic of adult learners. Adult learners are self-directed and take responsibility for their decisions when the training is relevant for their jobs. In addition, Knowles emphasises that adults will learn best when the topic is of immediate value. Knowles (1984) provides an example of applying andragogy principles to the design of personal computer training. His conclusion states that there is a need to explain why things are being taught and instruction should be task-oriented instead of memorisation. Further, different backgrounds of the learners should be taken into account and learners should be able to discover things for themselves, with guidance and help only when mistakes are made.

Schank (1997) criticises adult learning for punishing failure and says that people need to fail in order to learn. Schank adds the word "expectations" to his explanation. *"For learning to take place there has to be expectation failure"* (Schank 1997, p.30). According to Schank, real learning does not start until the learner fails. Some of his rules for learning might be worth mentioning:

1. People remember best what they feel the most: an intense emotional experience.
2. Deliver training just in time, or when the learner has just failed and really needs help.
3. Memorisation without corresponding experience is worthless.
4. Training should open with a bang.

Schank says that the best way to break through resistance and apathy to learning is with an opening that's immediately involving and fun. Marc Prensky (2001) supports the latter. He stresses that learning should be fun and engaging and in most cases that could be learning through games. Schank thinks that simulations have some advantages in terms of learning by failure, because the user can fail in private, failure can be explained by an expert right away and failure can be controlled and designed into the script.

However, Schank (1997) also raises a critical question about failure in simulations when he asks: *"What motivates employees when the learners know their failure has no impact in the real world of their organisations?"* He says that learning has to be linked with the real world so learners feel that they practice a skill that is needed in their everyday work. If the simulations can create suspension of disbelief, people act naturally and behave and feel exactly like they would in real life. However, immersing people into such a state is challenging for the designer of the program. It is important to provide different paths through the simulation and alternative ways of navigating through the situations. Schank disagrees with what he claims is the unofficial motto of training: "Keep it simple." Simple is not real, says Schank, and reality is necessary to engage the user.

In addition, the consensus so far seems to be that adult learning has to be relevant to real life work and related to the learners' experiences. Adults need to be motivated to learn. Learners should also be able to explore content on their own, and the latter raises the question of whether the teacher or the learner should control the learning.

4.1.1.3 Teacher-centred vs. learner-centred training

Prensky (2001) advocates that learning should be engaging, but usually it is not. He says that learning today is boring compared to all the alternatives like television, computer games and even work. What he calls the game generation is taking over the workplace. The game generation has grown up with computer games, the Internet and graphic-rich movies, and Prensky says that this has changed experiences, attitudes and expectations. People today have problems with old-fashioned learning. Learning is too focused on the teacher or the content. The teachers are the ones with knowledge, and they try to transfer that knowledge by lectures, textbooks or online text followed by an assessment. Prensky refers to this as tell-test education, and says that it is failing because the learners have changed, and now there is a need to focus on the learner.

Schank (1997) agrees with Prensky, and Schank criticises the assumptions made by both schools and organisations, that if something is clearly taught and tested, people will remember it. Schank claims that this has little to do with what is remembered because we recall best what impacts us most. Schank explains how people will remember situations that turned out to be different from what they expected, and that failing in interesting ways should be a goal of training. By failing in a scenario in the training, people will not make the same mistakes again because they remember what they did wrong.

Schank also thinks that education has not changed even though there is a need for it. He says that teacher-centred models are still dominant in adult learning, even a century after the first proposals for learner-focused education and the extensive research on adult education. Schank mentions John Dewey, who back in 1916 noted that schools insist on telling students what they need to learn, despite research clearly demonstrating that learning by telling does not work and learning by doing does. Also, Schank emphasises the need of learner-centred training, and is supported by Rogers (1969). He distinguished two types of learning, cognitive (meaningless) and experiential (significant). The key to the distinction is that the latter addresses the needs and wants of the learner. Experiential learning has the following qualities: creates personal involvement, is self-initiated, is evaluated by learner and has pervasive effects on learner. Experiential learning is, to Rogers, equivalent to personal change and growth.

Cecilia Katzeff (1999) at the Swedish Research Institute for Information Technology launches learner-centred design (LCD) as a fruitful approach to bridging the gap between theoretical models of learning and the design of interactive media for learning. The central claim of LCD is that interactive media supports learners while they engage in activities that are normally out of their reach. This is often referred to as scaffolding. She claims that it seems to be a constant gap between the analysis of user needs and the process of transforming these into actual designs. The challenge of designing interactive media is to address the unique needs of learners. A developer of multimedia learning programs, Netg, discusses learner-focused education in their research. In a white paper report on their Skill Builder courses,[10] Netg concludes that adult learners are time sensitive, and want to set their own pace and select their own content.

Literature and research stresses the importance of focusing on the needs of the learner, and this applies for eLearning as well. Multimedia learning programs have the potential of letting the user choose how he wants to acquire knowledge. We agree with literature describing most of the so-called tell-test education as boring, but it must be borne in mind that this really depends on the teacher, and to what extent he is able to engage the learners. Anyhow we believe that learners must be activated while they learn.

4.1.1.4 Learning by doing

As discussed in the previous session, the role of active engagement is being advocated. A general conclusion often presented by researchers claims that adults learn more effectively when the learning has an experimental component, hence they learn by doing. Educational psychologist William Glasser[11] claims that we learn:

- 10% of what we read
- 20% of what we hear
- 30% of what we see
- 50% of what we see and hear
- 70% of what we discuss with others
- 80% of what we experience

[10] Internet-page: www.netg.com/research/skillphilosophy.htm

[11] Internet-page: http://www.wglasserinst.com/

- 95% of what we teach someone else.

Schank (1997) claims that there is no substitute for learning by doing. Schank uses a reference to his grandfather during his apprenticeship as a watchmaker. *"Grandfather learned by looking over the master's shoulder and trying his hand at his chosen trade. I'm sure he screwed up a few watches while he learned, but eventually he learned the job through trial and error"* (Shank, 1997, p.8). Schank supports the use of games and simulations when he presents the basic premise of learning: *"When learning isn't fun, it's not learning,"* (Schank, 1997, p.11). He says that doing is fun, and computer simulations offers people the chance to participate, make mistakes, to take chances, to challenge themselves and to learn.

Prensky (2001) disagrees to some extent with the latter. He says that doing can be boring and that doing by itself does not make anything interesting. Prensky thinks that one major question is missing in the "how do people learn" debate, and that is: *"How do they learn* ***what****?"* (Prensky, 2001, p.80). He says that learning by doing is not always the best way of learning. Prensky separates how we learn facts, skills, behaviour, language, processes and so on. He wants to illustrate that the same learning methods are not used for everything we learn.

Schank admits that learning by doing is easier said than done. However, he says, the computer has made learning by doing a realistic option in many situations. A partial reason why organisations miss the boat with eLearning stems from the following reasons: they think it takes to long and costs too much, they think it is not effective and it can't be measured.

Gibbs (1987) also talks about learning by doing or active exploration. He states that in order to achieve "deep learning," we need to practice new behaviours and skills, receive feedback and see the consequences of new ways of behaving. This way we can integrate new skills into our way of thinking and behaving. Benjamin Bloom (1956) developed a classification of levels of intellectual behaviour important in learning. Bloom found the cognitive domain to be the predominant in most learning, and within this domain he identified six levels. They range from simple recall or recognition of facts, through increasingly more complex and abstract mental levels, to the highest order, which is classified as evaluation. The 6 levels are *knowledge,*

comprehension, application, analysis, synthesis and evaluation. A learner will be more active the higher the level in Bloom's taxonomy.

It is important to look at how people learn different types of knowledge, behaviours, etc. when developing learning objectives. We also think Prensky is right when he says that doing can be boring. When looking back at the principles of adult learning, we find that learning must be relevant for learners' work and related to their experience. Otherwise they might not be motivated to learn, even if it is by doing. However, learning could take place while getting new experiences and this is often done when practising skills or applying knowledge in situations to see a certain outcome, hence learning by doing. It might be smart to look at the individual in learning situations, and ask the question: "How does *who* learn *what?"*

4.1.1.5 Learning styles

Until now we have been talking about adult learning principles in general. The assumption of learner-focused training makes it interesting to look at each individual and different learning preferences. McCarthy (1987) claims that there are two major differences in how we learn: how we *perceive* and how we *process*. Perception describes how we absorb information, either by sensing and feeling or by thinking. Processing separates those who are active and those who are more reflective.

David Kolb (1984) found that the four combinations of perceiving and processing determine four different learning styles:

1. Reflectors are imaginative people that start with what they see and then they generalise.
2. Theorists are analytic people that take in experience abstractly, and process and analyse it reflectively.
3. Pragmatists are practical thinkers and doers that take in experience abstractly and then process it actively. They start with an idea, try it out and see if it works. (Practical/common sense people)
4. Activists are dynamic, intuitive people that take in experience concretely, and process it actively. They start with what they see, hear and touch, and then they plunge in and try it out in action.

Kolb (1984) claims that learners have a preferred learning style, but that they should develop other learning styles as well. Kolb presented an experiential learning cycle that explains how training programs should go in cycles through the four styles of learning.

Marcia Conner at Learnativity[12] explains how learners access through all senses, but generally favour one. We process *visually* (by sight), *auditorally* (by sound), *kinesthetically* (by moving) and *tactilely* (by touch). Visual learners prefer seeing what they are learning, and pictures and images help them understand ideas and information better than explanations. Auditory learners fall into two categories, listeners and auditory-verbal learners. The latter often need to speak to themselves and learn from that as well as from listening to others. Kinesthetic learners want to sense the position and movement of what they are working on, while tactile learners want to touch it.

Schank (1997) disagrees with research done on learning styles. He claims that people don't have different learning styles, but different personalities. Everyone learns the same way, and that is through failure and practice. Because people have different personalities, designers must take this into account when developing a learning program. Some are willing to try anything, whereas others are more cautious. According to Schank, teachers must give learners options for learning, but the way they learn is the same.

It might be said that people have different ways of doing things, and that people have preferred ways of learning as well. The most important thing to remember is the fact that some differences exist, e.g. style or personality, and what people prefer is likely to be conditional on the situation. In terms of learning, a condition could be the subject, which brings us back to: "How does *who* learn *what?"* However, one of the principles of adult learning claims that adults will not learn until they are motivated, and a discussion on motivation is needed.

[12] Internet-page: http://www.learnativity.com

4.1.2 Motivation

Motivation is a pivotal concept in most theories of learning. It is closely related with arousal, attention, anxiety and feedback/reinforcement. For example, a person needs to be motivated enough to pay attention while learning.[13] Learners' unique motivation helps them stay focused and stick with a topic until they solve a problem. Cyril O. Houle (1961) identified three subgroups to categorise motivational styles. Goal-oriented learners use education to accomplish their clear-cut objectives, activity-oriented (social) learners take part mainly because of the social contact, while learning-oriented learners seek knowledge for its own sake.

Marcia Conner at Learnativity[14] says that in the same way certain things motivate, others discourage. Few things are more de-motivating than fear. Learning is, after all, an emotional process, in which we must see, feel and do. Fear, anxiety and anger are emotional factors that negatively effect learning. According to Conner, two big issues that influence motivation are relevancy and immediacy. Information has to be relevant for the learner's needs, and it must feel useful to the learner. This aligns with theory on adult learning. Most people don't have time to waste, and want to focus on what makes the most difference right now. This is often the case in today's hectic business environment.

Katzeff (1999) stresses motivation as a critical consideration for designers of interactive educational media. She says that if the learner is not motivated to learn, he won't learn no matter how well the material addresses the rest of the individual learner's needs. Schank (1997) explains that everyone needs motivation to start learning, because failure isn't a catalyst for learning. Employers will be motivated by business-goals, but not everyone sets learning as a target, and might be triggered by other goals. Therefore, managers must recognise the goals to which their people will respond. According to Schank, another motivator is approval of peers. This is supported by Katzeff, who says: *"People are not motivated as much by approval of the trainers as they are by approval of their peers in the room"* (Katzeff, 1999, p.38).

[13] Internet-page: http://www.gwu.edu/~tip/motivate.html

[14] Internet-page: http://www.learnativity.com

4.1.2.1 Intrinsic and extrinsic motivation

In order to define motivation more specifically we look at the work of Edward Deci. Deci (1975) explains that there are two types of motivation, intrinsic and extrinsic. Intrinsic motivation comes from within, often called self-motivation. In intrinsic motivation there is a natural relationship between the person and the reason why he is performing an activity. An example might be going to a soccer practice because you enjoy the companionship of friends. Extrinsic, or external, motivation comes from the outside, such as verbal rewards like praise and tangible rewards like money.

Deci (1975) also presents evidence that intrinsic motivation is indisputably exists, and that people have a general need for feelings of competence and self-determination. Intrinsically motivated behaviours are defined as behaviours in which a person engages to feel competent and self-determining. Intrinsic motivation will be people's inner drive to learn in order to feel more competent, and this aligns with Maslow's hierarchy of human needs (Maslow, 1954).

Extrinsic motivation has a negative effect on intrinsic motivation according to Deci (1975). He did research with two groups to see the effect of extrinsic rewards on learning. Group one received an extrinsic reward (money) for solving a puzzle while the second group received no rewards. Afterwards, both groups were left alone and secretly watched. The group that was paid stopped playing, but the group not paid kept playing. Deci concluded that intrinsic and extrinsic motivation are not additive. Extrinsic rewards seem to decrease intrinsic motivation in most situations, except for positive feedback to males, which seems to increase intrinsic motivation. Also, when rewards are contingent on performance they are more likely to decrease intrinsic motivation. Some theories on work motivation disagree with Deci, and assume that the effects of intrinsic and extrinsic motivation are additive. Lawler and Porter present one of them.[15] They claim that people could be working for both intrinsic and extrinsic rewards at the same time, and that this maximises motivation.

Motivation seems to be crucial in learning, and an inner drive and self-motivation to learn is better than extrinsic motivation. However, a certain level of motivation is

needed, and the use of extrinsic rewards might be necessary to generate minimal motivation.

4.1.2.2 Organisational motivation

Deci (1975) claims that just as in education, there are two approaches to motivate employees in organisations, intrinsic and extrinsic. On one side, scientific management as presented by Taylor (1911) assumes that workers are indolent, lazy and need to be told what to do and how to do it. McGregor (1960) also refers this to in his theory X. People are thought to have no intrinsic motivation, and in order to motivate people control mechanisms like rewards must be used. On the other side, so-called participative management focuses on intrinsic motivation. Underlying this approach is the thought that people have intrinsic motivation to perform effectively, and will derive satisfaction from this. McGregor refers to this as his theory Y. The workers' need for competence and self-determination is met by participation in decision-making that affects them.

The debate on employees' motivation and attitude towards work is still going on, and Hartley (2000) says that today's knowledge workers are self-motivated to learn what is relevant for their work. However, it appears to be difficult for us to make any conclusion other than that people need motivation through an inner drive or incentives to seek knowledge and to learn.

4.1.2.3 Intrinsic motivation and computer games

Malone (1981) presented a theoretical framework for intrinsic motivation in the context of designing computer games for instruction. He argues that intrinsic motivation is created by three qualities: challenge, fantasy and curiosity. Challenge depends upon activities that involve uncertain outcomes due to variable levels, hidden information or randomness. Fantasy should depend upon skills required for the instruction. Curiosity can be aroused when learners believe their knowledge structures are incomplete, inconsistent or unparsimonious. Senge (1990) believes that people are inherently curious, creative and seek challenges that relate to what they value. This refers back to the debate on whether people are self-motivated or not.

[15] As discussed by Dr. Alex Lee, University if Singapore, in his article: "How to motivate your subordinates to better performance"

4.1.3 Design of learning programs

Based on our findings so far, design of learning programs faces a lot of challenges, and is at the same time important for effective learning. The learning must be motivating, hence relevant, engage the user, and at the same time allow the user to control the learning to an appropriate extent. The method many developers seem to advocate is instructional design. Instructional design is the systematic approach to creating learning materials and activities.[16] Instructional design aims for a learner-centred rather than the traditional teacher-centred approach to instruction. A model for instructional design is the ADDIE-model (Dick and Carey, 1990). ADDIE stands for analysis, design, development, implementation and evaluation. The analysis should define the learner's needs, what they want to achieve, how they are going to apply it in the job and which skills need to be taught. Design and development is about creating the training program based on the analysis, and focusing on sequencing, presentation and reinforcement. Implementation may involve teaching users how to make the best use of interactive learning materials and co-ordinating the learning program. Both learners and teachers should participate in the evaluation.

Keller (1983) links an instructional design model with motivation based on a number of learning theories. His model suggests a design strategy that encompasses four components of motivation: arousing interest, creating relevance, developing an expectancy of success and producing satisfaction through intrinsic and extrinsic rewards. Carroll (1990) aligns design with adult learning principles in a minimalism theory. The theory deals especially with training for computer users, and emphasises the necessity to build upon the learner's experience. Carroll claims that new users always learn computer methods in the context of pre-existing goals and expectations. The critical idea in minimalism is to minimise the extent to which instructional material obstructs learning and, instead, focus the design on activities that support learner-directed activity and accomplishment. Carroll feels that training developed on the basis of other instructional theories is too passive and fails to exploit the prior knowledge of the learner or use errors as learning opportunities. This also aligns with Schank (1997) and his focus on learning through failure.

[16] http://www.fbe.unsw.edu.au/learning/instructional design/materials.htm

Prensky (2001) does not think that instructional design makes learning more learner-centred after all. He thinks that the structured process of instructional design makes learning boring, and that it takes a more creative approach to arrive at more learner-centred programs.

Instructional design is the method most widely referred to in terms of creating learning programs. The model faces some criticism, but the critics present no alternative. It is clear that experience and creativity is required in order to cope with the many challenges associated with design of learning programs. Design is likely to influence the effectiveness of learning, and we will now look at research done on learning effectiveness.

4.1.4 Learning effectiveness

In the following section we will both look at measurements and the multimedia effect of learning effectiveness.

4.1.4.1 Measuring learning effectiveness

As we stated in our market research, there seems to be much qualitative but less quantitative research on learning effectiveness. We also pointed out some difficulties associated with measuring long-term effects of training. Huber (1991) says that learning does not always increase the learner's effectiveness, or even potential effectiveness. This will make a measurement more difficult. As for theory, Kirkpatrick (1994) is often cited on his four levels of measuring the effect of learning. The 4 levels were presented in our market research. Kirkpatrick stresses the importance of evaluating training programs and thereby measuring some of the effects.

Phillips, Phillips and Zuniga (2000) have taken Kirkpatrick's work to a next stage by adding a fifth level on Kirkpatrick's model, Return on investment (ROI). In their report they claim that the literature is limited when answering questions on the effectiveness and ROI in eLearning. Phillips' study found that most of the current evaluation at the business impact- or ROI-level (level 4 and 5 in their model) has been driven by clients of eLearning (buyers and users). The developers and implementers are not pushing this evaluation process. On level 1 (so-called smile-sheets), available evidence suggests that traditional classroom instruction yields more favourable responses than e-Learning solutions. However, while many are

more satisfied with face-to-face learning, the outcomes are not different. eLearning is as effective as traditional face-to-face learning. Furthermore, Phillips et al. (2000) point out the potential advantage of building evaluation into the computerised training process. This could save both time and money. They emphasise the importance of continuing to conduct evaluation studies, since the technology aspects of eLearning place other demands for evaluation:

1. The tremendous cost of technology often demands accountability, including measuring the actual return on investment.
2. The newness of eLearning to many groups brings pressure to develop information about its effectiveness and efficiency as a learning solution.

A lot of the data available on ROI are summarised by Allen (1998). He has written several white papers on computer-based training. In the article "Step right up" he discusses ROI in computer-based training, based on his own experiences and collected data from other articles and white papers. Allen focuses primarily on "business results" from training, level 4 in Kirkpatrick's model. He says that a core issue regarding ROI and learning effectiveness is whether or not results relate directly to training programs. There seems to be consensus that there are always "intervening variables" in the equation, such as compensation, market shifts or advertising, which created the business results. However, Allen presents some quantitative evidence on the results. He divides them into three “rings” of results: cost savings factors, performance improvement factors and competitive position factors. The latter is most difficult to measure and document, but still describes a trend Allen has seen in working with clients over several years. As to cost savings, Allen gives examples of reduction in training time, delivery costs, travel expenses, opportunity costs and development costs. Performance improvement is discussed in the next session.

Because eLearning is not a proven process in many organisations, there is a need to show value now rather than later when it becomes a routine process. This aligns with our findings from the market research. Measuring learning effectiveness requires a lot of planning and research. In addition, the research results are doubted by many, and because of this few companies seem to have figures and reliable quantitative data available on learning effectiveness. However, numbers exist on cost savings,

and therein lies some great potential benefits with eLearning. We have yet to find out how effective computer learning is relative to alternatives.

4.1.4.2 Multimedia learning effect

Studies have compared the effect from multimedia-based learning with traditional classroom-based learning. Allen (1998) discusses the effect of multimedia-based training. He claims that in addition to cost savings, good multimedia training is not only faster than classroom training, it is also better. People remember what they learn more accurately and longer (retention) and they are better able to use what they learn to improve their performance. Allen refers to Adams (1992), who reviewed six studies that carefully compared multimedia training to classroom instruction: "Learning gains" were up to 56% greater, "consistency of learning" (variance in learning across learners) was 50-60% better and "content retention" was 25-50% higher. Brett (1997) claims that multimedia-based learning is more motivating and exciting than more traditional educational methods, and that it is usual to claim that use of multimedia increases learning effectiveness.

Clark and Craig (1992) disagree to some extent with the above-mentioned statement, and claim that not much theory supports a difference between dissimilar media. There is likely to be an increased effect, but research seems to prove that this effect comes from other factors, for instance:

1. Novelty effects
   Students seems to increase their attention to media that are novel to them, and the increased attention paid by students sometimes results in increased efforts or persistence which yields achievement gains. If they are due to a novelty effect, these gains seem to diminish as students become familiar with the new medium.
2. Interactivity
   Clark and Craig claim that studies comparing multimedia to more traditional instruction show that interactivity is the factor that has the biggest impact on learning.
3. Design problems
   “The positive effect of newer media more or less disappears when the same instructor produces all treatments in a study.” Instructors are likely to use different content and different methods in the treatments that are compared.

