

Design and Development of Effective and Customizable Educational Business Games

MASTER THESIS

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CREATE BUSINESS VALUE THROUGH IT

Table of Contents

Abstract	4
1. Introduction.....	5
1.1 Educational Business Games	5
1.2 Why Serious Games?	7
1.3 Customizability	8
2. Problem identification and motivation	9
3. Research approach.....	11
3.1 Research Questions	11
3.2 Research Approach.....	11
3.2.1 Problem Identification and Motivation	12
3.2.2 Define the Objectives for a Solution	12
3.2.3 Design and Development	13
3.2.4 Demonstration	13
3.2.5 Evaluation	13
3.2.6 Communication	13
3.3 Validity and Reliability	14
3.3.1 Internal Validity	14
3.3.2 External Validity.....	14
3.3.3 Reliability	14
4. Define Objectives for a Solution.....	15
4.1 Clients needs	18
4.2 Conception	20
4.2.1 Specification of Pedagogical Objectives	21
4.2.2 Choice of the Serious Game Model.....	25
4.2.3 General Description of the Scenario	26
4.2.4 Searching For Software Components.....	40
4.2.5 Detailed Description of the Scenario.....	41
4.2.6 Pedagogical Quality Check	41
4.2.7 Specifications for Subcontractors.....	41
4.3 Pedagogical quality control	41
4.4 Production	42
4.4.1 Tooling.....	43
4.4.2 Game Engines	43
4.5 Coherence Control and Debugging	43
4.6 Test on test group	43

4.6.1	Selecting Play-testers	45
4.6.2	Play-test Session	45
4.6.3	Play-test Methods	46
4.7	Assessing the Educational Business Game’s Effectiveness	47
4.7.1	What To Evaluate?	47
4.7.2	Evaluation and Serious Game Assessment Methods	49
4.7.3	Serious Game Evaluation Approach	51
4.8	Customizable design in Educational Business Games	52
4.8.1	Customization.....	53
4.8.2	Configuration.....	55
4.8.3	Adaptivity	55
5.	Design and Development	58
5.1	Educational Game Design Framework	58
5.2	Educational Game Checklist	60
6.	Demonstration	67
6.1	Anderson MacGyver	67
6.2	Educational Business Game Process	67
6.2.1	Clients’ Needs.....	67
6.2.2	Specification of Pedagogical Objectives	69
6.2.3	Choice of the Serious Game Model.....	74
6.3	The Resulting Game, Hotel California	74
6.4	Self-evaluation of the Game According To the Checklist.....	76
6.4.1	Pedagogical Objectives.....	76
6.4.2	Formal Elements.....	79
6.4.3	System Dynamic Elements	83
6.4.4	Dramatic Elements	84
6.4.5	Additional Elements	86
7.	Evaluation.....	88
7.1	Evaluation Approach	88
7.1.1	Determine the Goals.	88
7.1.2	Explore the Questions	88
7.1.3	Choose the Evaluation Methods	89
7.1.4	Identify the Practical Issues.....	92
7.1.5	Decide how to Deal With the Ethical Issues.....	92
7.1.6	Evaluate, Analyse, Interpret and Present the Data.....	92
8.	Analysis of the Results (Communication).....	93

8.1 Overall Observations for Both Evaluation Sessions	93
8.2 Target Group Evaluation Results	96
8.3 Domain Experts	100
8.4 Comparison Between two Evaluations	103
8.5 Meta-gaming, Mixed Reality and Customizability.....	105
8.5.1 Meta-gaming	105
8.5.2 Mixed Reality.....	106
8.5.2 Customization.....	106
8.6 The Effectiveness of Hotel California	107
9. Discussion and Conclusion	110
9.1 Conclusion	110
9.2 Limitations.....	111
9.3 Further Research	111
10. References.....	113
11. Appendix.....	117
Appendix 1. Play-test session questions	117
Appendix 2. Heuristics for gameplay.....	118
Appendix 3. Self-report	119
Appendix 4. Questions used during evaluation	120
Appendix 5. Game balancing.....	124
Appendix 6. List of requirements.	125
Appendix 7. Target Group test results and questionnaires.	128
Participant 1	128
1.4 Post-test multiple-choice questions about IT Governance for target audience:	128
Participant 2	132
1.4 Post-test multiple-choice questions about IT Governance for target audience:	132
Participant 3	135
1.4 Post-test multiple-choice questions about IT Governance for target audience:	135
Appendix 8. Domain expert interview transcripts and questionnaires.	138
1.2 Post-test questions about the game experience and engagement based on Lund (2004)	139
1.2 Post-test questions about the game experience and engagement based on Lund (2004)	142
1.2 Post-test questions about the game experience and engagement based on Lund (2004)	145
Appendix 9. Game Pitch Document	147

Abstract

Serious Games are becoming increasingly popular. In all domains they are used to transfer content to players by mixing learning with pleasure in order to make teaching more easy and fun. However many of them are designed in an ad-hoc way without structure. Several research efforts have been conducted to tackle this deficiency and to improve the design of these games. Despite the vast literature, the domain is still in its infancy and scattered. Serious games offer great opportunities for learning, but only if the game is designed effectively. In this thesis, we design and develop an educational business game according to state-of-the-art methods from the literature. This game has been designed using the proposed Educational Game Design Framework and Educational Game Design Checklist created in this thesis by combining best practices and guidelines. The game, called 'Hotel California', has been evaluated on its effectiveness as a teaching tool. The first results obtained through two evaluation sessions are promising and indicate that following the guidelines found in scientific literature can be useful in designing an effective Educational Business Game. This thesis contributes to the domain of serious gaming by proposing a Framework with a corresponding Checklist that can be used for the design of new serious games and the evaluation of existing serious games.