> Well-designed studies that control for methods by having the same method available in all media treatments generally show “no significant differences” on learning outcomes. (Clark and Salomon, 1986, in Clark and Craig)

However, Clark and Craig present two assumptions that promote the use of multiple media. The first assumption, *the additive assumption,* is that instructional media, if used properly, make valuable contributions to learning. Therefore, instruction presented by several media increases the learning benefits, because the benefit of each of the combined media are additive. *The multiplicative assumption* is that multimedia benefits are sometimes multiplicative, that is, greater than the sum of the benefits of individual media.

Our findings so far, both in terms of literature and market research, prove our assumption made in the problem definition, that it would be difficult to conduct a quantitative research on learning effectiveness. The literature, however, outlines some important factors for effective adult learning. We want to summarise this chapter by presenting a model. It can be used as a basis for discussion in our analysis, to help us discover what developers and users of eLearning programs think is important in order to create effective learning for the user. Our target is to arrive at some conclusions on learning effectiveness.

4.1.5 A model for learning effectiveness

Our model will serve as a framework for discussion when analysing our case studies. The model must be used in a qualitative fashion and is meant to illustrate factors that will affect the learning effectiveness in a computer-based learning program. Cost is a very important issue in terms of effectiveness for an organisation, and expenses in terms of developing and delivering training must be taken into account when comparing alternative ways of providing training. Cost would be a natural part of quantitative research, but due to our limitations and lack of data we will not have an in-depth discussion on cost in this report.

Figure 4 is an illustration of our model. *Willingness to learn* and *expectations* are pre-training characteristics that says something about the learners' motivation to learn and attitude towards training. When the training has started, *content, learning design and engagement* describe the important features in the learning program.

Eventually the program could be placed in a surrounding physical, social context that could facilitate *mentoring* and *collaboration*. We believe that these factors will influence learning effectiveness. The various factors in our model will now be described in more detail as a summary of this chapter.

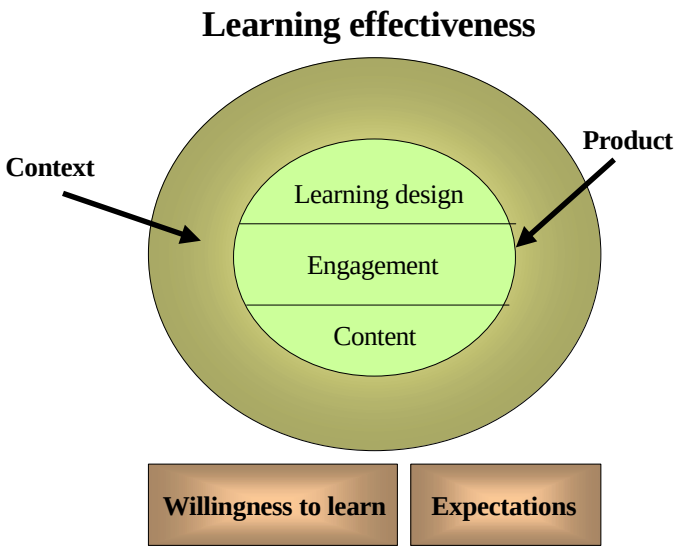

Figure 4: Learning effectiveness

4.1.6 Summary of theory part 1 - learning effectiveness

Figure 4 presents our findings from the literature study on learning effectiveness. We think that the greatest benefit that arrives from using games and simulations in eLearning is their ability to motivate learners and encourage fun during the learning process. This is necessary for creating an effective eLearning product, but still there are some other important features that will affect the learning effectiveness.

4.1.6.1 Willingness to learn

We define willingness to learn as the motivation to start learning a particular program or subject. This includes intrinsic needs and desires and extrinsic motivation through rewards and incentives. The training could also be more or less forced on the learner, in which case willingness to learn is likely to be lower. Origin aside, it seems clear that learners need a certain level of motivation to start learning, they must want the learning for some reason. Many developers of eLearning content say that willingness to learn is something they assume users have, and that it is a condition for effective learning. Willingness to learn is closely linked with content.

The more relevant the content appears to the user, the more likely he or she is to feel the need and willingness to learn.

4.1.6.2 Expectations

Learners also have expectations to what and how they are going to learn. Adult learners have rich experience bases, and it is crucial that the product fulfils the user expectations both in terms of quality of the content and the use of multimedia. Expectations could be high because of the newness of the media used, because of trainer reputation and because of previous experiences. Expectations will affect motivation, hence the willingness to learn. Expectations are also influenced by other experiences than those associated with learning. The high standards of multimedia entertainment games are likely to raise expectations of educational multimedia as well.

4.1.6.3 Content

The content in the program must be relevant for the user, both in terms of topicality and complexity. Also, the content must be of good quality. The user wants to learn something that he or she can use in his daily work, and the user must value increased knowledge in the subject area. Content must be developed by experts to ensure the quality. Low-quality content that is not relevant, will not align with the user's willingness to learn, thus making it difficult to create an effective learning situation. Topics of relevance will vary from organisation to organisation and from user to user.

4.1.6.4 Learning design

The program must be designed in a way that meets the learner's needs and preferences and at the same time ensures learning outcome. Instructional design is a method that is often used and referred to. However, some researchers point out the lack of creative and innovative designs in educational software. We think that a motivating learning design is important for the learning outcome, but at the same time very challenging.

4.1.6.5 Engagement

We think that engagement is a condition for effective learning and that it deserves more attention. The next sub-chapter will therefore discuss engagement in learning. However, we think that both content and learning design will affect engagement and

that the sum of the three is what generates both motivation and learning with a computer-based learning product.

4.1.6.6 Collaboration

In the surrounding social context, collaboration can take form as both face-to-face interaction and linkage through the computer. Face-to-face collaboration could be formal and planned, such as several users playing together on one computer, but could also be informal social interaction with peers. The social context that surrounds the learner in the learning situation influences the learning effectiveness. The program could also facilitate collaboration on the network, through chat-groups, communities and multi-player options.

4.1.6.7 Mentoring

Interaction with a mentor also falls into the social context. Mentoring could also be a feature built into the core product. The difference is that the mentor in the social context can answer questions and provide help and motivation as needed. We will now discuss the characteristics of games and simulations that create user engagement.

4.2 Section 2 – Engagement in games and simulation based learning.

This second part of the theory will focus more specifically on computer-based games and simulations in learning. Our target is to find out which features create engagement among users. As described in theory section 1, engagement is one of the important features creating learning effectiveness. Looking closer at engagement, we found at least six factors that more or less influence user engagement in games and simulations. The background for formulating these factors were active testing of eLearning products with game and simulation elements, as well as discussions with experts in the field. These are the factors we came up with:

- **interactivity, flexibility, competition, reality, drama effects and usability**

Before discussing these factors more in-depth, we will take a closer look at engagement, games and simulations in eLearning today.

4.2.1 Engagement

Jane Linder (1999) of The World Game Institute finds three major reasons why engaged learning works so well. It is "sticky," meaning that it involves experience and this makes the content more memorable than passive listening. Secondly, engaged learning fosters more holistic and creative solutions, using simulations, games and workshops to experiment with new ideas. Finally, engaged learning ignites commitment and pulls the participants closer to the business (Linder, 1999). The World Game Institute presented a model to show how engaging different learning experiences are.[17] As we see from figure 4, simulation games are ranked highly, both in terms of the extent to which the experience is active, and to which the experience is emotionally compelling and relevant.

[17] Internet-page: http://www.worldgame.org/mba/exhibits/exhibit3.htm

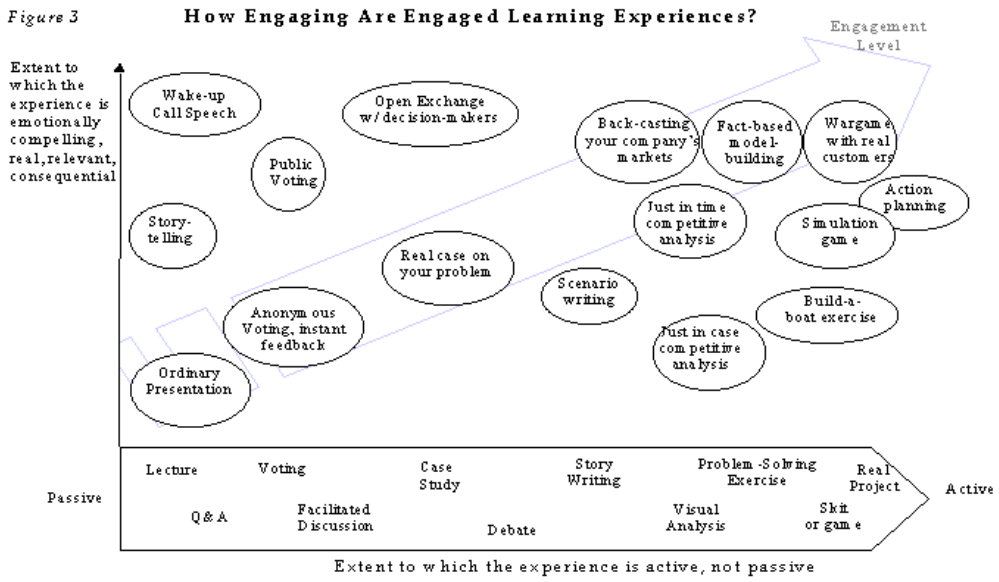

Figure 5: Presentation of different learning experiences

Jones, Valdez, Nowakowski and Rasmussen (1994)[18] have tried to find specific indicators of engaged learning. They justify their efforts by referring to a strong consensus from researchers on the importance of engagement in learning, and by recognising the changing needs of the 21st century. Among the listed indicators we find the following statements interesting:

> "*In order to have engaged learning, tasks need to be challenging, authentic and multidisciplinary. [-] They are authentic in that they correspond to the tasks in the home and workplaces of today and tomorrow. [-] The most powerful models of instruction are interactive. Instruction actively engages the learner, and is generative*" (Jones et al., 1994).

They conclude that some of the most important features of engaged learning are interactivity, reality and flexibility. We will come back to these concepts later in the theory discussion.

[18] Internet-page: http://www.ncrel.org/sdrs/engaged.html (North Central Regional Educational Laboratory)

Given the intention and consensus of having an engaging learning experience, we have to find out where to go to get such experience. Reiber (1996) uses the notion of having a learning environment that is endogenous. In such an environment the content and the structure are closely related. Taking games as an example of structures, Reiber (1999, p.50) puts it this way: *"…one cannot tell where the content stops and the game begins."* Such integrated solutions are also likely to be found in other kinds of learning experiences. However, many authors have found some of the most engaging products of today to be computer games and simulations. Marshall G. Jones (1997) at the Northern Illinois University says that learning environments are most notable in the area of commercial computer games, combining content and fantasy so seamlessly that one can become lost in the game for hours.

4.2.2 Suspension of disbelief

There are many words describing the feeling of "being lost in something." During our market research we spoke to several developers that used the term suspension of disbelief. The Doblin Group[19] talks about "compelling experiences" as something that delights you and gives you a great memorable experience. They break it down to different states: attraction, entry, engagement, exit and extension. These factors describe people's feelings at different stages, starting with curiosity to try something, the engagement while using it and the desire to share it with others afterwards.

Prensky (2001, p.124) talks about "flow" as being in "*a mental state of intense concentration, often to the point where previously difficult tasks become easy and whatever you are doing becomes enormously pleasurable."* Prensky describes flow as a situation where your abilities and the challenges are almost perfectly matched. This balance can be hard to maintain (equivalent to Jones et al., 1994), either because the user gets bored when the tasks are too easy, or frustrated when too difficult. The flow experience does also have other features, described by Jamie Chamberlin in her article "Reaching 'flow' to optimise work and play":

> "*Some people become so deeply focused when writing, they experience an almost euphoric state of joy and pleasure in the process. They lose track of*

[19] Internet-page: http://www.doblin.com/new/

time, are highly alert and feel they are writing to the best of their ability." (Chamberlin, 1998, p.1)

Another word for being lost in something could be what Clark N. Quinn (1994) at The University of New South Wales calls "immersion." He believes that the notion of immersion in an activity comes from Virtual Reality games, in which more of the human senses are being used. Hence, Quinn (1994, p.50) says that *"this supports the transfer of game action to world action and, consequently, has a great potential for instruction."*

In summary, there seem to be many different words describing the user behaviour in an optimal learning situation. They describe different qualities of such a user experience, and give important knowledge on what to prioritise when developing engaging eLearning products.

4.2.3 Games and simulations

Along with Jones (1997), Schank (1997) and Prensky (2001) seek help from games and simulations to provide engaging learning experiences. The purpose of this theory section is to shed some light on elements in such products that actually create engagement within the user. Our market research presented an initial classification of games and simulations, based on research from ASTD (1987).

Prensky (2001) lists a number of features that supplement the characteristics of games and simulations. When discussing games, he mentions six structural factors:

- Rules
- Goals and Objectives
- Outcomes and Feedback
- Conflict / Competition / Challenge / Opposition
- Interaction
- Representation or Story

Prensky (2001, p.119) says in his book: *"There are thousands, perhaps millions of different games, but all contain most, if not all, of these powerful factors."*

Simulations are described as a synthetic creation of an artificial world that approximates the real one, something that creates the reality of the workplace or a mathematical model with a set of initial conditions that allows prediction and visualisation as time unfolds (Prensky, 2001).

Shank has practical experiences from designing simulations for corporate learning. In his book "Virtual Learning," Shank (1997) describes a good simulation:

> *"Like a good novel, a good simulation asks your learners to suspend their disbelief. Whether you're creating a simulation on a computer or through role-playing, you want participants to experience the event as if it were really happening. Perhaps more to the point, you want to avoid evoking an unnatural response—a response someone wouldn't give in real life".* (Shank, 1997, p.22)

We will continue this discussion when describing the different elements of creating engagement.

4.2.4 Interactivity

This term is perhaps the most important one when it comes to using games and simulations to engage the user. In most of the theory we have studied, the term "Interactive Multimedia" (IMM) is used frequently. Several researchers have given their views on what interactivity is really about.

Barker (1994, p.1) describes interactivity in learning as *"a necessary and fundamental mechanism for knowledge acquisition and the development of both cognitive and physical skills."* This definition, according to Sims (1995), describes interactivity as something more than just mouse-clicks and simple menu selections. It also has to be more than low-level interaction programs with text and slideshows, given the requirements needed for a successful implementation of interactivity. To succeed with implementation, Sims emphasises that one has to understand the learner, the software engineering capabilities, the importance of instructional design and the application of appropriate graphical interfaces.

To simplify the term interactivity, Sims looks at it from a technical perspective. The user accesses a range of input devices (keyboard, drawing, pointing, touchscreen or speech) all of which can activate the technology being used to give visual or audio feedback (text, graphics, printing or speech). *"A sequence of such action forms will thereby form an interaction"* (Sims, 1995, p.2). Damarin (1982) uses a similar analogy describing the interactive options as watching, finding, doing, using, constructing and creating. These options have different effect when it comes to engaging the user. There seem to be no specific conclusion on which of these features provide the best user engagement, except that more interactive involvement seems to have a better potential for engagement.

Bork (1992) accentuates that little research focuses on how to measure interactivity and which spectra are involved. He finds it useful to divide the term interactivity in two: the degree of interaction and the quality of interaction.

Keeping in mind the different aspects of interactivity, we have several options on how to structure the theory discussion. We choose to use Bork's formation, since it is a broad structure that defines a framework, in which different views and facets of interactivity can be discussed. Although other literature says something important about the technical aspects of interactivity, we find it harder to use as a basis, given the large number of different contexts for interactivity in eLearning products.

4.2.4.1 Degree of interaction

Bork (1992) uses the term degree of interaction to describe how often "meaningful interaction" takes place. To explain meaningful interaction, Bork compares this interaction to the total learning process. A lecture for example, usually has few questions compared to the length, hence a very low degree of interaction. If this degree gets too small, the material loses motivational capability.

On the other hand, Bork points out that decreasing time limits between interactions is a good thing only to a certain limit. *"Some time is needed in a thoughtful learning process for reflection"* (Bork, 1992, p.6). This way we can say that the analogy of using games and simulations for learning has a flaw when it comes to making learning more effective. The almost constant interactivity in a game can make it harder to learn within such an environment. At minimum one has to add time for

reflection without destroying the "game feeling." Woolsey (1994, p.94) agrees with Bork on the issue of reflection, stating in an article that: *"Many of us who work the electronic domain are completely fixated on interactivity. We regard action as somehow inherently good."* A major point is that action and interactivity are just parts of the big picture, and she emphasises that important learning experiences should include both content, form and interactivity. This accentuates *reflection* as a critical element in learning and the glue that holds the pieces together. *"A compelling goal for multimedia designers, is to find ways to combine action and reflection in an effective learning cycle"* (Woolsey, 1994, p.94). Hence, one serious challenge is to find the optimal degree of interaction—one that creates engagement through feeling the action and fun, as well as through the reflection that is necessary for the learning outcome and meaningfulness of the learning product. This discussion gives a way to focus on the quality of interaction, and we will address it further in the next chapter.

4.2.4.2 Quality of interaction

Jonassen (1988, p.101) defines quality of interaction: *"Generally, the quality of the interaction in microcomputer courseware is a function of the nature of the learner's response and the computer's feedback. If the response is consistent with the learner's information processing needs, then it is meaningful."*

Sims (1995) points out the importance of understanding what makes an application interactive, instructional and effective. The use of multimedia in education often requires a higher level of interactivity than the basic "point and click" level, and interactivity is the one element that can distinguish traditional training from multimedia-based training.

Bork (1982) states that developers must produce interactive multimedia resources that exhibit:

1. Interacting with the student depending on what the student has just done.
2. Interacting in a way that depends on what the computer knows about the student.

This way Bork illustrates a point that concerns the quality of interaction—the way the interaction between the user and the program develops along the way, just like in a conversation.

There have been several attempts to identify different kinds of interactivity over the years. Sixteen years ago, Rhodes and Azbell (1985) identified 3 levels of interactivity, ranging from *reactive* (where there is little learner control of content structure with program directed options and feedback), to *coactive* (providing learner control for sequence, pace and style), to *proactive* (where the learner controls both structure and content). However, the latter implies that interactivity is improved when the learner has more control, while this control refers more to navigation than to instruction. As the aspect of learner control is discussed under the chapter on flexibility and navigation is considered in the usability chapter, we will expand on them in those settings.

Sims (1995) presents a more recent and detailed taxonomy of interactivity developed by Schwier and Misanchuk, in which the levels of interaction are based on the instructional quality of the interaction. In his criticism, Sims refers to Spector (1995), who asserts that with interaction, the critical factor (of learning effectiveness) is more likely the learner's mental engagement or involvement with the subject material. It seems that whatever the level or quality of interaction, it is hard to find out to what extent cognitive processing is occurring.

Sims developed a 10-level model as a guide to different types of communication between computer and person, and claims that by integrating these elements based on instructional decisions, it will allow higher educational effectiveness through more effective communication. The 10 levels are:

- Object Interactivity – mouse-activated objects that provide an audio-visual response to "clicks" on the object.
- Linear Interactivity – when the user can click to move forward or backward in a linear sequence of instructional material.
- Support Interactivity – the user receives performance support, from simple help messages to complex tutorial systems

- Update Interactivity – a feedback or update that responds to the user input, for example, in trying to solve a problem.
- Construct Interactivity – somewhat the same as update interactivity, but an extension that requires more design and strategic effort
- Reflective Interactivity – providing new users with feedback from old users or experts. This way the learner can reflect on the response.
- Simulation Interactivity – extends the role of the user to be more like a controller or operator. One can, for instance, test out a number of switches, and see the results coming up.
- Hyperlinked interactivity – "Travel" over the Internet with help from updated hyperlinks.
- Non-immersive Contextual Interactivity – combines other interactivity elements into a complete virtual training environment.
- Immersive Virtual Interactivity – Projects the user into a completely computer-generated world, providing response to individual movement. The ultimate interactivity.

Most of the interactivity levels are highly relevant for eLearning products using game and simulation elements. However, s*ome* of these types, especially the latter ones, define use of interactivity that is not widely used today, nor relevant for the cases we will look at more closely. Still, it serves as the upper qualitative level of interaction in a continuum, and says something about what we can expect of interactive use in the future.

4.2.5 Flexibility

Many authors have touched upon this topic when writing about learner control and educational challenges. Haugan (1994) explains that a major pitfall for developers of multimedia learning, is the fear of not engaging the user enough. This derives mainly from the fact that a lot of users tend to judge the product as good because of new, technical gimmicks. To make sure that the user gets through all the gimmicks (that adds some of the value to the product), the developer *"tends to lay very rigid tracks through a complex collection of material. Thus no real choices may be left for the user"* (Haugan, 1994, p.43). In this way, Haugan opens the debate of how many choices of action the user has, and how linear the learning really is. The solution,

according to Haugan, is to use games and unexpected events or, more generally, to present the content itself in a mind catching manner.

Research by Christian Depover and Jean-Jacques Quintin focuses on learner control versus computer control. They say that, *"Without the usual limitations of the linear sequence imposed by the traditional visual supports, the conceptor must exploit the possibilities offered, keeping to a minimum the limitations imposed to the learner"* (Depover and Quintin, 1995, p.234). Having this as an initial principle, they emphasise that learner freedom not necessarily give the best knowledge acquisition method. This depends on several issues, for instance whether the learning is in the context of immediate professional training, a situation in which they claim that more guidance could be needed.

Several applications favour learner control, justifying it with the transfer to real life working environments. It is also a major issue that learner control can enlarge the user's meta-cognitive skills. Depover and Quintin (1995) believe that it is important to build in structures that encourage the user to reflect on his/her own learning strategies. The authors focus on some of the difficulties with this approach, for instance not being able to perform detailed pedagogical analysis of the didactic strategies involved. As a last point of characterising learner control, the authors focus on the factors that make the learning effect among students extremely variable. These are; the learner's *age*, *level of knowledge* in the field and *familiarity with the content*, plus the *progress* during the course and the *complexity* of the material. As a conclusion to the article, Depover and Quintin find it difficult to highlight learner control as a solution to difficulties with designing multimedia systems to the specific user. Their solution is a mixed strategy with both freedom and structure, that they call "focused exploration." This method uses focusing elements to direct user's attention to some specific skills, while they still have the option to control their own learning.

Prensky (2001) puts a historical perspective to this debate, stating that the traditional way of teaching was created as a part of the mass distribution of books together with the Industrial Revolution. With the new technologies of today, learner centred education gives the user the opportunity to learn at his/her own pace and with his/her own style. Prensky also emphasises that new approaches show great

promise, for instance letting users select and solve problems that they find relevant in addition to adaptive systems that change according to users response. Schank (1997, p.48) says that *"it makes sense to take personality differences into account in designing a system."* As an example, he describes the way his company develops simulations, giving people options according to their personalities.

As a summary we find flexibility to be both a complex and diverse engagement element. Despite different focus and conclusions among authors, they all claim user control to have importance for engagement. They also give a good background for evaluating flexibility in the case products of this thesis.

4.2.6 Competition

A lot of eLearning products have elements of competition built into them, often referred to as game elements. Games usually have some kind of conflict, challenge or problem solving involved (Prensky, 2001), but this does not mean that you necessarily have to compete with others. Some games are co-operative and demand teamwork. Others are single-player games where one competes with the computer, other people or simply with one's self. Prensky discusses how competition creates engagement in the user:

> *"Conflict/competition, challenge or opposition is what gets your adrenaline and creative juices flowing, and what makes you excited about playing the game. While not everyone likes head-to-head competition and some people shy from conflict, most of us enjoy a challenge, particularly if we get to choose it and set its difficulty."* (Prensky, 2001, p.122)

The last argument is very important. If there is a mismatch between the level of difficulty and the user skills, the user will lose the engagement and drop out. Prensky (2001) calls this synchronising between the user and level of difficulty "to balance the game". There are several ways to achieve this balance for the user. It is closely linked to the flow-experience described in chapter 4.3.2. Prensky describes "negative feedback" as one solution to keeping the user in such a preferable state. Negative feedback implies that the game becomes easier when the user falls behind, and more difficult when he or she gets ahead.

Jones (1997) claims that a mix of strategy and twitch is important, because it combines both thinking skills and quick movement. In a twitch game the user is actively engaged for instance by shooting aliens, and feedback to actions is immediate. Strategy games require problem solving skills, exploration and more intrinsic motivation from the user. Consequently, Jones claims, when designing learning environments it should be the goal to include fast action along with a more unifying problem to solve.

4.2.6.1 Game taxonomy

We want to look more closely at different game types present in the industry today, and the types of competition involved. There are several taxonomies that try to structure these aspects. Jones (1997) did research on how games engage people. He focused purely on entertainment games, and selected popular games within three broad categories: Action, Strategy and Fantasy. He concludes that engagement was created for people who thrive on competition, with others or themselves. Prensky (2001, p.130-131) provides a more detailed game taxonomy. He presents an 8-genre classification of games, including *Action, Adventure, Fighting, Puzzle, Role-playing, Simulation, Sports and Strategy*. These different game types are not meant to be completely mutually exclusive, meaning that sometimes the categories overlap.

Sue Peabody (1997) at the Washington State University has a slightly different approach to a taxonomy of different types of games. She has divided the games in two broad groups; skill and action games and strategy games, and then made subcategories. We will use this taxonomy to describe some of the game types, and also provide well-known game examples to most of them.

Skill and action (S&A) games

This is easily the largest and most popular class of computer games. Indeed, most people associate all computer games with S&A games and all arcade games are in this category. This class of games is characterised by real-time play, heavy emphasis on graphics and sound, and use of joysticks or paddles rather than a keyboard. The primary skills demanded of the player are hand-eye co-ordination and fast reaction time.

- **"Combat"**: Combat games all present a direct and violent confrontation. The human player must shoot and destroy the bad guys controlled by the computer. The challenge is to position oneself properly to avoid being hit by the enemy while shooting him. SPACE INVADERS is one of the classic games; DOOM and QUAKE are some of the newer ones.
- **"Maze"**: Characterised by maze of paths through which the player must move. Sometimes one or more bad guys pursue the player through the maze. PAC-MAN is the most successful of these.
- **"Sports"**: Model popular sports games. All of these games take liberties with their subject matter to achieve playability. The most enjoyable aspects of the computer game have very little to do with the real game.
- **"Paddle"**: The central element of the game, that of intercepting a projectile with a paddle-controlled piece. It has been used in endless variations. PONG is the classic example of such a game.
- **"Race"**: A straightforward race game. Most of these games allow the player to move at constant speed, but extract time penalties for failure to skilfully negotiate an assortment of hazards. There are endless examples of such games, for instance FORMEL1 and RALLY.

Strategy games

These games emphasise cogitation rather than manipulation. The major distinction between strategy games and S&A games is the emphasis on motor skills. All S&A games require some motor skills while strategy games do not. Indeed, real-time play is rare in strategy games.

- **"Adventures":** In these games, the adventurer must move through a complex world, accumulating tools and knowledge adequate for overcoming each obstacle, until finally the adventurer reaches the treasure or goal. Some examples in this category are MYST and ZELDA.
- **"D&D":** The name comes from Dungeons & Dragons, and represents games similar to that story, including fantasy and role-playing. One popular example is the game EVERQUEST.
- **"Wargames":** The computer wargames available now fall into two distinct groups. The first group is composed of direct conversions of conventional

boardgames. The second group of computer wargames is less slavish in their copying of board wargames.

- **"Chance":** These games include many versions of CRAPS, BLACKJACK and other similar games.
- **"Educational":** Such games are designed with explicit educational goals in mind.
- **"Interpersonal":** These games focus on the relationships between individuals or groups. This class of games is not developed into well-known products yet.

As Peabody (1997) mentions in her introduction, the taxonomy is not perfect and it will probably change over time. Put up against the Prensky's taxonomy, it is easy to draw links between both structures. The categories in Prensky's book are more general in nature and, therefore, wider than Peabody's. Still, it seems that the Peabody taxonomy lacks major elements, such as simulation games and puzzles. At the moment, popular games such as SIM CITY and THE SIMS do not have a natural place in Peabody's taxonomy.

Concluding this chapter, we now have a taxonomy with a structured way of describing most of the different kinds of games in the market today. For our purpose, we will try to use the taxonomy to map the cases in the thesis, hence describing them and their characteristics.

4.2.7 Reality (Media Elements)

How eLearning products compare with real life has several discussions in learning literature. Roger Schank writes in his book "Virtual Learning" about how some rules apply for "real learning." The first rule says that, *"People remember best what they feel the most"* (Schank 1997, p.42). Under this statement, Schank talks about how important it is for the learner to be engaged in the learning experience, "*something intrinsically interesting can become dull if it is treated as a subject the learner has to learn and if it lacks personal meaning."* As a consequence, we can say that the closer an eLearning product is aligned with the users own real-life experience, the greater the probability for evoking emotions and actual learning to occur.

In his article "Barefoot multimedia" Dan Ellis argues that he believes multimedia-rich products are just as poor as the text-based products when it comes to learning effect. He also says *"…it is much easier to produce an acceptable no-brain*

multimedia experience than it is to develop a text-based no-brainer" (Ellis, 1994, p.152). Although this is an argument for learning effectiveness (see Chapter 4.1 and 7.1), Ellis makes a good point about how to give the user reality in the learning experience. It is about more than the kinds of media involved, hence it is a threat to the use of games and simulations, that can be more wrapped up in fancy effects than the content.

Describing the use of media rich elements and the effect on learning, Judy Strauss and Raymond Frost (1999, p.6) suggest that:

> "*…the less rich channels provide great possibilities for learning. For the user, accurately encoding and decoding plain text is very difficult: it requires precise thought, reflection and revision, whereas viewing video is facilitated by voice inflection and body language cues…plain and formatted text generally are stronger than richer media for active learning, unless the learner is creating multimedia presentations (himself).*"

They build a continuum of different media, ranging from text, graphics, speech, video and multimedia. Their suggestion is still debatable, given the possibilities of using several media that attract people's attention and lodge in their memory. In their article "Measuring memory" Lombard and Ditton (2000, p.3) describe the use of virtual reality in this way: "*Virtual reality may share common elements with reading a book in a quiet corner, but this book is stretched in all directions and wrapped itself around the senses of the reader—the reader is swallowed by the story*". This shows a completely different approach to learning.

Just like the theory section on flexibility, reality is regarded differently as an engagement element by different authors. Still, the link to engagement is substantial enough to be regarded as interesting for games and simulations in eLearning products.

4.2.8 Drama effects

Following up last chapter on reality, drama effects have a similar approach and position. It is also a way of engaging the user in the learning experience, but the effects can reach *beyond* what is real.

Roger Schank (1997, p.49) says, as another of his rules for learning, that *"Training should always open with a bang"*. As explanation for this statement, he upholds that the learner often has some kind of resistance or apathy to starting a new learning program. By opening the learning experience with something immediately involving and fun, the user will focus his attention, relax and become curious and interested in the learning program.

Jones (1997) has done research on how computer games engage the user and whether the principles from games apply to learning or not. One of the features of the study was to describe the production value of a game. Jones (1997, p.4) says that:

> *"Participants stated that an important piece of their enjoyment was linked to how good the game looked. The quality of the multimedia assets such as images, sounds and animations were a key factor in getting people interested in the game".*

The drama effects of a product seem to have many different components that attract the user's attention and keep it. Jones (1997) draws the line to learning by claiming that educational software should focus on how to make the learning environment richer, more meaningful and enjoyable. Elements that tend to engage users are things such as believable characters and circumstances, an illusion of reality, and a set of controls that make sense relative to the reality they are engaged in. He says however, *"it is important to note that while attention to detail is important, 'details' should have a purpose to them"* (Jones, 1997, p.4). It is easy for developers of multimedia products, both entertainment games and educational ones, to be tempted to add elements that are technically impressive, but not in relationship with the rest of the product.

Jane Linder's study of engaging experiences includes a section of techniques that provide engagement. In connection to drama effects, some of the most important

techniques are storytelling, dialogue and role-play. Storytelling is a way of dramatising, adding context, characters and a plot to the content. When performed well, it brings the user deeper into the story and the learning experience. Dialogue offers a way of addressing different opinions, trying to find a solution to the problems. Role-play gives the user a chance to practice new skills, while creating engagement through acting and behaving as another person (Linder, 1999).

These various drama effects seem to have the common element that they create engagement, fun and excitement into learning. It is hard, however, to say something about which elements provide the greatest user engagement. The most interesting discussion is perhaps how long these elements actually provide user engagement. Some might have a greater long-term effect than others. Theory including such a discussion seems hard to find at present.

4.2.9 Usability

Theodor H. Nelson (1990) says something about what makes a good design instead of a bad one. He describes three major mistakes with many software designs. The first one is the so-called “featurities” and clutter, which can be described as “*unclarity and confusion that results from having too many separate, unrelated things to know and understand*” (Nelson, 1990, p.236). Hence, these design mistakes lead to user reactions that can be hard to harmonise with user engagement. Further on, the author criticises the metaphor ideology in which pictures and catchwords are an implicit comparison to the real thing. Nelson (1990, p.237) says, “*The metaphor becomes a dead weight. Once the metaphor is instituted, every related function has become a part of it. The visualisation becomes locked to some sort of continuing relation to the mnemonic.*” This problem seems to be exemplified by how a software real life desktop metaphor. As a final point of bad designs, Nelson points out that a lot of software designs compile bad designs, and do not solve the real user problem. Generally, the same debate takes place when evaluating a product on package versus content.

The solution, according to Nelson (1990), is to have another approach to structuring the design process. A method he calls “the jingling-idea method" consists of several possible principles that will be reworked in a gradual organisation, instead of the top-down approach of using the metaphors and the bottom-up design of featurities. This

way, Nelson upholds that it is easier to be innovating and fresh when incorporating different ideas.

In his theory about what types of design contribute to the best usability and understanding among users, Donald A. Norman (1988) puts up two important principals that apply to usability, a conceptual model and visibility.

> "*A good conceptual model allows us to predict the effects of our actions. [-] Visibility acts as a good reminder of what can be done and allows the control to specify how the action is to be performed. The good relationship between the placement of the control and what it does makes it easy to find the appropriate control for a task.*" (Norman, 1988, p.21-23)

Vertelney, Arent and Liberman (1990) divide the use of interfaces into three important elements:

- Usability
- Functionality
- Visual communication and aesthetics

This way of dividing the different elements makes it easier to find out what usability really is, and what it's not. The usability way of designing interfaces begins with imagining different scenarios the user is likely to experience. Furthermore, it is important to find out the practical functions of every feature (i.e. buttons, graphics, animations etc.). (Vertelney et al., 1990) The authors emphasise something important with usability; the user-centric idea of having him/her decide what is the best way of being guided along the path to achieving the goal. If accomplished, usability will add to the engagement of the user.

To view the element of usability from a different angle, Norman (1988) discusses how sound adds to the discussion. "*Sounds should be generated so as to give information about the source. They should convey something about the actions that are taking place, actions that matter to the user but that would otherwise not be visible.*" (Norman, 1988, p.103) This rule would likewise apply to visual elements of usability. Unpractical and gimmick features often cause more irritation than

engagement. These different views on usability serve as framework for discussing usability as engagement factor in the case studies.

4.2.10 Summary of theory part 2 – Engagement

The theory work on all these different categories gives us the feeling that engagement is a widespread and complex concept. The six different features we have used to represent engagement have both different value and influence on different users, and will also depend on the specific learning product we are looking at. To summarise this topic, we have made a model that will give an overview of engagement in connection to learning.

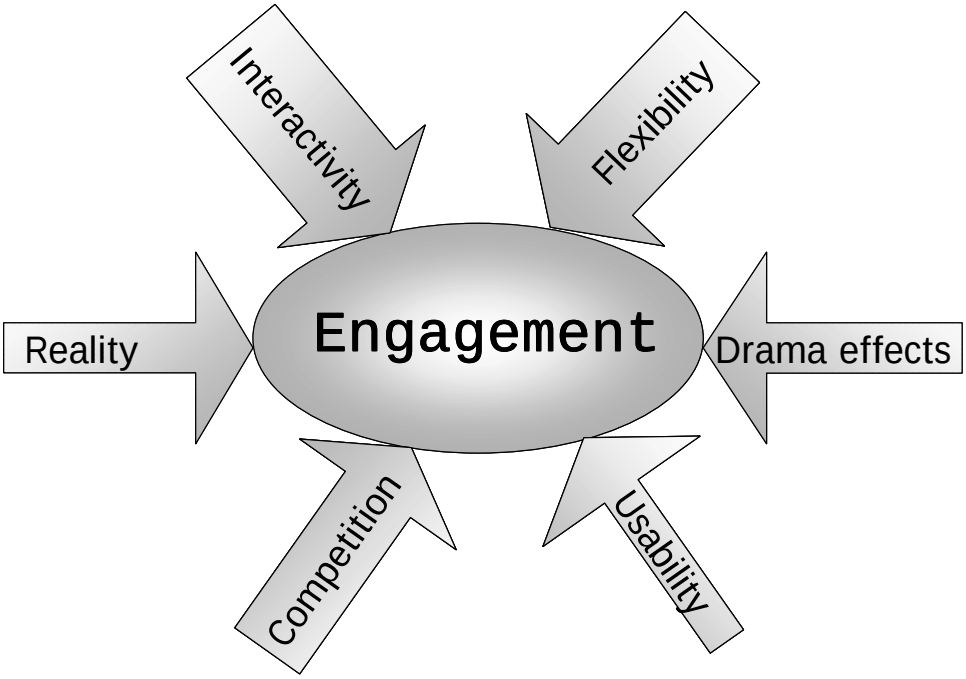

Figure 6: Features influencing engagement.

According to our description of the different features, there are some that have a stronger influence on engagement than others have. Figure 6 suggests how important the different features are in general, differentiated by the size of the arrows. As mentioned above, the relative differences between products can be considerable, and the figure is not meant to be absolute true in all cases.

Interactivity is in literature described as necessary and fundamental for engagement in learning situations. In eLearning the human interaction is less frequent, and *interactivity* in terms of degree and quality is even more important for user engagement. Not emphasised to the same extent, but still of distinctive influence, *flexibility* adds more engagement to those users who want to have control and investigate the content following their own path. *Flexibility* touches some of the same ground as interactivity, and it seems hard to have a high quality of interaction without having good flexibility at the same time. Hence, the influence of *flexibility* is considerable for engagement too. *Drama effects* cover all the factors that make the learning content more entertaining. Features like sound, music, storytelling, humour and role-play work to the purpose of the user engagement as long as they are appropriate to the learning content. Hence, *drama effects* are important for user engagement but serve more as an "add on" than a basic engagement feature. Usability is also important for the user engagement when talking about how easy to play and intuitive the product is. Still, this term is probably more often when a product is too difficult to use, than when it is working well. Therefore, engagement in a positive way is not influenced as much by *usability* as it is when contrary. When describing *competition* and the effect on user engagement, much focus is put on different game styles and how they match the learning content. The optimism among theorists seems to be significant on the effect for user engagement, although not as fundamental as for instance interactivity. Finally, *reality* is describing how different media elements provide the user with the necessary "nearness" to the real work situation. This will evidently give engagement to the user, but we see no consensus as of importance relative to the others mentioned.

Chapter 5

Method aspects

"The greatest reason for adult education is that it offers an escape from boredom."

J. Jarret

5 Method aspects

This chapter presents the type of research methodology used in the thesis. We will discuss the methods used for collecting the data, as well as describe the way the interviews were held. The third and final focus of this chapter is to highlight the coding and general analysis of the data in the process of our work.

5.1 Choosing the methodology of analysis

We will first cover the choice between qualitative and quantitative methods for the work, then choose the specific research design for the thesis, and finally show how this design applied to the development of our paper.

5.1.1 Qualitative vs. quantitative methods

Our thesis focuses on corporate learning and the use of simulation- and game-elements. Hence, the paper suits both the topic of organisational development through learning and the topic of technology focusing on the electronic use of games and simulations. The methods chosen for this research work should therefore cover both these topics in a satisfactory way, and be the best way of getting answers to our study questions.

Quantitative methods are generally focused on numbers and statistical analysis of collected data. In the quantitative approach it is preferable to isolate the variables, before the data collection takes place. This way there can be a broader and more scientifically valid view of the research project, formalising and structuring the approach to the study questions. With the use of objective methods, the results can be used to build up under other research projects, and this way be applied outside the specific research project (McCracken, 1988).

Qualitative methods are different from the quantitative ones, in the sense that they often tend to focus deeper on the specific study questions. This way it is easier to answer the questions on how and why certain phenomena apply. On the other hand, they are usually more subjective and thereby harder to generalise onto other research projects (McCracken, 1988).

Given our limitations of time and resources, together with the nature of our objectives with the thesis, we found the qualitative methods to be most suitable to our work.

5.1.2 Choosing the research design

To be able to choose a research design that suits our thesis, we have used the method theory by Yin (1994) as a guideline. He puts up five different research strategies. These strategies are *experiment, survey, archive analysis, historic analysis* and *case study*. One basic way of differentiating them is to look at which type of questions the methods use when formulating the hypothesis (i.e. what, how, why, how much etc.). Another way is to see if you can control the setting and the order of actions when doing the research. To check if the focus in the research is present or past could also help one decide which research design to choose.

Comparing our research situation with the different strategies, we found the case study to be the best research design for our purpose. This arrives mainly from the fact that we are asking "how and why"-questions, we do not control the setting and the actions in the research, and we are focusing on the current use of games and simulations in corporate eLearning.

5.1.3 The case study

This research design has both pros and cons. We will take a closer look at each, and also present the different elements in the design.

5.1.3.1 Pros and cons with using the case study

One of the most important features that make the case study favourable is its flexibility. Yin (1994, p.8) says, *"…the case study's unique strength is its ability to deal with a full variety of evidence – documents, artefacts, interviews and observations"*. The researcher is also given the freedom to update the data material. When it comes to developing the study questions and propositions along the way, the case study also adapts these features.

However, this great flexibility in the case study has several downsides as well. Yin (1994, p.9) expresses it this way; *"Perhaps the greatest concern has been over the lack of rigor of case study research"*. Lack of rigor can in this matter be exemplified

as to little preciseness in the use of methods. Other aspects could be to allow the use of biased data, creating conclusions that may be wrong. With less structure this means that the results and conclusions easily could be adapted to the study questions. Such a situation makes it easier to fabricate results that suit the researcher better. It is, of course, hard to reject this accusation, when the collection of data in this case always has a subjective side. Further discussions of this are found in the subchapter entitled Reliability.

Yin (1994, p.10) also says; "A common concern about case studies is that they provide little basis for scientific generalisation". In this case we are talking about to what extent the results of our research will have value for other research projects. From our standpoint, we are not focusing on such value in our thesis. We are mainly looking at a few different case studies, to see how they give answers to our study question. Still, we will try to give some comments on future steps to research in this field, and hopefully some overarching conclusions that refers to the general eLearning environment outside our specific case studies.

As a last drawback using the case study as research design, Yin (1994, p.10) points out the fact that *"A frequent complaint about case studies is that they take too long and they result in massive unreadable documents"*. This statement can probably be addressed to qualitative studies in general. Our goal is to see that this statement does not apply for the thesis work. The thesis reviewers will have the last word on saying if this goal is fulfilled.

5.1.3.2 The basic elements in the case study

Yin (1994) states the importance of using the following elements as the basis for case study work:

- Study's questions;
- Proportions;
- Unit(s) of analysis;
- Logic linking between the data and the preposition;
- Criteria for interpreting the findings

We will take a look at these elements using our thesis to explain them further.

5.1.3.2.1 Study question

This is the key question to answer through the thesis, and should cover all the main topics of the research paper. We have chosen to split up the study question in two, to cover the aspects that we want to look at more closely. The difference in focus between the developer and the user is very important to our findings, and we are asking both groups the same two study questions.

- Study question 1:

How can you use games and simulations to create an effective learning product?

- Study question 2:

How does the use of games and simulations succeed in offering the user an engaging learning experience?

5.1.3.2.2 Propositions

These hypothesis and approaches are based on the study questions, and specify more accurately those topics and features that characterise the thesis. According to Kathleen Eisenhardt (1989), the propositions can be replaced by a few important variables that describe the study question. For our purpose, we are outlining a few major dimensions that are important when focusing the study questions. We have received experienced help from different contributors, as well as used theory findings to come up with these dimensions (further described in chapter 5.4).

5.1.3.2.3 Unit of analysis

Given the limitations described in chapter 2, Problem definition, we are looking specifically at three different cases. These are described in more detail in chapter 6, Case Studies.