1. Introduction

Videogames have become an important part of people's lives. Not only for the young generation but no matter what age, gender or social environment, all became familiar with gaming. A lot of people are playing games on traditional computers and consoles but also more casual gaming is getting more popular on tablets and smartphones that makes gaming accessible to everyone (Li & Counts, 2007). Nowadays Games are not only being used for pure entertainment but they can draw the players attentions using the fun aspects for other objectives like training, education, health, public policy and strategic communication (Alvarez, 2008; Michaud & Alvarez, 2008). Games who offer more than only entertainment can be called '*Serious Games*' (Susi, Johannesson & Backlund, 2007). Serious games are used to transfer information to players and make them 'aware' of the content. This trend continued into in the educational system as an innovative learning technology that is often called '*Educational games*' (Ito *et al.* 2008). Educational Business Games are a subpart of serious games and are specified in educating and training in the business domain. Educational Business Games originate from the need of organizations to train employees to cope with decision-making processes in their everyday work (Lainema & Makkonen, 2003). Educational Business game have been around for some time (Faria, 1987) in both academia and businesses but mostly in a physical form. Currently with the serious game trend, digital aspects of Educational business games get also more attention (Lainema & Makkonen, 2003). This interest in gaming is not strange as serious games have two advantages over traditional learning: (i) games have unlimited patience and (ii) can be adapted to the learner. The scenario, difficulty, speed of progress and other elements of the game can be adapted to the knowledge and preferences of the players (Marfisi-Schottman, Sghaier, George, Tarpin-Bernard, & Prévôt 2009).

As serious gaming gets more attention also the design of these games gets more attention because there is still a lot to learn in designing and developing serious games. In scientific literature, serious games get support from academics by contributing guidelines and best practices, but this is still a field in its infancy (Marne, Wisdom, Huynh-Kim-Bang & Labat, 2012; Marfisi-Schottman *et al.*, 2009; Tran, George & Marfisi-Schottman, 2010).

1.1 Educational Business Games

As stated earlier educational business games are a subpart of serious games, see Figure 1. Serious games have various definitions by different authors. Here we use the following definition for serious games:

"A mental contest, played with a computer in accordance with specific rules, that uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives" (Zyda, 2005).

Educational business games are a subpart of serious games but focus on the area of business teaching and training. According to Manin, George & Prévot (2006) an educational business game is defined as:

"Educational business games are pedagogical applications that teach people several aspects of the functioning of a company, of a business or industry."

Here we can see that educational business games have the intention as serious games but in the business domain. The only thing that is missing in the definition of Manin *et al.* (2006) is the part where is explicitly states an educational business game is played on a computer (at least when viewed as a serious game) and that entertainment plays a big part in reaching the objective. In that account we define educational business games as:

“Educational business games are pedagogical applications, supported by a computer in accordance with specific rules, that uses entertainment to teach people several aspects of the functioning of a company, of a business or industry.”

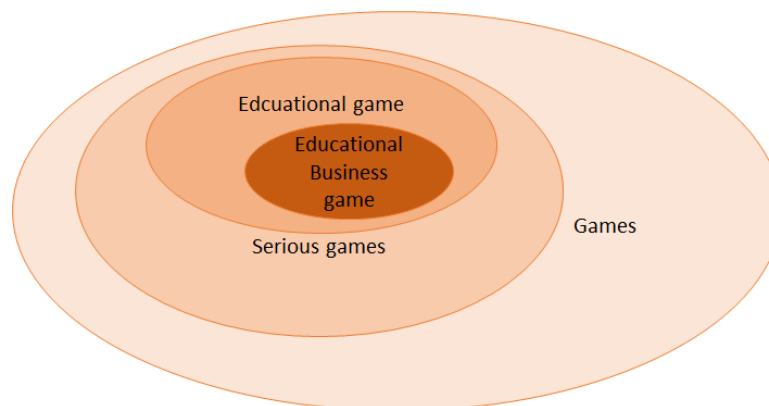


Figure 1, Position of Educational Business Games

The combination of the two definitions is the aim for the educational business game in this thesis as we want to create a serious game in the business domain that focusses on teaching with the help of entertainment. We stress that an educational business game is supported by the computer because there are still some parts that need to be physical in order to understand the interaction between the functions in an organization.

Lainema & Makkonen (2003) state that there are some ‘requirements’ that business games should meet in order to qualify as educational business games. First, they recognize that educational business games should include business decision-making cases that represent the temporal and process characteristics of real-world organizations. Essential here is the role of time in decision making, the interaction between different stakeholder groups and the flow of internal business processes. The players need to understand the complicated relationships between the different stakeholders and how internal processes influence decision-making. Secondly, the educational business training tool should be able to present different business environment scenarios. This includes appreciating multiple perspectives, developing and defending the learners’ own position while also recognizing views from other functions in the organization (Cunningham, Duffyn & Knuth (1993). Finally, educational business games should focussed on how business work from an organizational perspective rather than a functional perspective. This organizational perspective looks at a series of integrated activities in a company instead of largely independent functions. The educational business game should promote business process understanding and how a business organization operates as a whole. Where business schools often focus on functional departments the interaction between departments is what should be taught (Walker & Black, 2000).