More specifically we are using 3 different products as case studies. This means we are interviewing both people developing the product (1-2 persons), and people representing the buyer and users of the same product (1-2 persons). We looked at the following products and companies:

- Involve Learning and Electrolux, "**The Business Challenge**" (value creation training simulation– soft skills)
- Intermezzon and Canon, "**The MoneyMaker**" (sales training simulation game – soft skills)
- Games2Train, Think3 and Sun Design, "**The Monkey Wrench Conspiracy**" (3D-software learning game – hard skills)

5.1.3.2.4 Linking data and propositions

By this Yin is referring to the importance of using the collected data material in connection with the former described variables. This way the interviews, articles etc. can illuminate the variables and develop new approaches to the problems surrounding them. The use of theory can also fuel discussions on some of the findings, hence supplement and enrich them.

5.1.3.2.5 Criteria for interpreting the findings

Different data can have different characteristics and thereby be difficult to compare. Conclusions can also be different and contradictory. Yin acknowledges that finding criteria often is difficult, and that the solution at minimum can be to compare the data against two rival hypotheses.

5.2 Practical method theory

In research it is sometimes hard to follow idealistic approaches. We will look closer at the writing process of a thesis, the process between data collecting and data analysis, as well as describe the structure of the interviews from a theoretical perspective.

5.2.1 The writing process

Harry Wolcott (1990) describes in his book "Writing up qualitative research" how important it is to start writing on an early stage in the process. He says *"Hear this: You cannot begin writing early enough. And yes, I really mean it"* (Wolcott, 1990, p.20). The writing process is more than just putting down words. Wolcott describes how the writing helps one to think in a more structured way and to see ways of improving what is already written. *"Writing is a great way to discover what we are thinking, as well as to discover gaps in our thinking"*, he says.

5.2.2 From data collecting to analysis

From classic theory Glauser and Strauss (1967) point out that data collecting, coding and analysis should happen in as close a period of time as possible. If so, experience from former interviews can help make the questioning more precise and definite than if the interview takes place a long time after the previous one. Eisenhardt (1989) says that researchers using the case study often let data collecting and analysis overlap each other in time.

For our purpose, this theory underpins the fact that research work is an iterative process, where you learn along the way, and use that as an advantage for the quality of the research work. We have changed the scope of the research and the specific topics to analyse under such circumstances. The market research conducted prior to the case studies also gave useful inputs as of questions to ask during the data collection.

5.2.3 Structure of interviews

In their theory, Fontana and Frey (1994) presents three different types of interviews; unstructured, semi-structured and structured interviews. The unstructured one uses very general topics, no formal questions and no specific structure for the development of the interview. The structured interview, on the other side of the continuum, has formal structure and pre-written questions.

We have chosen to use the semi-structured form because it, in our opinion, uses the best features of both the structured and the unstructured interviews. In practice, this means having a clear direction in the interview, and still an informal sound in the interview.

5.3 Collecting data in the different cases

The next section will describe the situation around the interviews, our method process and development of the interviews.

5.3.1 The interviews

In his book “The long interview”, Grant McCracken (1988) emphasises what is of importance when holding such interviews. “*These two factors, time scarcity and*

concern for privacy, stand as important impediments to the qualitative study…" (McCracken, 1988). Our interviews mostly concern factors outside the private sphere, but it is important to get a good and secure contact with the interviewee and motivate with the importance of the information he or she has got. Time scarcity is also an important factor to remember. The interviews lasted about an hour each, and there were several questions to get through.

To get views from both the developer and the user side in the research, we made two different interview guides (see appendix B and C). The interview guides were basically built up in the same way. They had main questions with sub-questions, followed by some lead questions to ask the interview objects after they had talked about the main ones. This way we wanted to make sure that the interviewee were kept to the agenda and stayed focused on the content of their answers.

In our case studies we have interviewed 7 people over a time period of 2 months. The interviewee received a document in advance, presenting our models for learning effectiveness and engagement factors. This document served as a basis for our questions in the interviews. Most of the interviews lasted about an hour, and all of them were done on a telephone conference system. This meant that we could communicate non-verbally during the interview without interfering with the interview object. The use of the telephone in interviews can also be a drawback, considering that it might be easier to develop a good atmosphere or connection face to face. Hence, the lack of comfort can limit the findings. Two interviews were also done one-to-one, forcing us to take notes while we were leading the interviews. Follow-up interviews were conducted with some of the interviewees. These persons were interviewed:

"The Monkey Wrench Conspiracy"

- Marc Prensky (Games2Train)
- Art Ignacio (Think3)
- Doug Vandy Bogart (Sun Design)

"The MoneyMaker"

- Daniel Strömer (Intermezzon)
- Peter Szabo (Canon)

"The Business Challenge"

- Cecilia Wickman (Involve Learning)
- Fiona Miller (Involve Learning)
- Lena Larsson (Electrolux)

After the telephone interviews, these persons received a copy of the preliminary case study and analysis of the interviews with themselves. This was done to confirm the reliability of the information from the interviews. This method also adds to the iterative process that such an interview process really is. Results from this "second round" with the interview objects, showed that a few details were either too general or analysed out of context. We had to make the necessary corrections before finishing the analysis and case studies.

5.4 Analysing the data "along the way"

The data material for our thesis consists of interviews, articles, theory and seminars attended during the research period. All these different sources have been helpful for the analysis of our research, and they have made it possible for us to focus our work.

From the beginning of the research work, we had a very broad focus trying not to exclude any possibilities when finding the best approach to our thesis. Our first draft had both technology, content, users, developers and economy as early basic elements. When collecting material, we found out that we could not possibly use all those features and at the same time make a report that was specific enough for our purpose with the thesis. Hence, we had to narrow down our field of primary data material.

As described earlier in the case study theory about propositions (chapter 5.1.3.2.2), we wanted to find a basic set of dimensions that would make the foundation for the specific questions we wanted answers to. With focus on the product features, we came up with the following:

- competition
- reality

- interactivity
- flexibility
- relevance
- usability
- entertainment
- progression

These dimensions were focused around engagement and effectiveness, but we realised that these dimensions did not cover the whole picture of game and simulation products. We found out that we had to use dimensions for the product context as well, to be able to give a realistic description of the dimensions that make an eLearning product learning effective. The dimensions we finally chose to look deeper into are:

- willingness to learn and expectations
- relevance
- engagement
- instructional design
- collaboration
- mentoring

We found these dimensions to be of a more general nature than the previous ones, but they covered the whole picture. To be able to answer our two study questions, we decided to keep or slightly change most of the dimensions first chosen, and place them as sub-dimensions to engagement. This change of structure along the way is not preferable, but according to Weber (1985) one of the classic problems when you are categorising. Still we believe this final structure is best suited to our study questions, and it forms the following dimension hierarchy:

- willingness to learn and expectations
- learning design
- engagement
  - reality (media elements)
  - interactivity
  - flexibility
  - competition (game styles)
  - drama effects
  - usability
- content relevance and quality
- collaboration and mentoring

To investigate the study questions further, we have made a couple of sub questions as direction for the interview guides that we will make (one for the developer and one for the buyer).

Developer:

- **What are the most important features in the product when it comes to learning effectiveness, and why?**
- **Which factors are most important when choosing between entertainment and education?**
- **Which elements do you use to create engagement, and why? Which are the most important engagement elements in the product, and why?**
- **What do you see as the most important elements to ensure a good learning outcome?**
- **Is there a social context around the product? If so, how do you facilitate it and how useful is it for the end-user (why/why not)?**

Buyers:

- **What is the feedback from users?**
- **How is learning outcome measured, evaluated and justified?**
- **How are the different elements (from the document) important for learning outcome?**
- **Can you give examples of possible improvements in the product, and what are the lessons learned from using it?**

- **Did you use the product as a standalone application, or did you place it within a social context? (Why, why not?)**
- **Which elements in the product created engagement, and why?**

5.5 Reliability

There are several different aspects of reliability that can affect our thesis. We will go into a closer discussion on some of these: credibility, transferability, dependence and verification.

5.5.1 Credibility

This aspect says something about how deeply and truthfully we have studied the topic of using games and simulations in eLearning. In total, we have used 4 months of research in this field and we have talked to a large number of developers in eLearning companies.

During the interviews, we made sure that we had follow-up questions ready, either to rephrase the question, or to add examples that would lead the interview object in a specific direction. This way we hoped to avoid possible misunderstandings and at the same time not direct the user from the start, letting him or her decide the structure of the answers.

Unbiased data is hard to guarantee when you are doing qualitative research. Some answers can be used for several conclusions, for instance, by taking quotes out of their context. We hope to prevent such consequences by letting the interview objects look over the analysis of their interviews.

5.5.2 Transferability

We hope that the findings from the case studies will, to some extent, have adaptable aspects to other companies and products in the eLearning business. We use as background many of the “non-case”-products we have seen. There seem to be a lot of similarities between several products, and it is likely to believe that some of our conclusions will apply to other products as well.

5.5.3 Dependence

Our background and personalities as researchers cannot be independent of the results of our research. Qualitative research will always have an amount of this uncertainty built in. We hope, still, that we have behaved as objectively as possible when it comes to describing companies and products, as well as interviewing different persons.

5.5.4 Verification

It is hard, if not impossible to do the same research over again, and receive the same result. Coincidences and uncertainty will always influence qualitative research like this. The fact that the eLearning industry is changing constantly also underpins this statement.

5.6 Summary of method aspects

In the approach to building up this thesis, we chose to structure our progress around a qualitative research method. Further we chose the case study as research design, because of the many "how"- and "why"-questions in the thesis and the flexibility of the case study. As study questions for the thesis, we came up with the following two:

- **How can you use games and simulations to create an effective learning product?**

- **How does the use of games and simulations succeed in offering the user an engaging learning experience?**

In the work with collecting the data and information, we have used several dimensions to describe both engagement and learning effectiveness (see figure 4). This structure was also used when analysing and concluding our thesis.

Chapter 6

Case studies

"Play is the original way of learning things."

Danny Hillis

6 Case studies

The following chapter presents the companies and products in our case studies.

6.1 Case study: The Business Challenge

This product is developed by Involve Learning in co-operation with Electrolux, and is to be used inside Electrolux.

6.1.1 Electrolux

This Swedish established company is the world's largest producer of powered appliances for kitchen, cleaning and outdoor use. More than 55 million Electrolux Group products (such as refrigerators, cookers, washing machines, vacuum cleaners, chain saws and lawn mowers) are sold each year to a value of approx. USD 14 billion in more than 150 countries around the world.

Electrolux has a strong environmental focus. In their strategy, they have statements of leading the development of environmentally sound processes and products, as well as working to encourage demand for such.

Being a big multinational company, Electrolux focuses on organisational learning and human capital. Some of the training for the top and middle managers in the company is done in a traditional way, but now Electrolux wanted to produce a learning experience to raise the general competence on financial management and business acumen for a wider range of managers. More specific, they wanted to give the employees a better understanding of the value creation in the company, hence give tools on how to increase Electrolux' profitability.

6.1.2 Involve Learning

This pan-Nordic company was founded in 2000, merging the Norwegian company In2Win and the Swedish Resco Learning. Today Involve Learning has over 100 employees, and offices in Stockholm, Gothenburg, Oslo, Helsinki and Copenhagen.

The company has experienced a solid growth in relatively short time, having a business idea of building customised products in the field of soft skill training. Since

1994 the companies now representing Involve Learning have made over 150 eLearning productions. These titles range from English language games ("A-files") and informational games on pension knowledge ("Pensjonsjakten") to customer service simulations ("Telenor Kundeservice"), simulation games to prevent credit card fraud ("American Express") and of course the business simulation for Electrolux ("The Business Challenge").

The use of both game and simulation elements is very important for Involve Learning. They have a philosophy that learning should be fun and engaging. Their products focus on interactivity, creative design and innovative learning methods. In most of their titles, Involve Learning makes all the productions themselves, but "The Business Challenge" is an example of a product where they used system dynamics knowledge created by the Swedish company BTS. This knowledge was the basis for some of the features in the product; namely the scorecard, giving results of the personal performance and the calculator, providing a tool to figure out all the elements in the customer bid.

6.1.3 The Business Challenge

The simulation game called "The Business Challenge" (BC) is developed by Involve Learning in co-operation with BTS and Electrolux. While BTS developed the system dynamics thinking behind the calculator, Involve Learning programmed the engine running the calculator and the balance scorecard as well as the development of the story, interaction and learning content in the product. Electrolux also took a great part of the development, influencing the learning content and design of BC. The product is only distributed on CD-ROMs at present, but the intention is to eventually use the Intranet as distribution channel. The animated multimedia intro sequence of BC, though, will only be distributed through the CD-ROM due to the Intranet capacity. Hence, you can decide whether to watch it or not. The product was launched in October 2000, and a survey has now been conducted among the first hundred customers/users around the world.

Electrolux has an internal school department for management training, Electrolux University, teaching within the areas of leadership, economy and project management. BC was developed with the basic idea that the employees should learn about the concept of value creation in the company. The use of eLearning for such a

purpose is different from the traditional training in Electrolux, and the reason for the production of BC was to use other methods than the old training programs and also reach more people with the same message in a shorter time.

The basic plot in BC is that you, being the new key account manager in Cosmo Corporation, get the responsibility for an important customer, Comfort Condos, located in Oceania and the European Federation. They need new kitchen equipment for 300 new condos, and your challenge is to set the deal, to make the customer happy and provide profitability for Cosmo Corporation. A long the way to the final delivery the user has to do preparations, meet the customer, organise the project, send the bid, do negotiations, and deliver the products, even though surprises may influence your work…Figure 6 shows the calculator in BC as the user prepares an offer.

Figure 7: The calculator in BC

Inside BC you have 10 different steps on the way from starting the work with Comfort Condos to finishing the program when delivering the kitchen equipment. Along the way there are different tools to help the user make the right decisions.

1. Calculator: This tool helps you analyse and estimate the different elements in the bid. The calculations include everything from financing to product features and service, so it is a complex tool.
2. Scorecard: The total shareholder index is made out from the sum of human capital, customer capital and financial capital. It is possible to see how these figures change along the way.
3. Bob's Corner: Here you can go if you want the mentor to help you out with something specific (financing, delivery issues, production etc.)
4. Contact List: Here you find the names of the potentially most important persons to contact along the way. At certain stages you can ask all these persons about a number of important issues
5. Briefcase: Here you find documents and facts useful for making the right decisions.

As mentioned above, value creation and businessman-ship knowledge is the most important purpose with BC. In more detail, the product consists of different features that together form the learning content of value creation. The approach of the game is to learn skills necessary in the process of managing customer sales from production to delivery and service. One of the most important skills is communicating with the customer. This factor continues through every part of the simulation game, changing with the different circumstances. Another important skill is the information gathering, and how to process it into value for the company. Economic skills through financing and calculations are also important for the result of BC.

The design of the game consists of two different phases: the training stage and the examination stage. The former is characterised by a lot of help from your mentor Bob Wilson. In the latter you are on your own making the decisions. Figure 7 shows a scene from BC, where Bob guides the user before meeting the customer.

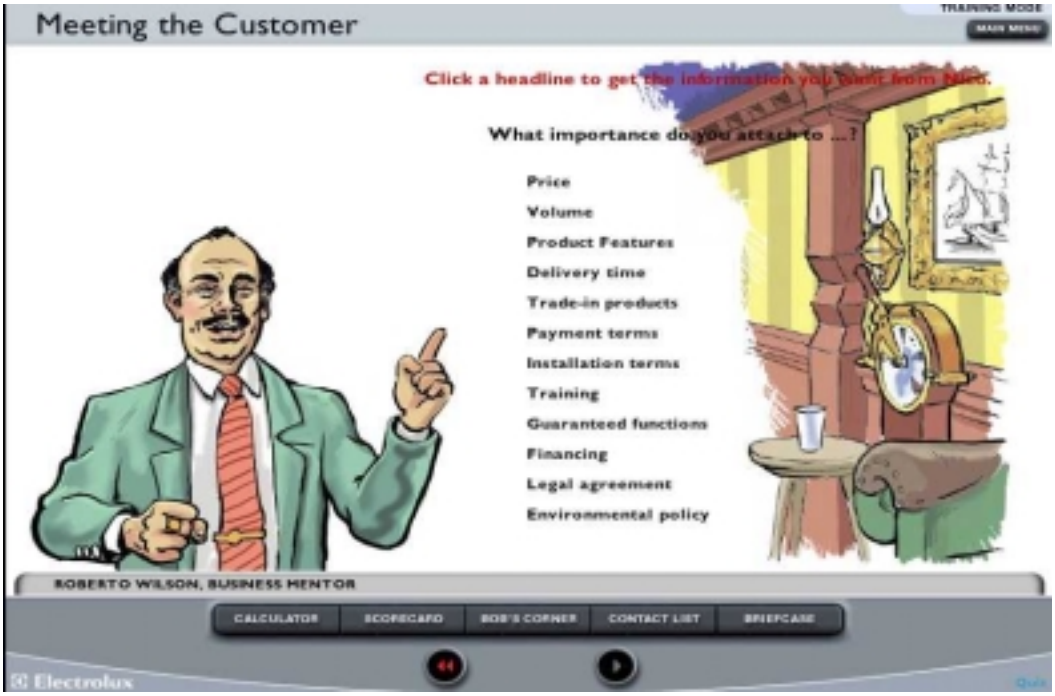

Figure 8: Feedback from the mentor in BC

6.2 Case study: "The Monkey Wrench Conspiracy"

The Monkey Wrench Conspiracy (MWC) is a game based on an action-game engine. It teaches designers how to use a 3D-design program, ThinkDesign (TD). MWC is developed by Games2Train (G2T) and think3. The latter is the company behind TD, and they produced all the tasks and multimedia in the learning part of the product. We interviewed Marc Prensky from G2T and Art Ignacio from think3, as well as Doug Vandy Bogurt from Sun Design, one of the companies that have bought MWC.

6.2.1 Games2Train

Marc Prensky is the founder of G2T. He also founded Corporate Gameware as an internal start-up when he worked for Bankers Trust. In both companies Prensky is bringing together learning and gaming technology under the philosophy that learning should be fun, and that the younger generations growing up will demand a new way of learning. G2T wants to bring engagement into workplace learning with the use of computer games. Prensky calls this Digital Game-Based Learning, which is identical with the title of his new book published in January 2001. G2T offers a range of game

interfaces from Solitaire, board games, arcade-style games and TV quiz games, to fast-moving 3D videogames.

Figure 9: Screenshot from the game part of MWC

6.2.2 think3

think3 is a privately held upstart company with more than 250 employees. think3 produces mechanical computer-aided design (MCAD) software, and is based in Santa Clara, US, with the engineering centred in Bologna, Italy. think3 has Research and Development-teams (R&D) at other locations in Italy and the US, as well as in France and India.

think3 was to launch their 3D MCAD software product TD, and wanted to encourage new users in an exciting way and at the same time teach 2D designers 3D design skills. Together with G2T, think3 developed MWC as a way of marketing TD to the masses, letting the users overcome their fear of 3D design, while making sure that they had fun when learning how to use the tool.

6.2.3 Sun Design

Sun design has 10 employees, and is a design service in Michigan, US. They design mechanical components, and their focus is mainly gauges for automotive and pharmaceutical companies. Sun Design was using AutoCAD, but was also looking at 3D design tools. However, it seemed quite difficult to learn how to use such tools properly. 3D tools were also relatively expensive, but having them could be beneficiary for Sun Design.

Sun Design tried the demo of MWC, and it sparked interest for TD. The designers went back to the demo in between ordinary work and tried out the game. They thought that TD was easy to learn and use, and ended up buying it.

6.2.4 The Monkey Wrench Conspiracy

This 3D game has a lot of rooms with puzzles, evil robots to eliminate and in total one hour of "game-time". Below is a figure of design in MWC, with the help screen to the right.

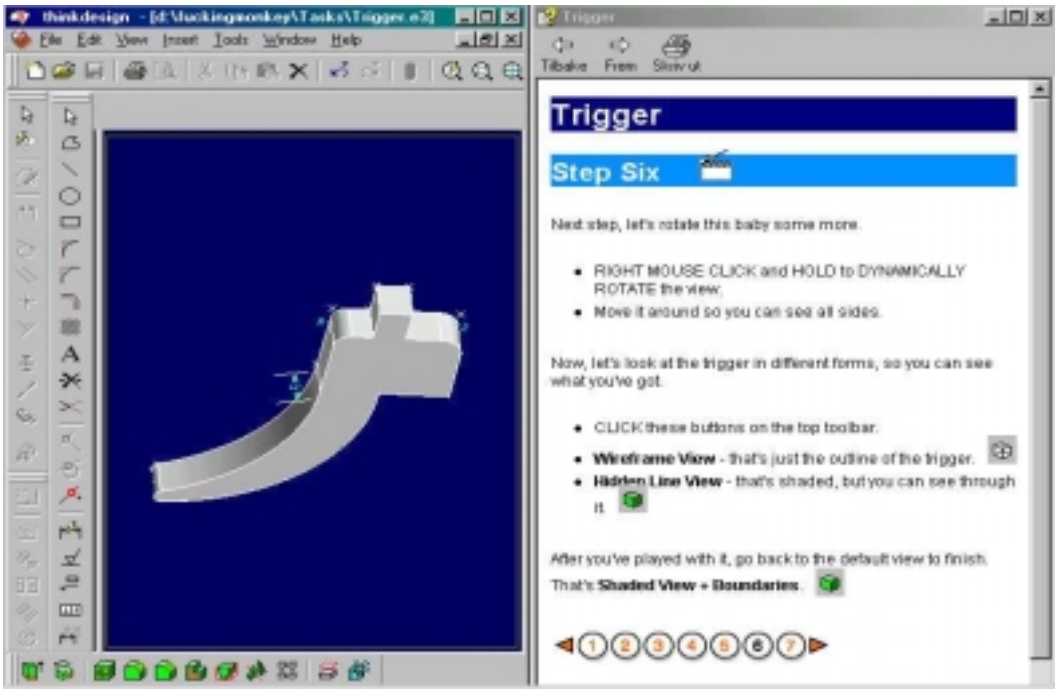

Figure 10: Design of a trigger in MWC

The game was launched in the fall of 1998, and the strategies behind MWC had both learning and marketing purposes. A demo CD-ROM was created with two levels of MWC instead of three as in the complete version. The demo also had a trial version of TD with almost the same features as the full version, but without the opportunity to save and load work. This way people who were interested in TD could try it and learn how to use it for free. These demo CD-ROMs were bundled into different magazines, and now there are close to half a million copies in print.

In MWC you are a secret agent named Moldey with a mission to infiltrate the space station Copernicus, currently occupied by the evil Dr. Monkey Wrench. The only weapon you are allowed to bring is a small lightweight computer with a 3D tool (TD). This tool is what you need in order to fix broken mechanical parts you will find as you move around in the game. In total there are 30 broken parts (hence tasks) to fix. You need to fix the task to be able to use the equipment in the game, that is, you can't go through a door unless you fix the switch that opens it. The overall target is to find Dr. Monkey Wrench, render him harmless and save Copernicus.

6.3 Case study - "The MoneyMaker"

The MoneyMaker (MM) is a simulator for sales professionals developed by Intermezzon. We have considered how Canon Sweden uses MM in their training, and interviewed Daniel Strömer, Manager of Product Development at Intermezzon, and Peter Szabo, Business Developer at Canon.

6.3.1 Intermezzon

Intermezzon was founded in 1996 and has 36 employees. The company is the descendant of Trainator, a consulting firm that provided sales and management training. The founders of Intermezzon combined the interactive sales training of Trainator with the possibilities afforded by multimedia and the web when they launched MM. With MM, Intermezzon wants to present methods of successful sales professionals, the patterns in the way they work and their awareness of their own and other people's personality types.

The company's headquarters are located in Göteborg, Sweden with additional offices in Stockholm, Malmö, London and San Francisco. Intermezzon is completing a new “Coach-analyser” that will enable training managers to compare all the students and

focus the training for each individual. While creating MM, Intermezzon also developed a tool called IES (Intermezzon Educational System). With IES clients can create their own customised dialogue-based simulations.

6.3.2 Canon Sweden AB

The Swedish subsidiary of Canon sells Canon products like scanners, cameras, copying machines and printers. Products are sold through sales centres in a franchise-concept, and sales centres also provide service and support. There are 25 Canon centres in Sweden with a turnover of 1 billion SEK. Canon provides both sales training and specific product training at the “Canon-school”. Canon wanted to test new and innovative ways of educating their sales staff and ended up trying MM. Canon bought their first licences 1 year ago, and started using it on the first sales persons in April/May 2000. So far about 70 of a total sales force of 180 persons have used MM and Peter thinks more licences will be sold during 2001. Peter is Business Developer and is responsible for developing the franchise-concept and to follow up with every sales centre. He compares them on a number of measurements, for instance service, quality, economy and environment. The target is to "benchmark" the organisation with the best people and learn from best practices.

6.3.3 The MoneyMaker

The MoneyMaker (MM) is a single player scenario-based simulator for sales staff. MM is primarily designed for companies with a business-to-business sales process. The intention with MM was to build a standardised "off-the-shelves" simulation to be used as a standalone application. Right now however, it is mainly sold to end-users via training partners who include MM in their training.

The overall mission in MM is to sell a technical product to a big potential client, Future Corporation. Intermezzon emphasises that the user is not just to sell a specific product, but also a total concept, which will include services linked with the product. As a new employee in the fictive Motivator Institute the user must build a relationship with the international concern Future Corporation, and success is dependent upon the ability to create good connections with five different managers inside Future Corporation. MM goes through all the phases of the sales process, from booking the first meeting to negotiating the final contract. Below is a screen shot from a final meeting where the user is to present an offer to the top managers.

Figure 11: Meeting with managers in MM

MM has 3 different levels. The first level is a test to map the user's knowledge and experience as a sales person. Level 2 is a guided sales process with 11 stages to go through in order to complete an agreement with Future Corporations. The user will get advises from his boss and must reflect on his actions when answering questions from the boss. In this practice modus the user has certain objectives within each stage and they must be reached before the user can move on to the next stage. One of the stages contains a personality test meant to give the user an idea of his personality profile and other types of personalities. After each stage the user will have to analyse the stage in the Analyser, a tool that tracks all the actions and the results from them. A Mindgym follows the analysis, with 8-10 questions that must be answered in order to get to the next level. The questions are linked to lessons learned from the previous stage. The third and final level is a certification in which the user will go through all the stages without any guiding.

As a user, the base in MM is the office desk. From this desk the user has two options, either to visit his boss or the personnel manager at Motivator Institute, or to click onto the computer. In the computer there are 6 alternatives:

- Customers

  This menu is a list over customers, in MM limited to 5 different people inside Future Corporations. Clicking on pictures of the people opens a list of all the

activities and agreements made with this person, and allows the user to email, call or meet this person. However, a meeting has to be booked by phone before the last option becomes available.

- Calendar

  Keeps track of all your previous and up-coming meetings and appointments.

- Email

  During the program the user will send and receive emails, but he has to choose from pre-written messages, he can't formulate his own. However, the number of alternatives increases from stage to stage in the sales process.

- Prepare offer

  If the user manages to arrive at a stage where Future Corporations wants an offer, he will prepare it in this section.

- Intranet

  The Intranet consists of two folders, the sales- and the product-folder of Motivator Institute. The sales folder gives the user information about sales techniques, negotiation skills, how to ask questions, personalities, market situations and how to treat customers. The product folder contains information about the concept the user is selling and technical facts and product support.

- Internet

  The Internet is limited to the homepages of Future Corporation, and is a source for information about the client and their products and business.

Figure 12: The user's computer screen in MM.

The core of MM however is meeting persons inside Future Corporations. In the meetings a person will speak to the user who has to respond by choosing from listed alternatives. The persons in MM are created with animations using Flash-technology, and in addition to audio their faces move when they talk. These dialogue-based conversations continue and create a scenario based on the user's choices. Sometimes the computer gives explanations on how the person behaves in order to emphasise and demonstrate behaviour that would be difficult to tell just from the animations.

Before we start analysing MM we have to explain a difference in versions of MM in this analysis. Canon has used MM version 1, which is CD-ROM based, whereas Intermezzon speaks about version 2. The latter is purely web-based, and except from that, mainly technical features distinguish the two versions. However, there are some variations in terms of pedagogic and structure as well. Our starting point was that Canon used the same version as Intermezzon described, and Intermezzon also gave us the reference to Canon. After the analysis was completed and we asked the companies to verify the content, we became aware of this problem. We will now briefly explain the difference between version 1 and 2 of MM, and we will take this into account when concluding our analysis of MM and comparing MM with the other two cases.

In the web-based version 2 it is easier for managers to follow up their students, and it also makes MM more accessible and easier to update. The pedagogic is changed by adding a new module called the Analyser. The Analyser makes it easier for the user to reflect on his performance and track his progression. Each meeting is given its own structure in MM to create larger variation between the meetings and strengthen the link to real life. The feedback-function is also improved to make the feedback more personalised and specific to the goals for a particular stage. When analysing MM in the next chapter, we will base our analysis on MM version 1. However, some of the comments from Daniel in Intermezzon apply only for version 2, and suggestions for improvements from Canon might already be dealt with in the newer version 2 of MM.

Chapter 7

Analysis

"I hear and I forget, I see and I remember, I do and I understand."
Confucius c.450 BC

7 Analysis

Following the structure from the theory chapter, this analysis will first focus on learning effectiveness and then on engagement. Under both sections we will first look at the three cases separately and then together, before making conclusions (See figure 13). This structure is chosen to be able to focus and make conclusions on one study question at a time.

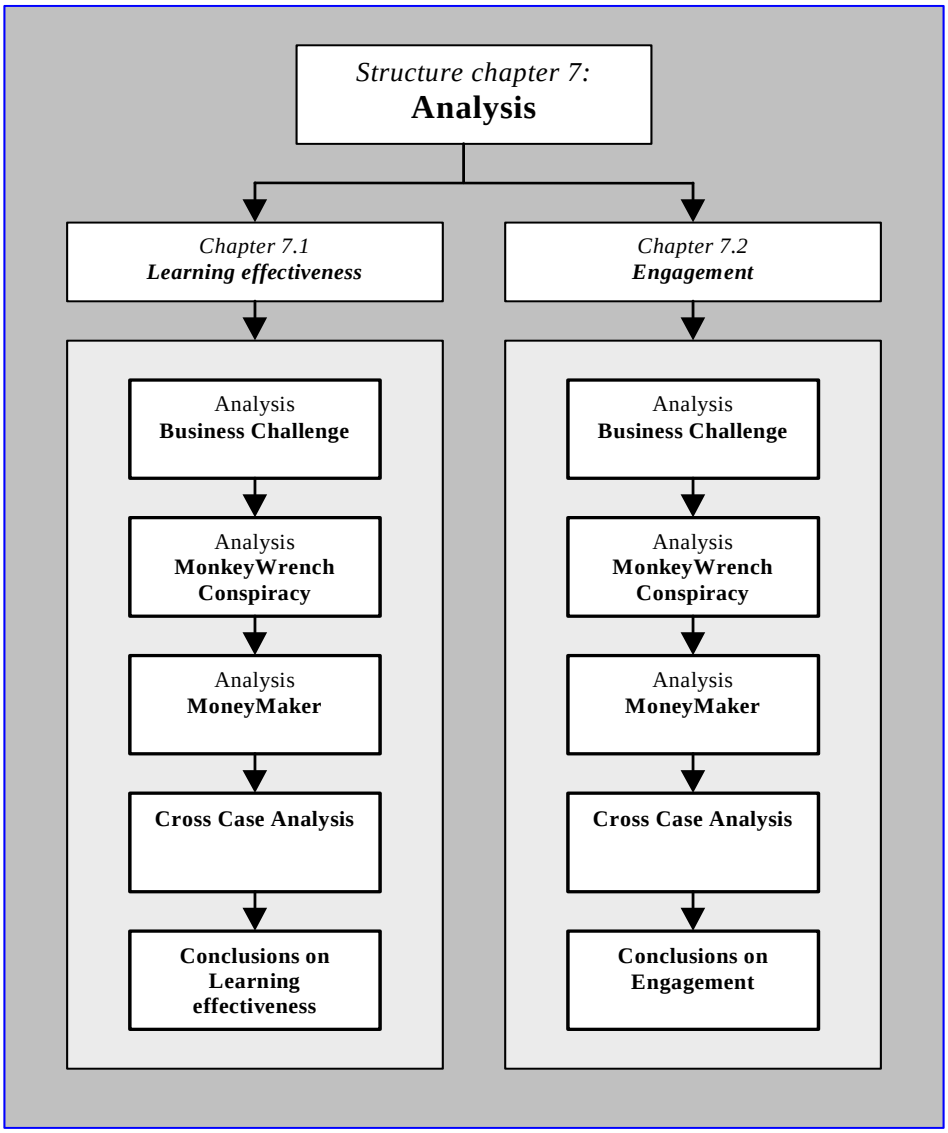

Figure 13: Structure of analysis

7.1 Analysis of learning effectiveness in the case studies

This section will evaluate how the different cases fulfil the first study question about learning effectiveness. Table 1 summaries some of our findings.

	Learning effectiveness	*Engagement*	*Content*	*Design*	*Willingness/ Expectations*	*Social context*
The MoneyMaker	**No quantitative measures** on learning effectiveness. Feedback based on "smile-sheet". says that learning is effective	Of **greatest importance** in terms of effective learning, and users seem to like it. Developer tries to use humour to engage.	**Relevant content important**. Sales situation in MM not that relevant for Canon.	Important and cannot be ignored. **Quite good** and flexible design.	Willingness to learn **varied with the age** of the user. Intermezzon tried to increase expectations to MM.	Canon saw a **need for a social context**, even though MM is sold as a standalone application.
The Business Challenge	**No measurements are available**, and it is difficult to measure. Electrolux has feedback from 100 test users.	**Crucial for learning effectiveness**. Believe in "learning by laughing." Those who completed BC liked it very much.	**Relevant content very important** to Electrolux. BC is custom-made.	**Pretty linear design.** It was not mentioned a lot, users liked the design.	Survey does not tell much, many seem to be willing to try and Electrolux **tried to increase expectations**. Some scepticism exists.	No mentor or collaboration. **Social context** provided **in some cases** when BC was used as a part of seminars.
The Monkey Wrench Conspiracy	No numbers on effectiveness, but **increased sales and reduced need for support** are indicators that MWC is successful.	Crucial for effective learning, the game part in **MWC really engages** the users.	Relevant content is **very important**, and TD is. However, tasks are not that relevant.	Very important for learning effectiveness, the **design seems to be good** in MWC.	User found it hard to learn 3D, even though they wanted to. The **expectations** to MWC were **low** because of bad experiences.	MWC is a single-player game. However think3 created an online community.

Table 1: Summary of analysis on learning effectiveness

7.1.1 The Business Challenge (BC)

Electrolux started using BC during autumn 2000, but did not have enough resources to complete the world-wide launch in 2000. This campaign will continue throughout this spring, and is planned to include quizzes and competitions to spread the message of Value Creation and measure learning effects of BC. Tests will hopefully provide more feedback on what people learn from BC and what to improve before introducing BC on the Intranet. Electrolux thinks that BC could have up to 10 000 potential users, and hopes to reach 3000-4000 of those. Electrolux is also hoping to have BC web-based within a year, and that is going to make tracking and updating easier.

7.1.1.1 Learning effectiveness

So far there are no numbers on the learning effectiveness in BC. Involve Learning says that it is hard to measure learning. Cecilia Wickman said: *"You will have to measure change, and therefore measure pre- and post-training knowledge."* This has not been done so far, but Electrolux have decided to try to measure the effect of BC. Involve Learning is looking forward to results from those tests, but Lena Larsson at Electrolux points out that it could be difficult to know from where employees got the knowledge and further more to measure changes in peoples mindset. *"Measuring learning effectiveness is difficult",* she says. The number of users so far has not been as high as Electrolux were hoping.

Based on conversations with and questionnaires to users, Electrolux concludes that the overall feedback is positive, and that most users think BC is a functional and good learning tool. Involve Learning claims that the users will learn on each stage of BC, and they are evaluated by the scorecard on three variables: profitability, customer satisfaction and shareholder value. According to Involve the users have to have a certain level of knowledge about value creation (score on the three variables) in order to get the diploma in the end. Electrolux did a survey amongst the first 100 users, and found that 25% of those had completed BC. Of those who did not, 28% blamed technical problems and 55% said that they did not have time to complete it. Those who have completed BC are positive to it, and said that they learned from it. 78% of them feel that they now understand better how they can influence Value Creation and 78% also think that they better know Electrolux Business Management

principles. 89% would recommend BC to colleagues. Half of the respondents completed BC all at once, the other half did it in steps. 11% used BC at work, while 89% tried it at home. 50% spend 2-4 hours on completing BC, 17% used less and 33% actually used more than 6 hours.

7.1.1.2 **Engagement**

Involve Learning claims that engagement is crucial in order to make learning effective. *"We strongly believe in learning with laughing",* says Cecilia Wickman. Involve thinks that entertainment might make up for the charisma of classroom teachers and make learning fun. Wickman says that Involve tried to make BC engaging by creating humorous characters, throwing the user into deep water from the beginning and adding competition and surprises. According to the above-mentioned survey in Electrolux, it might look as if Involve Learning has succeeded in making BC engaging. Everyone who completed BC liked eLearning as a method to learn. However, 75% did not complete BC and a question to ask is whether this number would have been lower if BC was even more engaging, or if there are other reasons for low the completion-rate. It is hard for us to comment on that, since the survey at Electrolux didn't ask the users why they didn't complete BC. Electrolux thinks that engagement is important, but says that relevant content also will appeal to the users. Involve Learning agrees and puts relevance just after engagement in terms of influence on learning effectiveness.

7.1.1.3 Content

Electrolux were more concerned with relevant content and context than Involve Learning. The calculator in the game has exactly the same concept as the one available on Electrolux's Intranet. Also the principles of value creation and the key ratios on the scorecard is closely linked with Electrolux. They wanted to make sure that the users "thought in terms of Electrolux" as they played BC. Involve Learning wanted to invest more in the story and add more fantasy, while Electrolux held more tightly to the link to real life. However, BC had to be general to some extent. The reasons for that are some internal differences in Electrolux in terms of how business is done and also different national cultures. Also, making BC more general increased the number of potential users, as BC became less focused on particular issues and more applicable to several types of managers and workers. The original target group was managers, with the exception of controllers and financial managers. The perceived relevance will therefore vary throughout the user-group, but everyone

should be able to recognise the “big terms” and see the ways income is generated. The briefcase also contains Electrolux information. Of those who have completed BC, 67% liked the content and 45% found it relevant for their work. 33% said that BC was not relevant for them.

7.1.1.4 Design

Electrolux did not mention design as particularly important for learning effectiveness, but a lot of discussions were held about the design both within Electrolux and with Involve Learning. When producing BC, design was somewhat important, because it should carry the message. Involve Learning just wanted to make sure that the users learned something from each stage, and that stages followed each other in a predefined order. At the same time the user is given the opportunity to do the training in his own way, and repeat it when necessary. Also, the user can choose between the training phase and the examination. But anyhow the design is pretty linear and the user has to follow a certain path through the game. At one stage the user is preparing for a meeting, and the computer asks whom the user would like to bring. If the user answers no one, the computer will advise the user to bring a certain person and the user will have to do so. Hence, there are few scenarios that can happen. It makes BC easier to design, but also simpler. People, who just have seen pictures and descriptions of BC, have criticised what they call an old-fashioned graphical interface and traditional characters in the game before they tried BC. But their opinions must have changed, because according to the conducted survey, everyone that finished BC liked the design and 75% liked the pedagogic.

7.1.1.5 Willingness to learn and expectations

It is hard to say something about the willingness to learn throughout the Electrolux organisation. According to Lena Larsson, there seems to be some scepticism, but most of the employees are willing to try eLearning. Electrolux is deliberately trying to increase expectations to BC, as it is the first world-wide eLearning production produced within the company. Most of the users are surprised with the quality in BC, and found it engaging and useful. One of the users said that BC was “fun and educating.” Some users expected BC to be more like traditional courses, and this is by no means the intention with BC. BC is designed to give another type of learning where the user can do everything at his own pace and go back to the learning situation and try several times, hence increase the degree of learning.

7.1.1.6 Social context

BC is a standalone program, but Electrolux has provided a social context in some cases. BC has been used as a part of seminars and training programs. Also, Value Creation and BC is spoken about in all leadership programs at Electrolux. A quiz with the same message is being developed. However, there is no collaboration and usually no mentoring while playing BC. As a way of distributing BC, Electrolux has been doing common kick-off sessions for BC. However it is not likely that users will play it in groups. BC is supposed to be used in a time-effective way without having to bring people together at one location, but BC is also used during Value Creation-seminars at Electrolux when people are brought together. It has to be mentioned that the users have a mentor inside the game. The mentor will give advises and hints as well as ask question in the training modus. There is no mentor in the examination phase. A question to ask is whether a mentor inside the program can replace a real teacher.

7.1.1.7 Summary

There are no numbers on learning effectiveness in BC. Those users who have completed it said that they learned from it and that BC was engaging. However, the completion rate is relatively low so far and it is hard to find out what those who did not complete BC really think of the product. Involve Learning thinks that engagement is very important to ensure learning effectiveness. Electrolux and Involve Learning focus a lot on content and relevance as well.

7.1.2 The Monkey Wrench Conspiracy (MWC)

We now want to look at the learning effectiveness in MWC. This game differs from our two other case studies in the way that MWC is a loosely linked game. This means that the learning is not embedded into the game. The learning happens outside the game in the actual design tool, ThinkDesign (TD). However, the game is linked with the tool and helps set the context in which learning is supposed to take place.

7.1.2.1 Learning effectiveness

think3 has not made estimations on how much the user learns from MWC or measured any increase in designing skills. One measure is the fact that there is no other training to get users started. Art Ignacio in think3 says that customer support follow-ups with users show a strong correlation between use of MWC and lowered

need for support help. But according to Art the main focus with MWC is not just learning: *"The purpose is to spark interest for ThinkDesign"*, he says. Using 3D tools is relatively complicated, and think3 wanted to make it easier to get started and break the first barrier. *"We have to lower the shoulders of the users"*, Arts says. Marc Prensky at G2T claimed that a game was just what think3 needed to accomplish this: *"Games are particularly suited as a way of learning what people find complicated, to make it more fun to learn".* This is supported by the buyer, Sun Design. The company had poor learning experiences with 3D design programs. But the game MWC looked interesting and they were curious to try it out. *"The game drove us until we got fascinated by ThinkDesign"*, says Doug Vandy Bogurt. After a while they stopped playing the game and spent all the time exploring TD.

According to think3, MWC has been a success so far. The response has been very positive both to the quality of TD and to MWC as an innovative way of increasing the interest for 3D design. There might be potential buyers within the user group that dislike action games and therefore refuse to try MWC. But think3 anticipated non-gamers, and also gamers, stopping use of the game by including "task mode" which allow users to skip the game entirely. However, the target audience for MWC was reasonably homogenous. They were mechanical engineers, and most of them males in their twenties and thirties, persons that are likely to have played computer games in their childhood. G2T also says that an action-game is not necessarily suited as a context for all types of software. The game style must be aligned with the user groups' preferences. think3 tries another game style in their next production launched in February 2001, and will hopefully reach an even broader target group. The new production is an adventure game called The Time Mechanic. Since it is completely Web-based, it is at www.timemechanic.com.

Sun Design thinks that the learning effectiveness is great in MWC. They tried to learn 3D design with another tool and found it very difficult. Doug Vandy Bogurt says: *"I did spend 2-3 days on the mechanical desktop in AutoCAD with thick manuals and help files. It got me nowhere."* Two designers at Sun Design found it quite easy to get familiar with TD. After a day they knew more about this 3D tool than others they had tried for longer periods of time. Doug says: *"Within a few days with MWC I started making my own productions."* He emphasises that he did not sit a couple of days in one stretch. He tried MWC in between his usual work, in breaks and at home.

In this case study the question of learning effectiveness seems to be just as much about whether the user ends up buying TD as how much the user learns while playing MWC. However, playing MWC might be necessary to create interest for TD. We will now look at which factors the interviewees think is important to ensure learning effectiveness.

7.1.2.2 Engagement

G2T claims that engagement is crucial for learning, even though content and design must be of a certain quality. think3 and Sun Design agreed but stressed that content and design are also important for learning. The developers wanted to create engagement by making a game that involves and makes the user feel urgency. *"The game sparks the interest, but when the user gets bored with the game, factors like relevance and design must engage the user to keep on going,"* says Art from think3. The consensus seems to be that engagement is quite necessary for learning to take place. The game is creating engagement from the beginning, but after a while content and design becomes important to maintain engagement.