Although there are some requirements that a game satisfy in order to be an ‘educational business game’, the design of these games is, with the exception of some decisions, the same as any other serious game. Therefore we use also literature on serious games in general to create our educational business game. We believe that the difference in designing an educational business game lies in how to present the content, the story, characters and so on. The players of educational business games are different and this should be taken into account when designing the game. For that reason we also use serious game design techniques and guidelines. But decisions will be taken based on the fact that an educational business game is the end product.

1.2 Why Serious Games?

As it comes to teaching, serious games are definitely not the only option to learn specific contents or skills. But why are they considered as a serious form of teaching? We want to explore why games can be a good method for teaching and how they add value to teaching.

According to Lieberman (2006) learning through games can provide eight benefits that are as follows:

- Games provide an interactive experience for players where they use knowledge actively rather than passively.
- Because games are interactive they encourage the player to learn by doing which makes the content stick.
- Games are a social medium that provide the player with human-to-human like interactions and can give emotional responses.
- Games give the player customized and rapid feedback.
- Games are engaging and participation makes the player pay close attention. Players need to pay close attention in order to advance. It demands learning if the player wants to succeed.
- Games promote behavioural learning. The player gets rewarded for their behaviour with points, power, ranks and so forth. This positive feedback can encourage desired behaviour in real life.
- Games offer consequences. These are not abstract or hypothetical and are represented in the game directly. The character the player plays in the game is a representation of the player self. The success or failure map directly to the actions of the player.
- Games can provide role models for players. The player can learn from the game characters and understand their behaviour.

For Educational Business Games we could add that when training adult employees, serious games could be considered better than traditional methods (Marfisi-Schottman, George & Tarpin-Bernard, 2010). The fact that adults have a hard time “coming back to school” can be overcome with the help of playing educational games. Sometimes it is also difficult for employees to take criticism from tutors that are not part of the company or are often younger than or not as experienced as them. Serious games can be adapted so that all results and comments are given by the computer and not by the tutor to overcome this issue.

De Aguilera & Méndiz (2003) who have also studied the benefits of video games and conclude that games are of ‘unquestionable importance’ for learning. In addition to stimulating motivation, acquiring practical skills, increasing perception, stimulation behaviour and developing skills in problem-solving, they state that video games are important because they complement traditional education. According to them video games can be essential to promote book reading related to the game. This indicates that games can make players curious or requires them to read in order to get more information.

There are many examples where games are used complementary to traditional training. Rosser, Lynch, Cuddihy, Gentile, Klonsky & Merrell (2007) studies gaming in the domain of surgeons. Where all the surgeons have had the same ‘traditional’ training, they gave some of them the opportunity to complement their training with video games about surgical incisions. Surgeons who had played video games for more than 3 hours a week made 37% fewer errors, were 27% faster, and scored 42% better overall than surgeons who never played video games. This section shows that serious games encourage the player to learn in an active way so that they not only see the knowledge but apply it directly into the context of the setting. But also that it is complementary to traditional methods and can be used to improve skills.

1.3 Customizability

In the domain of software engineering developers are much concerned with reusability. Reusing parts or components for new software systems can be very useful in saving time and money. Reusability in software engineering is defined as reusing software components from already developed and existing software systems in some way from (Budhija, & Ahuja, 2011). And also in the field of serious gaming we consider the reuse of components in new games an interesting aspect of game design (Marfisi-Schottman *et al.*, 2010). However for this research we are not so much interested in the reusability of the game or parts of the game but to what extent we can design it to be customizable. We believe that making it customizable is beneficial for the teacher to keep the game up to date without designing a new game. With customizability we want to explore how to design a serious game that can be adapted to different situations or adjusted so it fits in new domains. The need for serious games to be customizable and adaptive to different purposes and different user needs has its impact on the design process (Westra, van Hasselt, Dignum & Dignum, 2009). An adaptive game can be used not only in multiple settings but can also be adjusted with new knowledge and insights if this is needed. This makes the game to continue to be effective without redesigning a complete game. We will discuss how we tried to create a customizable game later on in this paper.

2. Problem identification and motivation

Game design is gaining increasing attention in the scientific literature, the educational system and the business domain. However, since it is still a young domain, a lot can be learned from the way serious games are designed and developed. The process of making games for educational purposes still takes place in a rather ad-hoc way. This makes the development of serious games a time and money consuming process (Marfisi-Schottman *et al.*, 2009). This calls for the need of more structure, best practices and empirical validation for serious game design and development. And a lot of scientific literature aims at exactly doing that. Much work focusses on models that give an overview of serious game design (Marfisi-Schottman *et al.*, 2009) or on methods research the execution of smaller steps in serious game design (Tran *et al.*, 2010). There is somewhat a consensus on how serious games should be designed. At least a lot of authors distinguish more or less the same processes and aspects in the design of serious games but they are not combined in one detailed and structured serious game design method. With all these theories on developing serious games, that are only partially validated and complete, there is still a shortage of studies that have scientifically examined the effectiveness of game-based learning (Bellotti, Kapralos, Lee, Moreno-Ger & Berta, 2013). Even though many see the benefits of these games, not knowing how to design a good effective serious game makes it a hard and complex practice.