7.1.2.3 Design

Designing the tasks and finding the right level of difficulty on each task was a complicated process. think3 and G2T also spent a lot of time choosing the sequence of the tasks. think3 wanted thorough explanations and a lot of text, while G2T were striving for pace and short audio-introductions. G2T wanted to make sure that the user was involved as soon as the game started, and the compromise was for think3 to learn to layer explanations and information, by embedding it in pop-ups and hyperlinks to online help. Doug at Sun Design liked the final result. *"You get your feet wet right away,"* he says.

As mentioned earlier, the user jumps between the game and the design tool. This relatively loose link between the game and design tool makes it easier to change and modify tasks and sequences without changing the game. There are in total 30 tasks, and if accomplished in order, these tasks would lead the players from using the easy to the more difficult features of the program Each task requires more sophisticated use of the software than the last. If the user feels that a task is too easy, he can jump to a more difficult one in the task mode. When designing MWC the developers also focused on giving the users guiding on how to use TD. CADA, the "Computer-Aided Design Assistant" follows the user throughout the game, and provides 3 types

of feedback. Green links are pop-up hints, blue links lead to online help and golden links are links to concepts. Animations are used to show concepts. Doug at Sun Design liked this design: *"The help screens has a good design and guides you while you learn the basic features of ThinkDesign."*

7.1.2.4 Content

The content in the game part of MWC is not particularly relevant. The story happens in outer space, and many of the parts the user has to construct are fictive, fantasy objects. These objects are not matched in any meaningful way with real life. The task designers at think3 typically came up with an object that conveyed the lesson, and G2T made up an imaginary use for that object. But they all require mechanical design and in order to design them the user will have to use TD as normal.

The design process is very relevant as it happens in the actual program. The designer also has the opportunity to design his own products. Quality is always hard to define and evaluate, also in terms of content. Training happens with the actual design tool and quality depends on this tool. Sun Design liked the final result, and appreciated the opportunity to decide which task to work with.

7.1.2.5 Willingness to learn and expectations

think3 assumed that designers found it hard to learn 3D design because of the complexity of the tools and extensive training programs with thick user manuals. Further, think3 thought the users were likely to expect that this applies for all 3D tools, and that MWC would be a surprise that could more than exceed their relatively low expectations and increase willingness to learn. Sun Design confirms this and says that their expectations were low due to poor learning experiences with 3D design. They were willing to learn 3D design, but so far it had been too difficult and time consuming. Sun Design really liked the way MWC tied together the game and the design software. MWC has raised their expectations to a next generation learning game.

7.1.2.6 Social context

think3 does not think that a social context is important as the user tries MWC. However, they believe it is important to provide support for those who need it. MWC is a single player game without any collaboration. There is, as mentioned above, a mentor built into the game called CADA. It speaks to the user and guides him in the

learning process. think3 has built up a community around MWC by setting up a web-site, with chat-rooms, discussion-forums, FAQ (Frequently Asked Questions) and hints from think3. Sun Design says: *"We are impressed with the customer service. We have called think3 and sent emails, and they have given answers quickly".* Sun Design feels that this human interaction is important both in term of sales and to help out users with questions or problems, when something stops you from getting any further. If your questions are answered immediately you can keep going, otherwise you might quit and not get started again. So even though MWC is a standalone single player game, Doug thinks it is smart to provide a mentor that can help you by phone or email. think3 were also clear that there should be no books or manuals with MWC, it should be as self-guiding as possible, and other questions should be answered by support staff.

7.1.2.7 Summary

The learning effectiveness in MWC can pretty much be read from the sales statistics. People buy TD because they have been engaged while trying it out and learning how to use it. MWC has fulfilled users' expectations and support from think3 has helped the users and made it easier for them to learn. Both content and design has created engagement and another section will look at features that make MWC engaging.

7.1.3 The MoneyMaker (MM)

According to Intermezzon, MM will lead to cost savings in terms of travel expenses and hiring trainers as well as training capacity. However, these estimations do not compare the learning outcome from different types of training. The users' performance in MM is measured in 6 different learning areas, derived from sales experience at Intermezzon:

- Attitude – determination to sell
- Strategy – how well the user plan and structure your meetings and presentations
- Customer focus – adaptation to customer needs and personality
- Business acumen – in negotiations, questions
- Industry knowledge – about the market and own company/product
- Self-insight – how well the user knows himself and what he is doing and hearing

The user can compare results from the training mode and the certification in all these areas. Strömer says that these comparisons show improvements on an individual level, and that this eLearning product really ensures learning outcome.

7.1.3.1 Learning effectiveness

Intermezzon has no quantitative measures on the learning effectiveness in MM. The feedback from buyers, Canon included, is based on so-called "smile-sheets", meaning that the response is based on conversations and simple surveys. The feedback is quite uniform according to Intermezzon, and concludes that MM is an effective way of learning. Peter confirms that the overall feedback is good and positive in Canon as well. However, he has noticed a difference in the feedback dependent on the age group. The youngest employees (up to about 30 years) really like MM and plays around with it. They like this new way of training, they are not afraid of trying it out and are used to playing computer-games. Users over 30 years can be divided in two groups. People from the first segment (often the youngest in the remaining segment, perhaps 30-40) are those relatively comfortable with the use of computer, and they also liked MM and thought it was interesting. However, they did not use it as much as the younger ones because of lower interest in computer games. They seem to prefer newspapers, television and spending time with their family. The last group are those who are uncomfortable with extended use of computers. They also have other interests and priorities at home and at work they did not try MM that much. The feedback was not as positive from this user group.

However, it is hard to measure and prove the effect from different types of training. What can be said, however, is that MM increases convenience by being available at anytime, anywhere with a network connection. For this reason, Peter Szabo thinks that MM is a good addition to Canon's existing training program. He also thinks that MM is a good tool for skill practice, however MM is not crucial to Canon. Peter finds it hard to measure learning effectiveness from MM and training in general. He says: *"It is almost impossible to isolate different training activities and calculate each contribution to improvements and business results."* Canon carries out tests after training and seminars, and has tested some of the users of MM. The results have been used to compare different sales centre and also to evaluate improvements between sessions. Canon thinks that the users learn from MM and that every learning activity contributes to the total learning. *"Learning has great impact on*

business results, but we can't afford to measure this, and we certainly can't stop training," says Peter Szabo. Since neither Intermezzon nor Canon has any numbers on learning effectiveness, we had a qualitative discussion on learning effectiveness.

7.1.3.2 Engagement

Both Intermezzon and Canon think that engagement is of the greatest importance for ensuring effective learning. Intermezzon wants to create engagement by using humour and telling a story that "locks up" the user in the game world. Also, relevance and design will affect the engagement in MM and cannot be ignored. Relevance, design and engagement are all important for the learning effectiveness.

7.1.3.3 Social context

Canon also said that mentoring was crucial. They were talking about a real person in a social context, not a mentor inside MM. Intermezzon intended to sell MM as a standalone application without any form social context. However they have seen the need for kick-off sessions and follow-ups. The implementation of MM has varied inside Canon. Canon trained all their sales managers at different centres. These managers then decided if they wanted to let their sales staff use MM. And the results have really varied with the engagement and enthusiasm of the sales managers. Some have arranged competitions with MM and given it a lot of attention, while other just distributed MM to employees and told them to try it out. Canon found out that the mentor and social context was invaluable for effective learning. Peter thinks that coaching is very important both in terms of motivation and guiding, especially when the workforce is diverse. *"Without coaches we would have stopped using MM by now, it would definitely not have been any success",* says Peter.

7.1.3.4 Willingness to learn and expectations

A coach will affect willingness to learn as well. It was clear that some users had a hard time getting up to speed with MM. They were a bit uncertain as of their computer skills and were not motivated to start the training. As mentioned earlier, most of them were elderly people. However, their low willingness to learn could negatively affect others and the coach had to motivate them. Peter also adds that most of the younger people really wanted to try this game, and as a new generation enters the workforce, programs like MM could be used as a standalone application only. But Peter says that MM has fulfilled Canons' expectations. *"We tried not to increase our expectations too much, even though Intermezzon wanted us to."* And

Peter thinks that this was smart, he doubts if MM would have fulfilled the expectations Intermezzon is trying to create.

7.1.3.5 Relevance

Intermezzon also emphasises relevance as important for the learning and engagement. They think subject matter experts are crucial, and used their own experience from the sales field to create MM. They wanted MM to be based on real life scenarios and used examples from situations that has actually happened. Daniel says, *"It is very important that the user recognises scenarios, and feel that they are relevant for his job."* The sales situation in MM is not exactly the same as the one in Canon, they are used to making quicker deals. However, Canon is selling more and more network-connected equipment, and the sales situation at Canon is moving towards the one simulated in MM. But, the sales people at Canon used to making "quick deals" did not feel that MM was all that relevant. They wanted a shorter, less complex version. Peter thinks that it takes too long to finish MM today (several hours), and Canon would love to have shorter version, perhaps one that lasted 20-30 minutes. However MM is relevant to some extent, and throws light on some important issues in the sales process. He also thinks that MM would have been even more engaging and relevant if the user could get the feeling of actually being in the sales situation. Being able to register the atmosphere in the sales situation, body language and "vibrations" would increase immersion into the game. As an example, Peter mentioned that a person should "soften" and change behaviour if the sales person did very well, just like in real life.

7.1.3.6 Summary

Engagement is very important for learning effectiveness, and Canon has also seen a great need for a mentor. Intermezzon says that the user must feel that MM is relevant to his job, and in case of Canon MM is just partially relevant. Canon still thinks that MM has some advantages in terms of availability and engagement.

7.1.4 Cross case analysis

Before presenting conclusions on learning effectiveness we will compare the case studies to explain similarities and differences between them.

7.1.4.1 No numbers on learning effectiveness

Reliable numbers on learning effectiveness seem to be hard to obtain in all three case studies. Users of BC say that they learned something from the program and that they know more about Value Creation after the training. However, we can state the fact that only 25% completed BC, and feedback from the survey is based on the opinions of those 25%. Nor Intermezzon has quantitative measures on learning effectiveness in MM. Feedback comes from "smile-sheets" and conversations with users. However, the web-based version makes it easier to compare students and results.

MWC is somewhat different to the two other case studies, because there are no other alternatives than MWC in terms of learning TD. Customer support at think3 reports a strong correlation between the use of MWC and lowered need for support help. Increased sales are also an indicator of effective learning and that TD is a good product. And like for BC and MM the feedback from users is generally good.

7.1.4.2 Each case study is different

MWC differs from the other cases in three ways. First of all MWC is distributed with no cost to interested designers. Potential users can test TD and actually learn how to use it without buying the software. Therefore one might say that sales statistics could be an indicator of learning effectiveness. Users are more likely to buy TD if they find it easy to learn and use. Secondly, MWC is meant to teach a hard skill, whereas MM and BC focuses on soft skills and a mixture of soft skills and hard skills, respectively. Hard skills are easier to define, train and evaluate than soft skills. The third difference between the case studies is that MWC is a loosely linked game. The game and the learning program are two separate programs, and some relatively loose links glues the two together. This divide has some benefits. It makes it easier to design both the game and the learning program, and gives the designers greater flexibility. Content and tasks in the learning program can be changed as long as they fit the story in the game to some extent. Developers can buy standard game-engines at a much lower cost than developing a game in-house. The learning program can be updated without changing the game part.

A downside with a loose link like in MWC is that the quality of the work in the learning program does not affect the game. When designing a trigger in TD, the user

can just draw a line and return to the game, and still get the complete trigger in the game. And even if the user designs the trigger perfectly, there is no difference whether he spends five minutes or two hours doing it. There is no score according to the user's performance like in a game with a tighter link. But then again the latter would reduce flexibility and make the design more complicated, so there is a trade-off between the two when choosing a game style.

These differences between the case studies means that the way learning effectiveness can be measured will vary. It is harder to measure increased knowledge in soft skills than in hard skills. MM and BC both teaches soft skills, but BC also requires the use of a calculator and is supposed to teach users facts about Value Creation as well. However, the biggest difference between MM and BC is that MM is an OTS product, while BC is customised to one particular user. The users don't pay for MWC and will not have to justify expenses with a certain learning outcome. In the case of BC and MM the users pay for the product before using it, and are therefore likely to demand more in terms of proof of learning effectiveness. Electrolux can refer to feedback from test users when distributing BC to the rest of the organisation, and Involve Learning can refer to BC when selling customised solutions to other clients. Intermezzon sells MM OTS and a repeated purchase indicates that users are satisfied with MM.

7.1.4.3 Engagement is crucial for effective learning

Even though there are differences in the case studies, they all conclude that engagement is very important for effective learning. All the developers seem to base their productions on the idea that learning should be fun, and it is natural that they all emphasise engagement. But also the buyers of these products strongly believe in making learning interesting for the users.

Based on our model for learning effectiveness, the companies point out different features as important for learning effectiveness. They also think that for instance relevance and design will create engagement, which in turn is necessary for effective learning. They all agree that engagement is crucial, and the characteristics that create engagement in these games and simulations will be discussed later. We will first look at which features the different companies regard as most important in addition to engagement.

7.1.4.4 Content relevance is important for learning effectiveness

Relevant content is necessary to engage the users over a longer period of time. The relevance in the case studies varies. BC is a customised production and thereby relevant to Electrolux. The calculator in BC has the same concept as the one on their Intranet and the principle of Value Creation is widely referred to inside the Electrolux organisation. Involve Learning focuses on customised solutions that are relevant for the users and also Electrolux thinks that the users are more likely to stay with the program as long as it is relevant.

It is easier to create relevant content for learning hard-skills than soft-skills. Hard skills are more definite, and in MWC the user can practise design with the actual tool. Training hard skills makes it easier for the user to say whether a subject is relevant or not in advance. The users practise TD even though the objects in MWC are not relevant to real life.

MM is not very relevant to Canon. However, other features in MM seem to engage the users and make the learning effective to some extent. The perceived relevance would be greater if MM was sold to a company with a sales pattern more like the one simulated in MM. MM is an OTS product and it cannot be as relevant as a customised product in every case. It seems hard to create relevant standardised soft skills training for a broad target group.

7.1.4.5 A social context can create engagement

A mentor or coach seems to be needed at Canon to motivate and follow up users. The results from MM varied with the engagement of sales managers. The way they facilitated the use of MM had an effect on the users. Engaged coaches had students who tried MM at home and spend time using it. These students were more positive to MM and said that they learned more from it, compared to the rest of the users.

Electrolux also provided a social context to BC in some cases, in terms of kick-off sessions and by using BC as a part of other courses. But BC is basically a standalone application. It is hard to evaluate how a possible social context would affect learning effectiveness in BC, but providing such a context could eliminate one of the greatest benefits with eLearning, namely training a dispersed workforce without having to bring them together.

think3 has created a social community around MWC. They have a web-site with discussion-forums, updates, hints and other services. They also have customer support for TD, and Sun Design thinks that the good service and help offered by think3 was crucial when deciding whether to buy TD or not. Some kind of social interaction might also prove to be successful in hard skills training as well.

It looks like soft skill eLearning cannot replace traditional training. A social context seems to be important for various reasons. Both MM and BC would have been more successful with a social context even though they are used without such a context. BC has been distributed to managers on a CD-ROM. Licences on MM are sold to companies and it is up to each company to decide how to follow up the use of MM.

Canon says that the role of the coaches was crucial to get the users up to speed with MM and to make sure that they completed the training. It must be said that the web-based version of MM is easier to start using, and it represents a next step towards a purely web-based soft-skills training. The MM Analyser helps the user reflect over choices made, and gives the user an overview over his performance. How effectively the Analyser works depends solely on the user. If the user decides to spend time on it and critically evaluate his performance, he is more likely to learn from it than if he just clicks through the Analyser. Therefore, we see a need for follow-up sessions to initiate discussions on and evaluate the use of MM and to make sure that the users really learned something from it. MM works as a standalone application, but a social context is likely to add extra value to the training. Some kind of hybrid model combining class-room training and the use of simulations looks like the best way of doing soft skills training on a computer right now. The advantage with a web-based simulation is that the user can access it from different locations without meeting at the same place.

This discussion involves BC as well. Electrolux has struggled to get users to try BC. Kick-off sessions might be needed to give the program a "flying start" and it might be smart to have follow-up sessions with users to get feedback on the program and to test what they really learned.

7.1.5 Conclusions on learning effectiveness (Study question 1)

This section will sum up our analysis of learning effectiveness in the case studies and answer our first study question:

- **How can you use games and simulations to create an effective eLearning product?**

We will in subchapters give some examples of how we think this can be done, and also discuss difficulties associated with measuring learning effectiveness.

7.1.5.1 Games and simulations can engage the users

The only way to create an effective eLearning product is to engage the users. One problem with eLearning today is that there are too many boring courses that users never really complete. Games and simulations have the ability to engage the users given their characteristics, and these will be discussed in detail in the next chapter. Games and simulations can spark interest for learning, and are well suited for learning content that requires practice. Games and simulations can make difficult or boring learning fun and thereby increase learning effectiveness.

7.1.5.2 The engagement might fade after a while

Engagement is crucial for effective learning throughout the learning process. However, it looks like the interest in the game might decrease after a while. To maintain engagement over a longer period of time, other features than typical game characteristics become important, for instance design and content relevance. User's willingness to learn and expectations will also affect the long time engagement. We think that games and simulations have the ability to engage the users and to be an effective learning product. However, the longer time it takes to complete the game, the greater is the need for good design, content relevance and in some cases a social context.

7.1.5.3 Learning effective relative to what?

We think that games and simulations can be used to create engaging and effective eLearning. A key question to ask is how effective learning really is, and to answer that question one must compare alternatives of learning. Alternatives to games and simulations are for instance text-based eLearning or traditional lecture-based

training. Another alternative is to omit training, but we assume that we are comparing different ways of training and we ignore that option.

Since the use of games and simulations in eLearning is a relatively new way of learning, there is a need to prove that it is better and more effective than the alternatives. As we have seen both in the market research and in the analysis so far, there is a lack of reliable numbers on learning effectiveness. But even if we had numbers on learning effectiveness, what should they be compared with? We are not convinced that companies are measuring the effects of other types of training, nor that these numbers are more reliable than those for game- and simulation-based eLearning. It is hard to isolate effects from all types of training, however it is easier to measure hard skills training with for instance pre- and post-tests. Measuring effects from training is difficult and companies choose not to. But many companies have experiences with traditional training, and need to be convinced that games and simulations is a better alternative before they are willing to try it. Hence there is a need to explain how and in which cases games and simulations can create an effective learning product.

7.1.5.4 It is hard to say how effective these cases are

It is difficult to arrive at any definite conclusion on how effective these case studies are in terms of learning because of limited numbers available. Such a conclusion would require a quantitative study and perhaps comparing alternative ways of learning. However, they all seem to engage the users, a condition for effective learning, and they have the benefits of eLearning.

7.1.5.5 The market for games and simulations is likely to grow

The age of users seems to influence the willingness to use eLearning, where younger people embrace games and simulations in eLearning to a greater extent than elderly people do. We have seen this trend in one of our case studies, where younger employees were more willing to learn and were more engaged while learning. Also another case study has young people as the target group.

This implies that the market for games and simulations in eLearning will increase as more of the younger generation enters the workforce. They are more used to playing computer games and to be engaged by the computer, and might be more open to try

a new way of learning. This could reduce the need for a social context and make it easier to use games and simulations as standalone applications.

7.1.5.6 Loosely linked game seems to work well for hard skills

MWC is an example of a loosely linked game that works well for teaching design skills. This loosely linked game style is not that suitable for soft-skills training. When training soft-skills it is necessary to simulate situations from real life and the learning should be embedded into the game. A big challenge with soft-skill training is to make it relevant enough, and the link between the story in the game and real life must be tight. The user must understand how taught principles apply to real life.

7.2 Analysing engagement in the case studies

In the following subchapters we will look more closely at how games and simulations succeed in engaging the users in the three case studies. Table 2 summaries some of our findings in the analysis of engagement.

	Interactivity	*Flexibility*	*Competition*	*Reality*	*Drama effects*	*Usability*
The MoneyMaker	Both good **degree and quality of interaction**. Uses scenario-based feedback a lot.	Fair amount of **freedom of choice**. The linear steps of the game limit the user control.	Important part of engagement. Uses **points** according to **sales performance** along the way.	Uses **Flash animations,** the web sets the limitations.	Uses **humour**, and different **characters** a lot. The **story develops** according to user performance.	Clarifying **intro**, easy to use **menu system**.
The Business Challenge	Fair **degree of interaction**, but the **quality of interaction** is limited, as well as the use of scenario-based feedback.	Little **user control**. The learning and story development is very **linear**.	Elements from an **adventure game**. Lower focus on competition elements like time and points.	Not much use of **rich media**, except for the intro because of Intranet limitations.	**Storytelling** is very important. Widely use of **characters, humour** and **human voice.**	Easy **navigation** and no problems with finding what you need.
The Monkey Wrench Conspiracy	Highly interactive game part (degree). **Quality of interaction** is low, with no evaluation of design work.	Good flexibility with **high degree of user control**. Can drop the game and work only with design.	Includes a game engine of a **combat game**. High focus on **urgency**.	Learning content is using the **actual** software. Text and pictures in **help windows**.	Combination of voice, sound, 3D and movement gives **high drama**.	A **game approach** to find the necessary help. It works.

Table 2: Engagement factors in the case studies

7.2.1 The Business Challenge (BC)

BC can be characterised as a simulation game. It consists of several elements that contribute to the user experience in the learning situation. Both Cecilia Wickman and Lena Larsson accentuate the importance of a good and engaging story that motivates the user. In addition, they both focus on other types of drama effects. Further, Wickman describes reality, flexibility and interactivity as important engagement features. Larsson describes the usage of BC among the employees. In addition to the story line, she says that interactivity and reality are some of the key factors in creating engaged users.

7.2.1.1 Drama effects

When looking at drama effects, it is important to have elements that create engagement and immersion when using the product. Theory describes several different aspects of elements creating engagement, for instance images, sound, storytelling, dialogue, characters and a plot. BC has most of these elements, and Cecilia Wickman particularly emphasises the storytelling. *"The sequence in the story develops similar to real life, you have to make the delivery to the customer",* she says. The philosophy is to give the user the feeling of creating the story as he goes along. The different characters are additions to the story. These are created with different personalities on purpose, for instance using nationalities and dialects to make the user remember them. The personal mentor, Bob Wilson, is meant to have a strong personality. "*Either you hate him or love him, you'll remember him and what he is saying"*, Wickman says. The introduction to BC uses a lot of drama effects, for instance music and sound effects that build up to a final crescendo, a pretentious voice that tells about the vision of the simulation game, and 3D graphics showing animations. This multimedia introduction is optional on CD-ROM, and will not be part of the training when it is introduced on the Intranet, because of the limited capacity of the latter. Hence, the employees using the Intranet will miss this opening. According to Cecilia Wickman this is a serious drawback, given the importance of an engaging start. She also emphasises the introduction effect of clearing the mind of the user before starting the simulation. As a contrast to the multimedia introduction, the simulation game itself contains very little sound effects and no music. Wickman says that the user has to focus on what is important in the product, and sound effects sometimes draw attention from important matters. The use of voices and dialogues is on the other hand a major priority in BC. The element

of humour is also included in these dialogues and the philosophy is, according to Wickman*: "You have to look at how far you can go without losing the user".* A last important element of drama effects is the surprises. BC includes several unforeseen incidents that will test the user's ability to choose strategic solutions. An example of this is the situation when one of the suppliers run late, and the user has to make a choice on how to proceed. Such drama builds a story that affects the user, and brings the user deeper into the story (Linder, 1999).

7.2.1.2 Reality (media elements)

Reality as an engagement factor in BC is debatable. On one side, BC needs to be close to the reality of a similar working environment in Electrolux. On the other side the fantasy world produced in BC also creates user engagement. Cecilia Wickman upholds that "*The Business Challenge represents a fantasy world with a tight link to the real life experiences in Electrolux"*. Especially the development of the customer relation, including the seriousness of product delivery, should give the user a feeling of the importance of playing the simulation game. According to the reality theory described in chapter 4.2.7, BC consists of mostly drawings and thoroughly use of human voice. Larsson says that "*The use of animations and video might increase the reality and the engagement, but it is by no means sure because it might also increase problems in opening and using the product, which decreases the engagement "*. This was a serious issue when developing BC. One of the reasons for not using video and animations is the limitations of the Intranet at Electrolux. The Intranet delivery restrictions leaded to the decision of using voices ahead of animations. On the CD-ROM, however, the calculator established most of the restrictions. This feature took up a lot of space on the CD-ROM, and will be discussed more closely in the next section.

7.2.1.3 Interactivity

Lena Larsson talked about interactivity as a very important engagement feature. When playing, the user has to make a lot of choices, usually based on different alternatives of answers or comments in dialogues. Other interactions occur if the user decides to seek advice from some of his colleagues, or if he wants to use some of the tools (calculator or briefcase). Given the theory background we might say that BC has a fair degree of interaction. The user also has the opportunity to think through his choices, and he is given time to reflect on his answers, or even to take a look in the briefcase before answering.

When it comes to the quality of interaction, we have to take a closer look at the feedback in BC. It seems that most of the feedback is not scenario-based and provides specific answers or comments to each choice the user makes. There are several situations in BC where the user is to choose in which order he wants to place different actions, for instance B, D, C and A. The feedback on C will then be the same independent of the order the user chooses, whether he put B, D, A or none of them before C. In practice, this means that it is sometimes hard to find out whether you did a good job or not. Hence, the feedback quality is low. Cecilia Wickman is referring to the customer (Electrolux) when talking about the lack of scenario-based dialogues in BC. Involve Learning has to work within the limitations of the customer. Electrolux wanted some of the choices to be valued almost equally correct, not having a "best practice" solution on all the levels in BC. *"Sometimes more then one decision could be a correct action to take",* Lena Larsson says. At the same time she accentuates that the distribution through CD-ROM and Intranet also set some limits on how many scenarios there are room for. Another way of providing feedback is by looking at the users' inputs in the calculator. When something surprising happens, the user is mercilessly dependent on how detailed he analysed and calculated the bid to the customer. For instance, if he didn't "secure the Shellac (monetary unit)" against the Euro, he will lose money when the Shellac exchange rate drops 30%. According to the interactivity theory, such a situation will build up the user's motivation and engagement, and most important: he will remember that situation!

7.2.1.4 Flexibility

Flexibility is closely related to the topic of interactivity, because of the strong link to the user control in BC. Lena Larsson considers the flexibility to be high, mentioning several examples: The user chooses to do training or examination, to redo a specific stage, to select the numbers in the calculator, or to contact fellow employees. As an example of limited flexibility, the latter opportunity (to contact employees with questions on specific topics) is only an option on one specific stage of the game. Of the other tools available, the user can for instance use the calculator and briefcase almost any time, adding another example of good flexibility. However, the development of the story is very linear, only providing the user with the choice to skip a few steps on the way. This could be an example that the lower the flexibility, the lower the engagement. Especially when redoing BC, it is easy to see that the

simulation game follows exactly the same stages and dialogues, even when answering completely different.

7.2.1.5 Competition (games styles)

Cecilia Wickman does not regard competition as important for engagement in BC. "*Even though you compete on points through the scorecard, such a basic competition element is not enough to create a true game feeling in BC"*. She believes this product to be more explorative, and hence, to be more like an adventure game. In theory this game type is characterised by a complex world, where the user needs tools to overcome the obstacles and finally reach the treasure (Peabody, 1997). This description seems to fit BC very well, and the adventure part of BC adds to the user engagement.

7.2.1.6 Usability

Evaluating over 100 users that enrolled for BC, Lena Larsson has not heard any negative comments on the usability. It seems that the users get the information they need when moving through BC. Cecilia Wickman adds to this discussion by telling that some people find the first chapter a bit hard. The user has to adapt to the different tools and opportunities before becoming comfortable with how to use it.

7.2.1.7 Summary

BC is a simulation game closely linked with an adventure game. The user engagement is induced by several of the above-mentioned factors, but especially the drama elements. BC also builds on a complex platform having a calculator and a briefcase as some of the important tools ensuring the connection to real life in Electrolux. The Intranet seems to set some important limitations for the production, having to leave out animations as well as more scenario-based dialogues and a less linear development of the story. Hence, the quality of interaction and the flexibility in BC seem to suffer a loss, and probably the engagement too. Still, we have to add that the feedback from the users finishing the simulation game is very good. For instance, 100% of the users completing BC wrote that they liked the design of the product.

7.2.2 The Monkey Wrench Conspiracy (MWC)

Being a videogame, MWC has a slightly different approach to eLearning than the simulation games described in the two other cases. Both the representatives from

the developer side, Art Ignacio and Marc Prensky, describe competition as the leading factor creating engagement. The user Doug Vandy Bogurt from Sun Design also talks about the importance of the game part in MWC, but especially emphasises reality and usability. In addition Prensky emphasises interactivity, flexibility and drama effects as important for the user engagement. We will look more closely at the mentioned features, and how they are connected.

7.2.2.1 Competition (and game styles)

We have to place MWC in a category of games. Art Ignacio defines MWC as a fast twitched battle game, and Marc Prensky describes it as a shooter game similar to "Quake" and "Doom". Placed in Prensky's own game taxonomy (Prensky, 2001) MWC would be categorised as an action game, while the Peabody (1997) taxonomy calls it a combat game. MWC has all the different features of a similar action or combat game. The user moves around in a 3D landscape and has to destroy enemies to get to the next stage with new tasks. Looking more closely at factors creating true engagement in MWC, Art Ignacio emphasises that the game part first and foremost is a motivator to get started: *"The purpose is to spark interest for ThinkDesign".* The game is inherently interesting, and the important thing is to ensure the "marriage" with the intuitively more boring design tool. On the user side, Doug Vandy Bogurt accentuates how you get drawn into the game, and that MWC is fun. As a new user, he got curious about this new concept, but started out with no expectations. He found MWC well put together and immediately involving.

Marc Prensky describes how MWC uses competition on time as an engagement factor. While solving the different design tasks however, the clock is stopped, giving the user the time he needs to get through. A drawback with the game is the fact that the program is not capable of quantifying how well a user did on the design. This way, there is no real performance measure that adds to the competition and the engagement.

7.2.2.2 Reality (media elements)

To describe the reality in MWC is not as easy as in the other cases. MWC can be divided in two: the action part in the 3D world and the design part "outside" the game environment. The action part uses 3D animations like a regular video game, hence, the engagement in this section is relatively high. This depends, though, on the user preferences, and MWC is built, according to Art Ignacio and Marc Prensky,

especially for mechanical designers. This group consists almost solely of men aged twenty to thirty. Naturally, the use of 3D animations in the game part does not make the learning content easier to understand. This is discussed more under content relevance.

The other part in MWC is the design tool that uses the same “media elements” as the regular software TD. These can best be described as 2D and 3D drawings. As guidance to the drawings the user has a help screen with text and pictures. We think that the media elements create engagement more because they are closely linked to the relevance of the content, than the actual media elements themselves.

7.2.2.3 Interactivity

It is important to look at the two parts of MWC separately also when evaluating interactivity. In the 3D game world, the interactivity is very high, making the user able to move around and shoot instantly. In the design part of the game, the user can also choose how much he wants to do, and how he wants to fulfil the task. The interaction is naturally slower when using TD. With the theory background given, MWC seem to have a very good degree of interaction, placing the user in the centre, and forcing him to give input almost all the time. If we look more closely at the quality of the interaction, this is in theory linked to the learning content and how the feedback from the program increases the learning and the engagement.

While the game part serves as a context to the real learning in MWC, the design phase is the place where the quality interaction should take place. As mentioned above, TD does not include a feedback session on each task for the user. Such a session could give the user response on what he did right or wrong while working on a task. Even if the user did not complete the design of a component properly, he will get full score in the game. The game, however, has links to different help-boxes that provide the user with pop-up windows, "jump to"-functions and animations to show design. Art Ignacio emphasises that MWC has a self-evaluation part. “*During a self-evaluation, the user can call up assistance. At the end, the student is shown the areas for which he requested help. These are not tests, but an opportunity for self-evaluation*”, Art says. The developers have to trust the help-boxes, tutorials and self-evaluation to provide the user with enough input. Feedback from the users shows that the tutorial is good and accurate (with a few exceptions).

7.2.2.4 Flexibility

There are big differences in the game and design parts of MWC in terms of flexibility. It is important to emphasise that the user can choose to stay in the task mode and work only with the design tool. This is an important feature in MWC, as it gives the user control over the learning. Flexibility theory is closely linked with learner control. Even though the user has a "what to do"-list to help him when he is designing the different models, the user is in control and has few limitations on his work. Accordingly in the game environment, the user can't do much more than to move around, pick up tools and shoot on monsters in the game-play mode. Hence, the user could get bored, unless he finds action games very appealing. Marc Prensky emphasises another part of the flexibility, the freedom to choose whether you want to play the game or just want to do the design part. As Doug Vandy Bogurt said, "*It is natural to stop playing the game and just do the designs after a while. Then you might want go back and play a little more later, and so on.*"

7.2.2.5 Drama effects

According to Marc Prensky, the drama effects in MWC are important features to ensure user engagement. The combination of voice, language, sounds and 3D-movement creates a feeling of urgency. The user is urged to do the designs at once, as Doug comments: *"You get your feet wet right away".* He adds that he really found the voice of the "personal helper" encouraging and helpful. Once you get started with the game, all the different drama elements draw you into the game. The music is quick and dramatic, almost like a techno-song, and the voice of the helper says: "*Come on Moldey, you have to design a new trigger, or we're doomed!*" Marc Prensky accentuates that such stress and "high drama" as we find in MWC, is important to motivate and engage the user category of young, male mechanical designers.

7.2.2.6 Usability

In the game part of MWC, the user has to navigate himself through the different rooms in the 3D environment. The user is pretty much on his own finding a way through the game and fighting monsters, except for descriptions of which keys to use and which level of difficulty to choose. According to our former discussion (see 7.2.2.3 and 7.2.2.4), it is the design part of the game that first and foremost has the learning content. Hence, it is important that this part of MWC really helps the user

through the different obstacles of designing in 3D. Doug Vandy Bogurt says: "*I would describe the usability of MWC to be flexible and yet still having a path for those who don't know what the correct path of learning is.*"

7.2.2.7 Summary

MWC is a learning game with the style of an action or a combat game. Positively, it is widely focused on creating user engagement, since the learning content tends to be difficult. The elements of competition and the linkage between the design tool and the game world are both important elements creating engagement. The game part draws the user into using TD. The fact that users tend to stop playing the game after a while and just do the design tasks, shows that a lot of users increasingly build up engagement for the learning content. This flexibility connected to the "real life"-experience of designing with TD is an important engagement element. On the downside, it seems that even though the degree of interaction is good, the interactive quality providing feedback for the user in the learning situation is weak. The user has to follow the tutorial, help-windows and self-evaluation to make sure he has done the design "properly".

7.2.3 The MoneyMaker (MM)

As MM is a simulation game, there might be many different features influencing user engagement. Daniel Strömer holds competition and flexibility to be the most engaging features in MM, and he also describes interactivity as of major importance. On the other side of the table, Peter Szabo said that the game elements and the humour in MM were the most engaging parts. After those, Szabo claimed interactivity to be the third most important element. Both the user and developer mention competition and interactivity among the top engagement features. We will look more closely at these, as well as the other features described in the theory part.

7.2.3.1 Competition

The competition elements in MM are of major importance for user engagement. MM has 11 different stages in which the user has certain tasks to complete. Examples of tasks are "Schedule a meeting with the Marketing Director" or "Meet the IT-Manager". When communicating with people in MM, the person's satisfaction is indicated in the top left corner of the screen. This level of "purchasing maturity" will increase or decrease depending on the chosen inputs from the user. This satisfaction

is important in the game, as the user will need to achieve a certain level in order to succeed with the sale. If a person in MM is very pleased, he might introduce the user to others in Future Corporation, making the sales process easier. Even though one is competing in a "qualitative way", that is, selling a product using communication skills, the purchasing maturity is quantitatively measuring performance. Strömer says *"The development of the story in the simulation game tends to give the user a certain drive to go through it"*. He also claims that competition is a familiar term for the target group of sales people. They like to compete, either against each other or with themselves. Peter Szabo agrees with this, but says that some of the users in Canon eventually found out how to "beat the game". Szabo continues "*They are mainly experienced game players, and for them it would be important to have more levels of difficulty or more challenges*". MM is by nature a single-player game, but Strömer says that several departments compare results from MM, and this way the employees compete against each other as well.

7.2.3.2 Interactivity

The interactivity in MM is mentioned by both the developer and the users as essential for the engagement in the game. In the first place the degree of interaction is quite high. The user is always in charge of the game and decides when to go through with a meeting or call somebody. When having a conversation, the user gets to choose the inputs, without having to answer within a time limit. This allows for reflection to take place, and is closely connected with the quality of the interaction. The number of choices (3 or 4) limits the possibilities of interaction in the conversations with the different characters. The quality of those inputs depends on how well they are written, and how they make the user reflect on his choices. Peter Szabo also emphasises the importance of getting good feedback from the program according to the choices made. He claims, however, that "*the persons in MM don't change their behaviour sufficiently to the different inputs from the user.*" Daniel Strömer says that creating the dialogues was the most difficult part. He says: *"You have to create a scenario-tree where the feedback from the characters in MM sometimes reflects the user's actions several steps earlier."* Comparing MM to theory on interactivity, we conclude that MM interacts dependent on what the user previously has done, which forms a very good and engaging interactive quality of this simulation game.

7.2.3.3 Flexibility

Daniel Strömer accentuates flexibility as one of the major features in MM creating engagement. MM gives the user the freedom of choice within the limitations of communicating with different characters in the game by telephone, mail or meetings, gathering information in the briefcase, Intranet or Internet, or talking to colleagues in the HR department. The only aspect of linearity in MM is the tasks the user has to complete on each stage. Apart from this, the user creates the story from the choices that he makes. When redoing some of the stages, he can get slightly different alternatives to choose from in terms of input, compared to the last time that he did the stage. As Strömer says, *"it is very hard to remember all the steps you made the last time you played, and therefore you will get a different story every time you play"*. Repeating what Szabo said about users "beating the game", it seems that the most experienced players either remember the steps or know how to choose the best answers by discovering a "system" on how they are formulated. Still, MM seems to be a good product when it comes to following Depover and Quintin's (1995) statement about learner control (see 4.2.5), keeping the limitations to a minimum.

7.2.3.4 Drama effects

Peter Szabo mentioned humour as one of the most important factors for user engagement. More specifically, the users at Canon found the different personalities and dialects of the characters in MM funny and engaging. This supports Jane Linder's (1999) theory, saying that storytelling and dialogue add value to the content, bringing the user deeper into the story and the learning experience. Daniel Strömer mentions that the characters in the first versions were even more extreme, "funny" and sarcastic. He says: *"Humour is the spices of the simulation, and we tried and failed on how much to use."* The feedback from the users told them that the characters didn't sound realistic enough, and the humour was toned down – apparently to the users' satisfaction. Of other drama elements MM has background music, barely possible to hear. This music adds to the feeling of getting into the game world, especially the way the music accentuates expectations and curiosity.

7.2.3.5 Reality (media elements)

Non of the interviewees believe that reality is very important in MM. Intermezzon uses a lot of Flash animations and sound as media elements to present the content. When the user is having a meeting with one of the characters in the simulation

game, they are zoomed in, and their lips move according to the sound of what they are saying. Daniel Strömer thinks that for instance video, instead of flash animations, would make MM a lot better, hence increase the engagement from reality. This suggestion aligns with Roger Schank's (1997) theory on keeping the product as close as possible to the users' own real-life experience. On the other hand Strömer says "*The restrictions on capacity over the web make such a media element impossible for us to use right now"*. As another drawback, Strömer mentions how the use of video means low flexibility to changes. When reusing MM, all the different scenarios and paths would make video an expensive and less attractive media element to use.

7.2.3.6 Usability

Usability is also claimed to be an important element of the keeping the user engaged. This is especially important when using MM for the first time. The introduction is clarifying how to use the menu system to go back or out of the game, how to look in the Analyser or how to load and save a certain stage.

7.2.3.7 Summary

MoneyMaker (MM) has a lot of elements that build up user engagement. The most important factors are probably competition and a "game feeling", as well as flexibility, interaction and drama effects. Together they seem to provide the user with a sufficient amount of engagement to make him go through the simulation game and actually learn something. As a drawback, critics in Canon think that MM is quite time-consuming, forcing the user to do smaller bulks at the time, and hence loose the feeling of flow.

7.2.4 Cross case analysis

Looking at the three case studies together is interesting, because it opens up for some generalisation of our findings. When holding the cases up against each other, we can try to find out what elements differentiate them, and what they have in common. We have chosen to divide this subchapter into different observations, which say something about engagement in eLearning through the use of games and simulations.

7.2.4.1 The importance of interactivity

All the case studies place interactivity as one of the most important factors to provide engagement. Although other factors might be placed as the most important in one particular case, interactivity is brought out as the most significant contributor to eLearning engagement.

This is interesting because the different cases use interactivity in quite different ways. While MWC uses interactivity richly in the game part, and on the same level as in the software during the design, MM and BC have a dialogue based "multiple choice"-way of interacting with the users. These variations reflect the big difference between hard skills and soft skills. In case of the former, it is much easier to make interactivity similar to the real experience, because it tends to be more deterministic than social interaction.

Under the discussion of interactivity, we have focused on both degree and quality. Although it seems that all the cases have a reasonably good degree of interaction, the quality of the interaction is generally low, possibly except for MM. This means that some players in the market are too optimistic in terms of the level of user control and personalised feedback in products. It seems that the scenario-based features in MM set the standard of today and give indications on where the progress in qualitative feedback is going, especially in the field of soft skills.

7.2.4.2 Reality versus reuse, cost and delivery

The three cases have the purpose of building up knowledge while showing more or less realistically how to do it in practice. Reality seems (again) to be harder to create in the soft skill context than with hard skills. One thing is the human interaction, with all its facets of feelings, notions and coincidences. Still, video and animations are not cheap and effective enough to be used efficiently when the learning content needs to be changed or revised. Hence, it seems to be hard to find the optimal balance between using rich media to create reality, and at the same time make the product cost-effective and reusable.

In practice, all the three cases use a lot of text in the learning content of the product. This means that for instance MM and BC use text when creating the multiple choice alternatives in the dialogues and decision making, while MWC uses it to guide

the user to get through the designs. At the same time they all make use of the human voice quite actively. For some of the products, this influence how deliverable the product is over the Internet or Intranets. Both MM and MWC are OTS products, with Flash or video animations. This is naturally a richer and more realistic medium than still pictures or drawings.

7.2.4.3 Storytelling

All the cases include a story that the user should adapt to. The soft skill products in particular need the story to really involve the user in the experience, and in BC storytelling is highly emphasised as the most important element. All the cases have different characters with names, and MM and BC have developed these persons further with personalities and behaviours that influence the story progress. All users of the case products are positive to storytelling as a way of creating engagement. This way of using drama creates an important “personal link” between the user and the program. Hence, engagement is accomplished and the user will do the whole game or simulation without dropping out halfway through.

One question is whether storytelling has a more “long term” effect than other engagement features. When combining the cases, it is seen that BC and MM are more story focused than MWC. Feedback from users underlines that MWC loses some of the engagement effect in the game part, and the users get more interested in doing the design. On the other side, MM and BC brings the user into a constantly changing story. Although some of the users found MM too long and the majority of the BC users haven’t had time to finish it yet, the feedback on user engagement tends to make no distinction on which part of the game is the most engaging.

7.2.4.4 Learning content versus package

The production of an eLearning simulation is often about trying to balance the costs with the learning outcome. Still it can be hard to really balance the amount of package elements, for instance graphics, video effects and sound, against the real learning content. Both package and content affect the user engagement, but in different ways. The three cases all use an exciting, media rich introduction to the product, after which the learning content comes more or less gradually into the game or simulation.

The three cases show how unique an eLearning production tends to be. All the cases have a different formula on how to balance elements of package with learning content. It is also hard to distinguish one as more or less engaging than the others.

7.2.4.5 The key element of flexibility

In the three case studies, flexibility is regarded as one of the important engagement features. It is interesting to see how other features are closely linked to the flexibility of the product. For instance, the use of scenario trees has something to do with both interactivity and flexibility. To make the user choose his preferred path to follow during the learning experience, the product needs a scenario tree that is big and complex enough to really engage the user. One of the biggest problems with the case study products is the lack of flexibility while playing. They all have a quite linear occurrence of tasks, and the ability to choose a different path is not present, except in MM.