Also the consultancy domain has started acknowledging the added value that games can bring in training employees and clients. Using existing games that have some educational aspects were the best option because it was still too expensive and time consuming to build serious games from scratch (Van Eck, 2006). But these existing games are often too generic and do not fit the expectations and objectives of companies that want to use them. Because they do not meet all the objectives the game is not a really effective tool for a company.

This thesis is focused on the case of a consultancy company, which is currently looking into new possibilities for a serious game (educational business game) to train IT organisations and departments according to their models and ideas. Our case is an example of a company that currently uses a game developed by a third party for education clients. They told us that this game proved to be too generic and did not manage to fully satisfy the objectives that the company wants to teach according to their own methods. The game that they bought does not completely satisfy their needs and therefore they wish to develop their own game. But in the quest in creating more fitting educational tool for their training purposes they realized that it is a complex process to produce a game. We feel that research in developing effective and easily adaptable serious games can be beneficial for these types of companies that are looking to create their own serious game to train employees or clients.

Like stated above, organizations can benefit from adjustable serious games is another issue in the serious game design domain. The educational value of the game will lose its power as time progresses. Making a complete new game every time the learning activities do not have the right fit anymore will make the game cost inefficient because its teaching power is only optimal for a short period. In order to make the game more sustainable it should be able to be designed in a customizable way. This means that aspects, game attributes or elements of the game can be deleted, added or adjusted if needed. Customizability could mean that a game can be applied in multiple settings (Alankus, Lazar, May & Kelleher, 2010) or adjustable to new situations with easy to customize software (Mininel, Vatta, Gaion, Ukovich & Fanti, 2009). So, creating a customizable game requires the design team to make some crucial decisions about the how to make it adjustable to different situations as well as making the software adaptable to new insights. Customization results in a game that can stay effective for a longer period then if it was not adjustable. In our case, designing a game from scratch, including customization seems like a nice opportunity to explore this. Like stated before, many see the benefits of serious

gaming but it is this time and money consuming. Creating this educational business game with a high degree of customizability might also help to overcome this issue.

Winn (2008) states that “serious games offer serious opportunities for learning, but only if the game is designed effectively”. In order to contribute to the serious game design domain and to overcome the issues of designing an effective and customizable game according to proven theory we developed a serious game for educational business training. The aim here is to explore the methods, models and tool that have been created to support the design of serious games. This research will follow scientific theories on serious game development and serious game effectiveness and propose an approach for creating effective and customizable educational business games. Applying serious game theories in the educational business games domain will contribute to the domain of serious games by investigating if the educational business game can be used as an *effective* training tool. Developing of this game requires a combination of various steps, models, theories and activities. Therefore, to contribute to the knowledge base of Educational Games we will propose an Educational Game design framework and a more in depth Educational Game design checklist that can be used for the design and development of Educational Games in the future.

3. Research approach

In this chapter, we formulate the research questions, describe the chosen research method and discuss the validity and reliability of the study.

3.1 Research Questions

This research is focussed on designing and developing a serious game, using scientific guidelines and best practices in order to investigate if an effective and customizable educational business game can be developed. This game provides training according to the methods of our case (Anderson MacGyver) and is designed using theories from the scientific domain of Serious Gaming in general as we have applied theories of serious games in the business area. The main research question is therefore formulated as follows:

“How to design and develop effective and customizable serious games for business training purposes?”

Some sub-questions aim to form a basis for the research question. At first we need a clear understanding of design methods that can be followed:

1. *What design methods currently exist in the serious game domain that can be used for the design and development of educational business games?*

An important question to keep in mind throughout the design process is how to keep the educational game fun and engaging:

2. *How to balance the educational value and the entertainment property of a game?*

Creating an effective tool that can be used for a long time because its pedagogical goals fit reality can be achieved by developing a game in an adaptive manner and therefore we want to know:

3. *How to design an educational business game in order to make it easily customizable?*

The games effectiveness should be evaluated. In order to do this in a structured and good manner we want to know:

4. *How to evaluate the effectiveness of an educational business game?*

In the end this should lead to an effective training tool for Anderson MacGyver to use in practise. We want to know if the scientific theories can produce a sound educational business game. This can be answered with our main question by suggesting whether or not our approach can produce an effective Educational Business Game or not.

3.2 Research Approach

Potts (1993) identified two ways of doing research in software-engineering. The “research-then-transfer” and “industry-as-laboratory”. He proposed that “industry-as-laboratory” should be preferred over “research-then-transfer” because laboratory research often fails to influence industrial practice and leads to undervaluation of technology transfer by researchers. In “industry-as-laboratory” the need for the research comes from problems identified from close involvement with industry. Because our problem also comes from industry we support this rationale and aim for utility. Therefore we decided to choose for the design science approach as the research method for this research.

While behavioral science seeks to develop and justify theories that explain or predict, design science aims at solving problems and find out what is effective (Hevner, March, Park & Ram, 2004). March and Smith (1995) proposed that *building and evaluation* are the two design processes that can be produced with design science in the information systems discipline. They also state that four artefacts can be

produced by design science: constructs, models, methods and instantiations. Design science is applicable to this research because we built an instantiation. An instantiation is the realization of an artefact in its environment. In this research we have done both building and evaluation. The instantiation of the artefact is the educational business game that we are going to build and also evaluate to investigate its effectivity.

Peffers, Tuunanen, Rothenberger and Chatterjee (2007) developed a method that can be followed when doing design science. Their Design Science Research Methodology (DSRM) is a six step method that was followed during the creation of our educational business game (Figure 2). In the following subsections we will describe the DSRM and its steps.

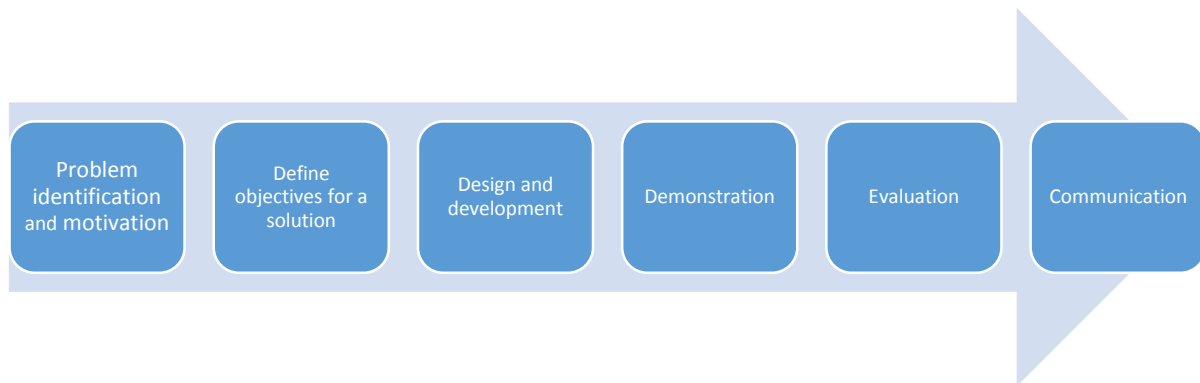


Figure 2, The Design Science Research Methodology model (Peffers et al., 2007)

3.2.1 Problem Identification and Motivation

The problem identification and motivation explores the problem for which a solution is needed but also to justify the value of the research and the solution. Chapter 2 of this thesis states the problem and motivation for finding a solution for both industry and the scientific domain of serious gaming. Over the recent years a lot of serious games have been produced for many different objectives. Because game design is quite a fuzzy subject a lot of these games are made in an ad-hoc way. Consultancy firms are increasingly seeing the benefits of serious gaming for training purposes. Only designing a good serious games is pretty hard and time and money consuming. In order to provide a solution to for this problem, an educational business game is being created that tries to satisfy the needs of industry in a way that it optimizes time and money efficiency. This is done by designing the serious game according to scientific theory know in the domain of serious gaming.

3.2.2 Define the Objectives for a Solution

In order to stay within the boundaries of what is possible and feasible a clear definition for the solution is needed. The overall objective of the educational business game design is to create a serious game for business training purposes and also to evaluate the game. Some sub-objectives have been recognized:

- The serious game should be based on scientific work. We do not only want to propose a solution for the problem of the industry, but also make a contribution to science. This is done by trying to developing an effective educational business game for business training by using known knowledge and theory.
- The educational business game should be developed with the intention to be easily adaptable. The aim is a versatile game that can be used in different situations. It is not within the scope of the project to create a pilot that can be used in different situations but it should be taken into account when developing the game. The serious game should be customizable if other

knowledge should arise or adaptive if new situations are in need of the usage of a serious game.

- The educational business game should be able to be used in training professionals in the domain of IT business. It is not enough to produce a serious game that can be played, for it to be a success it must be an effective training tool. This means that the design process is only successful and useful for others if the product can teach its content effectively.

How these objectives are met will be described in Chapter 4 where different models and methods will be combined to create an Educational Business Game. For the literature study we followed a snowball approach proposed by Jalali & Wohlin (2012) where relevant topics serve as a starting point for finding scientifically literature (e.g. Serious Game Design, Serious Game Development, Requirements for Serious Games, Concept Design, Intended Learning Outcomes). From here on forward snowballing will provide papers that cite the initial paper. Backward snowballing was used to find relevant papers in the reference list of the initial paper. Like stated before Chapter 4 will discuss the theoretical background of serious games and the exploration of techniques, approaches and best practices that should be included into our design for evaluation.

3.2.3 Design and Development

Chapter 5 combines everything that we have learned doing a literature study into a new model. This Educational Business Game design model formed the basis for the pilot version of our game. Also a checklist originated from the literature study with lessons that have to be taken into account during the design and development of serious games. This checklist can be used to explore whether all important aspects according to the literature are included in Educational Business Games (and possible also other serious games). This tool was used on the game that is designed in this thesis but it can also be valuable for other games. We use this checklist to assess our Educational Business Game and see how it satisfies what literature taught us. Next to presenting the Educational Business Game design model we will explain what step were taken mainly in the design process.