Another challenge for the eLearning business is the difficulty of creating a story that engages, and at the same time keep a fair amount of flexibility at hand. MM and BC being the most storytelling-focused products, differs slightly. BC has a very linear story and a scenario-tree with few options, whereas MM has more possible outcomes at every stage.

7.2.4.6 User segments and product alignment

Out of the three case products, only one is customised to a single client. This is not necessarily harmonising with the amount of customised products in the eLearning market today. Still, all the case products try to adapt to their potential user groups. Both OTS-products (MWC and MM) have quite homogenous user groups (technical designers and sales people) while BC actually could be more diversified.

While the soft skill products (MM and BC) have an adventure game style, MWC is a shooter game. The latter is perhaps the most limited one, because it has a very specific customer group. The user engagement is also dependent on how much the product corresponds to the game preferences of the user.

7.2.4.7 Competition an interesting ”outsider”

Researchers are positive and enthusiastic about using elements of competition in learning environments. Two of the cases describe competition among the most

important features influencing user engagement. Both these cases (MM and MWC) are OTS-products with totally different learning content. Looking more closely at the user target group, the picture is more homogenous. MM is developed for sales people while MWC educates mechanics. Both these groups seem to have close connections to either computer gaming or competitiveness. The engagement induced by competition is therefore clearly an interesting element for similar user groups.

7.2.4.8 Revising the figure from the theory chapter

We developed a figure at the end of the theory chapter to list the different elements in relation to engagement. With the background of the analysis we have chosen to revise it according to our findings.

There are lots of connections between the different engagement elements. This model captures the most interesting linkages expanded from the analysis. The most emphasised one is perhaps between *flexibility* and *interactivity*. A common link is the use of large scenario trees to ensure a high level of these features. The connection between *reality* and *flexibility* builds further onto this subject. It is very hard to ensure the use of rich media elements and to keep the product flexible enough given the present technical limitations. This is somewhat the same for *flexibility* and *drama effects*. When the flexibility and user control is high, it gets harder to write a story for the game or simulation. The debate on *reality* and *drama effects* is referring to the fact that it can be hard to produce reality when the product at the same time includes a lot of drama effects. Storytelling can for instance be hard to combine with media elements that should stay close to the real work environment of the user.

Adding the importance of competition and drama effects according to the findings of the analysis still offers the view that the first model gave a realistic picture of how the different features influence engagement.

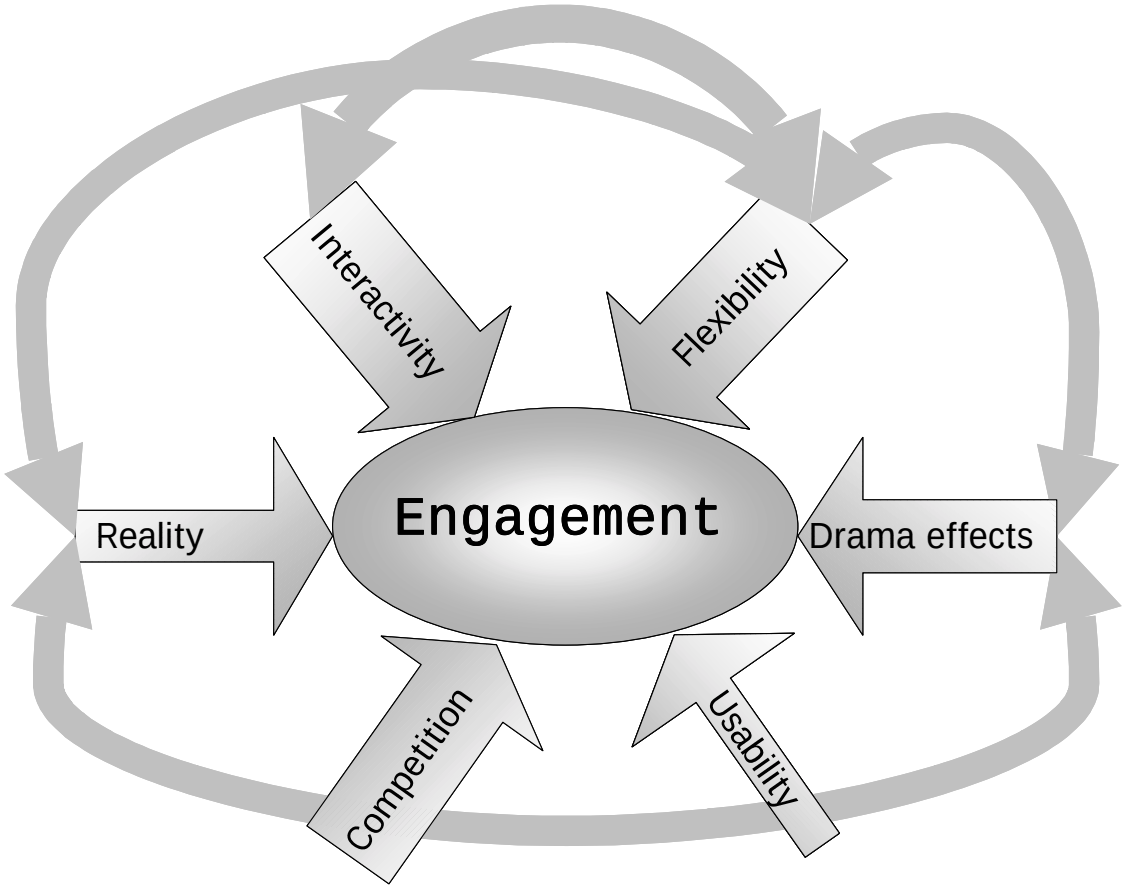

Figure 14: Revised engagement model

7.2.5 Conclusions on engagement (Study question 2)

Using the background of analysing the different cases separately, as well as together, this subchapter attempts to sum up what answers we have found to the study question:

- **How does the use of games and simulations succeed in offering the user an engaging learning experience?**

We have divided the conclusions into different aspects, in order to give as precise and structured an answer as possible.

7.2.5.1 Many users are positive and engaged

All the cases and market information tells us that many users regard games and simulations as engaging elements in eLearning. Even though there are limited research data to draw conclusions from, it would be correct to say that games and simulations in eLearning are a success, although being limited in some ways. Some of the users have comments on improvements that we will evaluate below. This does not, however, change the overall conclusion that games and simulations can be combined with eLearning content to create an engaging learning experience for the user.

7.2.5.2 There is still a big unproved potential

The focus on different engagement elements shows that there are still many potential improvements to ensure better user engagement. The analysis shows that interactivity and flexibility in particular are important elements, and that they have unproved capabilities to enhance user engagement. Especially the quality of interaction, describing how well the computer-produced feedback matches the user's input and background, is often not good enough to maintain engagement. Also flexibility with much too linear path of learning seems to need better user adjustment. Today most users do not have the ability to choose their own way of learning and to follow their own path and progress.

7.2.5.3 Difficult to maintain the engagement

Following up on flexibility, the cases give room for the conclusion that even though the user is engaged while practising the product for the first time, some of the engagement elements have a smaller effect after a while.

The flexibility of the game or simulation products is generally not extensive enough to prevent that the user recognises a pattern in how to succeed. Depending on whether the product is to be played just once or repeatedly, engagement is hard to maintain when the users are experienced game players. When they "beat the game" and get to the bottom of the reward system, the learning experience tends to slow down along with the user engagement.

Storytelling is also widely used as a long-term engagement element, because it builds up the users' motivation and curiosity on what will come.

7.2.5.4 The dilemmas and paradoxes of engagement elements

The analysis shows that it is not easy to create an optimally engaging learning experience. Some of the engagement elements will either demand a certain condition or restrict another element. This way it seems hard to find an optimal solution for the use of games and simulations to create engagement.

The use of media elements to create reality is particularly important in learning productions where soft skills are an important feature. The closer the product is to a real experience, the more the user is likely to become engaged. Still, using games in learning often demands the use of for instance storytelling and competition, that could be limited by the degree of reality. High reality also demands the use of rich media, and this seems to limit the flexibility and reuse of the production.

The use of flexibility with an extensive user control tends to limit storytelling. A high amount of flexibility tends to produce numerous scenarios. Hence, the challenges for the storytellers get bigger and more time-consuming.

A high quality of interaction demands a high level of flexibility. This results from the fact that both these elements use a big scenario-tree as basis for their impact on user engagement.

7.2.5.5 Hard skills versus soft skills

There is a big difference between these two types of skills in eLearning engagement. While hard skills are more structured, static and deterministic, soft skills have a deeper emphasis on communication between people and more indefinable elements. Engagement occurs quite differently between these two, even though they are both about managing the situation and the challenges. At present, hard skill games and simulations seem to have a greater success than soft skill games and simulations, because of easier product development with less variables and uncertainties. Many of the paradoxes and dilemmas mentioned earlier, strike soft skill games and simulations more seriously than hard skills.

7.2.5.6 Each product is different

Working with the different cases gives the conclusion that there are several differences between the products. This means that it is hard to evaluate them against each other on a general level. The different contexts of the products add to their diversity as well. A product that is optimal and engaging for some people might be the opposite for others. The different combinations of engagement elements might also do something with the overall feeling of engagement. We will now look further to concluding this thesis on an overall level.

Chapter 8

Overall conclusion

"Spoon feeding in the long run teaches us nothing but the shape of the spoon."

E. M. Forster

8 Overall conclusion

In this chapter we will look ahead and try to put our thesis in a broader perspective. We will also point out aspects to include in further scientific research.

8.1 Early stage

As the use of games and simulations for corporate training is a relatively new segment of the eLearning business, there are some aspects that make the picture somewhat elusive. It is difficult to measure and evaluate how effective and engaging games and simulations are. Users tend to compare them with traditional training and often find games and simulations more engaging. Unfortunately, feedback on that level does not really explain how engaging or effective the learning really is. There is a great potential within web-based eLearning to embed data mining into the programs and to track users' actions in order to generate detailed feedback on usage and learning.

The limited delivery capacity today sets an effective block on the use of rich media elements in web-based productions, but CD-ROM products give indications of what is possible. Broadband initiatives are likely to open up new opportunities for the use of media in web-based games and simulations. That is why some productions today not are "state of the art", but "state of the business" in terms of what the market is willing to pay for and what is possible to deliver.

8.2 Expectations in the market

John Chambers' statement that *"education over the Internet is going to be so big, it is going to make e-mail look like a rounding error"* seems almost too bold, given the research in our thesis. The challenges and problems associated with web-based education tell us that there is no simple, magic formula with eLearning, and that it is difficult to make it efficient and engaging, just like traditional training.

Games and simulations can be the salvation to the problems with boring eLearning content, but not in all cases. It depends both on the purpose of the training and the users' preferences. Developing a good simulation game requires a new, creative way of thinking in terms of combining learning content with multimedia. The market for games and simulations is likely to grow as a younger generation enters the

workforce. However, their expectations to educational games are high because of media rich and interactive entertainment games.

8.3 The potential of soft skills

Our research shows that game and simulation productions are easiest to apply to hard skill content and facts and information. However, the growing market for soft skills eLearning is perhaps the most interesting at the moment in terms of potential. It is, however, more difficult to make soft skills content relevant for the user than hard skills. Creating a large scenario-tree that also refers to a coherent story is very challenging as it forces developers to combine high levels of interactivity and flexibility with rich media elements. Feedback must be specific to each scenario and also personalised, and the latter fuels the discussion of so-called artificial intelligence, a vision of how computer programs might adapt to each user.

8.4 Customisation versus Off-The-Shelf (OTS)

This debate has been covered both in the market research and the analysis. The trade-off between the two is usually economies of scale versus content relevance. The success, and thereby the profitability of OTS products largely depends on the perceived content relevance and quality by the user. So far the distribution of OTS products is somewhat limited and defends a customised approach to developing products.

8.5 Ideas for further research

While working on this thesis we saw possible ways of improving our research, and some thoughts might serve as ideas for further research. Any research gains from prolonged engagement and continuous observation over a longer period of time. In our case it would be interesting to follow up with the case companies to see if any long terms effects occurs or new results become available. This might give more quantitative data on how well eLearning really works, and it would be very interesting to compare those with equivalent figures from traditional training.

Another study could try to find an optimal combination of engagement elements that also maximises learning effectiveness. The use of certain features seems to either restrict or demand the use of others, and further research could look closer at linkages between elements. It would be natural to also include a study of what

creates short-term engagement, and then look at the factors that have the ability to keep the user engaged over a longer period of time. Smaller learning objects could influence engagement and the type of elements used to keep the users' attention. An extended study would align combinations of elements with types of games and preferences of users.

Many of the leading developers today predict that the size of learning objects will decrease, and it would be interesting to follow up with companies to see what happens with productions in the future, and in which direction they will be heading. This could be done in an extended market research.

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Appendix A:

Company list – Interviewed companies

Andersen Consulting (now Accenture) – www.accenture.com

- This multinational consulting firm is one of the worlds largest, with over 65 000 employees worldwide. Accenture provides both consulting services, as well as eLearning products within the fields of hosting, content, infrastructure and customer service.
- Accenture has made lots of eLearning products (with both simulation and game elements), usually for internal use, or for clients. The new venture Performance Learning Technologies is making Off-The-Shelves (OTS) simulation products, using Accenture knowledge base.

BTS - www.bts.com

- BTS was established in Sweden in 1985, now with offices in the US, UK, Germany, Holland, Scandinavia and South Africa. BTS develops and delivers workshops using business simulationS in addition to classroom training in its blended approach. BTS has three types of simulations, boardgame based, spreadsheet-based and web-based.
- In addition to the spreadsheet-based simulations used in classroom training, BTS has developed web-based simulations using for pre-training preparations and post-training practice. BTS has worked together with for instance ELD and Involve Learning on some productions, for instance "The Business Challenge" for Electrolux.

Boxer – www.boxer.no

- Boxer Technologies was established in 1986, and has 80 employees divided among offices in Oslo, Stavanger and Kristiansand. The company focuses on multi-media based training programs in a wide spectre of branches.
- Boxer uses both simulation and game elements in several productions, often combined with in-house developed 3D-technology. At present the big production of "Åsgardspillet", simulates the entire value chain, within a mythic game environment.

Click2learn - www.click2learn.com

- Click2learn (C2L) (formerly Asymetrix Learning Systems) has a 16 years history and now employs about 350 people. C2L is a learning portal, and provides authoring tools and a learning management system. C2L creates web-based corporate eLearning sites for companies.
- In terms of games and simulations, C2L has developed courses for the Military using video, for instance maintenance training on equipment.

ELD Interactive - www.eld.se

- Swedish company with about 17 employees, started producing educational games for kids 6 years ago. Later they made programs for corporations as well. ELD focuses on using game elements and drama-effects in interactive education.
- Examples of productions include a public training program about funds for Fondskolan, a introduction game in business economics/finance for BTS, and a game for Ericsson Mobile Communication to emphasise the importance of design to some of their engineers.

Electronic Arts - www.ea.com

- Electronic Arts (EA) is a leading interactive entertainment software company with 2500 employees world-wide. EA has no plans to make a move into the learning industry, but gave some valuable inputs on the entertainment game industry, from which eLearning companies have a lot to learn in terms of creating engaging products.

Funcom – www.funcom.com

- This game company is one of the largest independent developers of interactive entertainment. Funcom has 145 employees, and offices in Norway and Ireland. The main focus is Internet games and online technology.
- The production of the Chemistry game "Molekult" is an ad-hoc project for Funcom, and the only eLearning game in their product portfolio.

Games2Train – www.games2train.com

- This New York based firm was established out of the Bankers Trust start-up Corporate Gameware. Games2Train has focused on building up a game-based learning technology for business training.
- Games2Train has produced over 30 software games for learning, where "The Monkey Wrench Conspiracy" for Think3 and "Straight Shooter" for Bankers Trust are some of the most profiled ones.

Intermezzon - www.intermezzon.com

- Swedish company founded in 1991 focusing on business development training, with offices in Sweden as well as San Francisco. About 35 employees.
- Intermezzon has developed MoneyMaker, a scenario-based simulator for sales training. Intermezzon is now developing IES (Intermezzon Educational System), an application or tool that will make it easier for everyone to develop customised simulation-based training.

Involve Learning – www.involvelearning.com

- This pan-Nordic company has over 100 employees, and offices in Stockholm, Gothenburg, Oslo, Helsinki and Copenhagen. Involve Learning focuses their production on customised soft-skill programs, and has made over 150 productions since 1994.
- Involve Learning uses both game and simulation elements in their products, focusing on interactivity, creative design and innovative learning methods. Their products range from small informational games (i.e. "Pensjonsjakten") to big, complex management simulations (i.e. "The business Challenge").

Mentergy - www.mentergy.com

- Mentergy, Inc. is the convergence of Gilat Communications, Allen Communication and LearnLinc. Mentergy offers live eLearning, custom courseware development, authoring and planning tools, and broadband and satellite technology.
- Mentergy has developed their own simulation engine while creating courses for the Military. The simulation engine has later been used both for technical hard skills training and soft skills training. Examples include car dealers, banks and newspapers.

NETg - www.netg.com

- NETg (National Education Training Group) has 550 employees and was acquired by Harcourt after being founded in 1997. NETg is an international player, and a major player in the IT training market. NETg focuses a lot on instructional design.
- NETg has developed some simulations in business skills training under the HR-wing, with some titles on subjects like motivation and leadership. The simulations are parts of courses on these different titles.

Ninth House - www.ninthhouse.com

- Ninth House was founded in 1996, have created a learning community or network. Around 150 employees develop eLearning content for business skills. Focuses mostly on the US market.
- The high-end business skills courses provided in the network are made in movie-style, using subject matter experts in the business field like Tom Peters and Ken Blancard as content providers.

Pensare - www.pensare.com

- Pensare was founded in 1996 and has about 70 employees. Its content is developed in partnerships with academic institutions, and Pensare creates knowledge communities for organisations around the world.
- Pensare uses simulations in business skills training in areas like leadership, innovation, marketing and sales. Simulations are usually a part of a course, where users can practice their skills.

Powersim – www.powersim.com

- This company was established in 1993 in Bergen, releasing their first simulation product, then re-incorporated in 1995, with offices in Reston (Virginia), San Francisco, London and Bergen.
- Powersim has a big system dynamic engine that defines the basis of their eLearning productions. The company sells both OTS software and customised business simulations.

Smartforce - *www.smartforce.com*

- Big global player established in 1984, with over 1200 employees today. Headquarters in California, principal R&D-department in Ireland, and sales-offices in 26 countries. Smartforce sells both to large corporations and directly to individuals through the web-site. Smartforce has content in a lot of disciplines and also provide a learning management system.
- Smartforce is now developing simulations to be used as parts of courses or as stand-alone training in soft-skills like for instance sales or negotiation.

SMGnet - www.smgnet.net

- SMGnet is a subsidiary of SMG, Inc (Strategic Management Group) with about 60 employees. SMGnet develops business simulations, however their approach is blended with a combination of classroom training and practice on computer-based simulations for large companies around the world.
- Simulations focus on different business client functions that drive performance, such as R&D, sales, marketing and finance. The simulations are developed in-house, and are based on economical models.

Statoil – www.statoil.com

- This Norwegian oil company has 29 regional offices world-wide, using considerable resources on electronic learning, both as customer and developer.
- A project group within Statoil has developed a geology simulation, called “Svalbard Simulator” to be used teaching employees how to analyse and prepare for geological fieldwork.

Appendix B:

Interview sheet – Developers

INTRODUCTION

- Make a short presentation of us and what we know of the company and product
- Let the interviewee present his/her position and ask if he/she has any questions
- If necessary, let the interviewee present the product in more detail

QUESTION 1:

- Based on the model for learning effectiveness, which factors are most important in your product? Why are they important?
- Is the product based on any model, for instance pedagogical or economic? (Problem-based learning, balance scorecard)
- If so, can you explain why it was chosen?
- How do you make sure that the product is relevant to the buyers?
- Do you customise, and to what extent?
- If not, which criteria are most important for the buyer?
- How do you ensure the buyers that you are creating a learning effective product?

QUESTION 2:

Many developers think that there is a trade-off between entertainment and education when developing a simulation or game for corporate eLearning.

- How does that statement apply to developing your product?
- With limited budgets, which elements are to be removed first?
- Or, if you were to make the product slightly more sophisticated, what feature would you add?

QUESTION 3:

- How do you create engagement for the user in your product?
- Based on the model, which engagement elements are most important?
- Why are they important?
- Which features/elements are most expensive to add?
- Some claim that it is difficult to create an engaging product without spending a lot of money. What is your comment on that? How can you do it?

QUESTION 4:

- What do you see as the most important elements to ensure a learning outcome?
- How do you enable measurement of learning outcome?
- Some claim that scoring high on assessments in simulations is not the same as increased knowledge and improved performance. Have you done any research on how to measure the learning effectiveness?

QUESTION 5:

- How would describe the setting in which your product is used?
- Collaboration and mentoring available features? Why/why not?
- How important is collaboration and mentoring in your product?

Appendix C:

Interview sheet – Buyers

INTRODUCTION

- Make a short presentation of us and what we know of the company and product
- Let the interviewee present his/her position and ask if he/she has any questions
- If necessary, let the interviewee present the product in more detail
- Let the user explain briefly their experiences/prior use with eLearning

QUESTION 1:

- What are your experiences with this product?
- How many have you trained over how long a time period?
- Who imposed the use of the product?
- Is it part of a bigger training program?
- How would you describe the focus on learning in the company?

QUESTION 2:

- What is the overall feedback from users on this product?
- Which features did the users like or dislike?
- Did the users suggest any improvements?
- Did the program fulfil the user's expectations?
- Was the feedback uniform, or were there a lot of different opinions? If so, what could be the reasons for that?

QUESTION 3:

- Was the training relevant for the users? In which way?
- Was the training well enough adapted to the user's work environment?
- Was the product engaging and challenging for the users?
- Which elements in the product created engagement?
- Do you think the users will be happy to use eLearning again?
- Did everyone complete the program?

QUESTION 4:

- How is learning effectiveness measured and evaluated?

- Do you have any former training programs to compare with?
- What kind of feedback do you have from users? (Qualitative or quantitative)
- Was the training worth the money spend on it? Why/why not?
- Have the users showed that they can apply what they learned in their jobs?
- Has the training has affected bottom-line?

QUESTION 5:

- How are the different elements (from the model) important for learning outcome?
- What is the most important feature in the product?
- Which improvements would make the product even better?
- Could the product be used as a standalone application, or do you have to add contextual features (reality and social interaction)
- Will you use eLearning again? How will you use eLearning in the future?