3.2.4 Demonstration

A prototype of the educational business game is developed and can display part of the tool that can be used for business training purposes. This prototype should have a small part of a learning activity that satisfies a learning outcome from the beginning to the end. Chapter 6 will discuss the game that was the result of the design and development process and how the game is played can be played. In this chapter we also demonstrate why and how our resulting game satisfies that what has been learned from the literature study. The pilot game is used to demonstrate if the game can effectively train a player on that subject.

3.2.5 Evaluation

The Artefact is evaluated in terms of its effectiveness as a teaching tool. This is needed in order to see the possibilities of methods, guidelines and tools found in literature. The evaluation is done with domain experts and some players that can be seen as the 'target group' for the Educational Game. The evaluation both assesses the effectiveness as a learning tool, but also the fun and engagement that the game possesses which increases the motivation to play the game. How the game was evaluated will be described in more detail in Section 7. The Results and analysis of the results are discussed in Chapter 8.

3.2.6 Communication

We will discuss the results of the evaluation and address the problems we have encountered in Chapter 8. The feedback from test players and experts lead to some suggestions for improving the educational

business design process. This thesis document counts as the communication part of this research where all the findings, results and outcomes are discussed.

3.3 Validity and Reliability

Validity and reliability are important when it comes to quality research that can provide a contribution to both science and society. This section describes how the validity and reliability criteria are met based on the work of Brewer (2000).

3.3.1 Internal Validity

The internal validity deals with the importance of a causal relationship between the independent variable and the outcome variable, and that it is not influenced by another variable (third variable). In this research this validity is guaranteed by applying the scientific theory in all the steps of the serious game design and avoid an 'ad-hoc' method. If the result is an effective playable prototype then it has been created following known theory. A lot of factors in game design influence the effectiveness of a game. We have combined multiple evaluation methods in order to map different perspectives of players experience in order to make a distinction between how players are influenced by the game.

3.3.2 External Validity

With the creation of an artefact for a specific problem in industry it is always the question to what extend the research can be applied in other domains. However the design approach we take might not only be suited for our case but could be used for the development of other educational business games as well. It is true that we clearly define the domain in which the findings can be used are games for business training purposes but many of the relevant methods and tools used to design our game are applicable to other types of serious games as well. We aim therefore to create a design process that is also useful for other serious games.

3.3.3 Reliability

The reliability is concerned with whether the research is repeatable by others and achieving the same results. To ensure the reliability of this research all the design decisions have been documented and all the choices made are based on scientific literature. To ensure further reliability, a clear description of the complete design and development process is given. The design of a game stays a creative process and some decisions are based on the creativeness of the designers. This means that the end artefact will always be different on the content of the game. However the approach of how to design an effective game is the core of this paper which will be described in detail. In order to reproduce an artefact, and test the reliability, like the one that was made in this research, our proposed Framework and Checklist can

4. Define Objectives for a Solution

In this chapter we explore how to satisfy the objectives of this thesis in more detail through the execution of a literature study. First of all we will explore the global overview of the serious game design process which will elaborate on the design process of educational business games and all what is important when designing an effective serious game. In the sections (4.1 – 4.6) after that we will describe the steps of the serious game design in more detail. Secondly we will discuss how to evaluate the effectiveness of serious games in section 4.7. Finally we will discuss how to design the game to be customizable in section 4.8 that was set as an objective. Although both customizability and effectiveness are not part of the serious game design process described by default, because not all serious games are designed with the aim on effectiveness (Mitgutsch, & Alvarado (2012), we still describe them in this chapter while we want to include them in our game design process. Every section will start with discussing different views and arguing the decisions made prior to explaining the models and methods that will be used for the design and development of our Educational Business Game. Every section will conclude with one or more 'lessons learned', which will act as guidelines and requirements for our Educational Business Game design. The 'lessons learned' are linked to the checklist presented in Chapter 5 through their corresponding numbers that are presented between brackets.

Making a good game is difficult but making a good serious game is even harder (Winn, 2008). Rather than trying to optimize the entertainment aspect of the game a serious game must be optimized to achieve a set of serious outcomes. This means that serious games, maybe even more than games for entertainment, require a good design process. In current literature there are many views on serious game design that are told in a slightly different manner but most recognize the same elements during the process. Among others, Marfisi-Schottman *et al.* (2009), Van Eck, (2006), Marne, Wisdom, Huynh-Kim-Bang, & Labat (2012), Annetta (2010), all propose a mixture of play, learning, design and gameplay. We will discuss and combine different ideas in order to get a complete focus on the serious game design process. A lot of these articles and papers on serious game design discuss the different aspects that should be included to develop an effective serious game. What is missing however is a clear chronological process that depicts what steps one should take to design a serious game. This could be due to the fact that serious game design is an iterative process and it knows many that do not need to be sequential (Marne *et al.*, 2012). Because we do want to include a chronological order which we can follow (with iterations) the basis for our design and development will be based on the global vision of the serious game production chain by Marfisi-Schottman *et al.*, (2009).

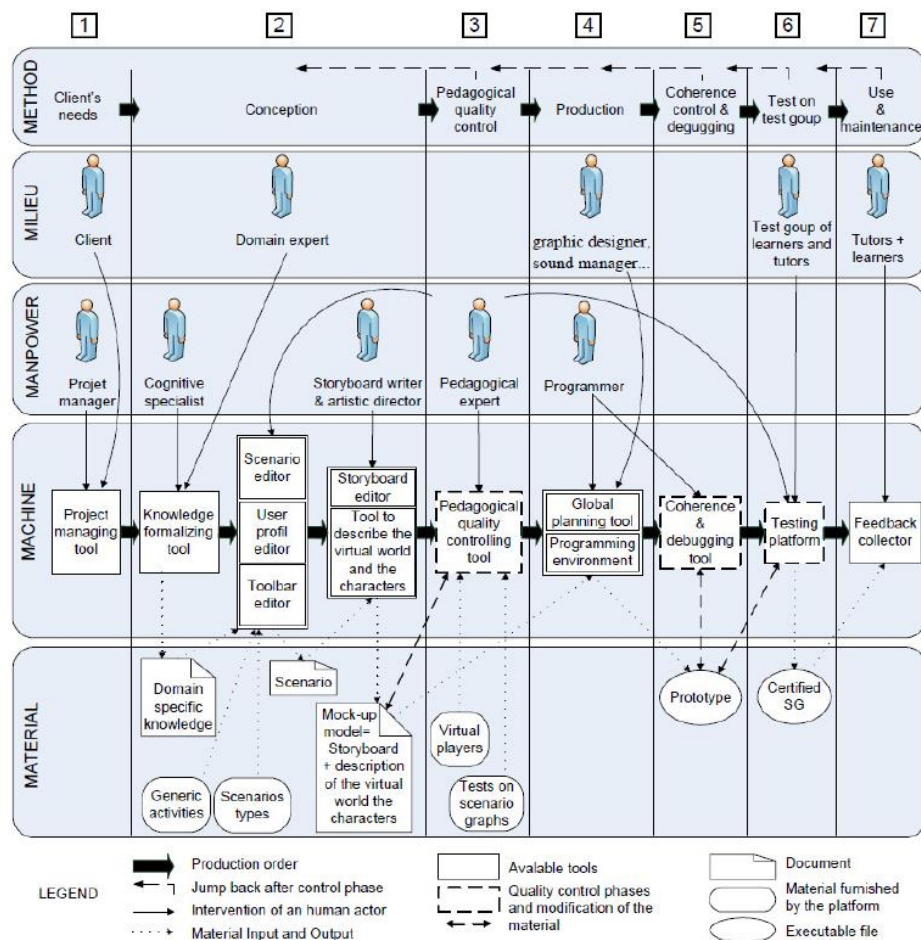


Figure 3, Global vision of the serious game production chain by Marfisi-Schottman et al., (2009)

Also recognizing the different aspects that need to be combined during serious game design, Marfisi-Schottman et al., (2009) provide a ‘global overview’ of the serious game production chain. Their model, depicted in Figure 3, not only shows the different phases but also who should do it, and how it could be done. They distinguish 5 layers during the design process, *Method*, *Milieu*, *Manpower*, *Machine* and *Material*. Where *Method* are the overall steps in the production process (in which we are interested in this case). *Milieu*, the external interference like domain experts. *Manpower* are the persons involved in a certain step. *Machine*, the set of tools that will assist the actors in producing a serious game. The last one is *Material*, which are the documents, models and other files that are created during the different steps.

Although this model tries to cover many parts of the production process, we believe that it misses some depth in explaining how the different steps are to be executed exactly. The steps that are identified here are discussed in more detail in other papers with more sub steps that need to be taken. These other models and theories will be discussed later. Also Marfisi-Schottman et al., (2009) do not discuss the iterative aspect of game design that seems to be very important (Marne et al., 2012). For example testing on a group is a phase in this model while often play testing is required in all phases during the development process (Winn, 2008). Although this model is not perfect in our eyes we will still use the steps as a global overview of our research to give our own design process more structure. We also believe that not everything that is depicted in Marfisi-Schottman’s et al., (2009) design process is useful in our project. We are mostly interested in the different steps and the chronological order and not so much in the people (as we do not have all these different actors) and the materials. Figure 4, therefore, depicts the simplified version of model by Marfisi-Schottman et al., (2009) with the global

overview of the steps in serious game development that we will use as a guideline for our research to figure out which steps need to be taken.



Figure 4, The simplified version of the serious game design steps

1. The first step is defined by Marfisi-Schottman *et al.*, (2009) as: ‘the moment when a client request for a serious game that meets his specific needs.’ It does however not say anything about the actual gathering of these needs. This phase is used to get an image of the domain in which the game should take place. ‘The business’ knows many domains and this phase is a rough narrowing down of the scope.
2. The conception step, described as the phase where a mock-up model is made of the serious game, is more complicated according to Marfisi-Schottman *et al.* (2010). This step builds upon the client’s needs in a more detailed manner. The real problem that needs to be solved with the game will be explored, what need to be taught and how this can be achieved are the parts that will be explored in the conception phase. This is also the phase were game attributes are be designed to match the goals of the game. This part will be based on Marfisi-Schottman *et al.* (2010) because they are more detailed on concept design then the global overview.
3. Pedagogical quality check is there to make sure that the game activities will actually satisfy the pedagogical goals.
4. During the production phase the game will be developed, or in most cases a pilot version of the game
5. Coherence control and debugging is the phase where the game undergoes a series of debugging test in order to create a working and playable game.
6. A test on a group is needed to validate the game’s effectiveness. Game evaluation has different levels and happens throughout the game design process. Therefore the evaluation of the game will happen on multiple stages. We will discuss them in detail later.
7. The last phase that Marfisi-Schottman *et al.*, (2009) identify is the use and implementation phase, which means the actual use of the game as a tool for education and learning. This step is out of scope for this research as we are investigating how to design and develop a game and not how to implement it.

These phases will form the basis for the design and development for the educational business game developed during this thesis. These phases might consist of multiple sub steps that will be derived from other sources.

Figure 5, by Garris, Ahlers & Driskell, (2002) depicts a better representation of how games are designed in practice but does not describe the different parts of game design. In order to address all the different parts in serious game design for educational business training we need to define the different steps clearly.

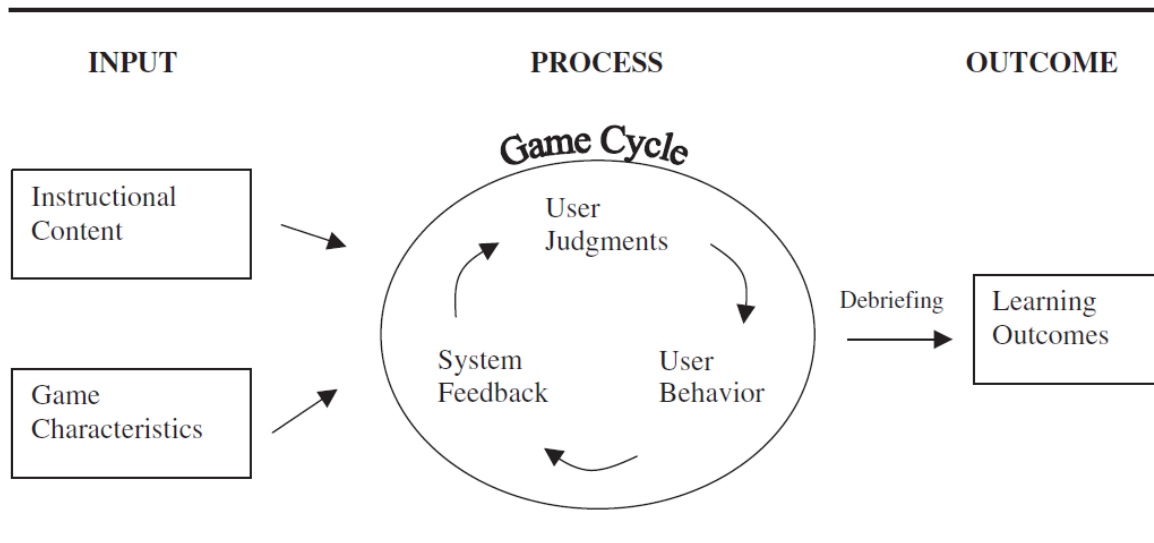


Figure 5, Input-Process-output game model by Garris, Ahlers & Driskell, (2002).

The Input-Process-output basically states that the production phase is the iterative part and it needs input by playing the game with users. We use the successive steps of the global overview to describe the different parts of game design. The actual game design that was done to write this thesis happened in a more iterative way like displayed in Figure 5.

In order to design and develop a sound educational business game we need more in depth knowledge on the different steps of serious game development because Marfisi-Schottman *et al.*, (2009) is too abstract.

Lesson learned 1	In order to identify all the different aspects of Educational Business Game design, a sequential methods prevents that important aspects will be overlooked. However, the actual process of developing a game will need to be an iterative process (44)
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4.1 Clients needs

The first phase is pretty generic and not really in-depth. In this phase the client makes clear that he want a serious game and maybe goes into some detail of the domain in which the game should take place. Because for educational business games the game can take place in various contexts. This gives the game designer some feeling for the context and the domain in which he has to design and create a game. This is also the phase where the client forms an idea of the requirements of the game. Of course these requirements are not definite, but give the design team an idea of the scope and boundaries of the game.

Requirements elicitation. The clients' needs can be very extensive and can come from various sources (Regnell & Brinkkemper, 2005). However creating software that satisfies the client or customers' needs requires a structured way of requirements elicitation, often with the customer. Requirements are one of the most critical activities in requirements engineering and a vital part of software development projects (Carpers, 1996). In order to explore requirements elicitation for serious games, we will discuss some of the work by Zowghi & Coulin (2005). Although requirements elicitation itself is a very complex process with multiple activities, we discuss them here shortly. Also our requirements elicitation process is not as extensive as it would be for large software products. Zowghi & Coulin (2005) explore all kinds of tools, techniques and approaches for requirements elicitation in software development.

Requirements elicitation is about the learning and understanding of the client's needs with the aim of communicating these to the system developers. Following a structural approach this can be done in five steps:

1. Understanding the application domain
2. Identifying the sources of requirements
3. Analysing the stakeholders
4. Selecting the techniques, tools and approaches to use
5. Eliciting the Requirements from Stakeholders and Other Sources

In order to understand what the program should do, one should know where it is for. In the case of creating a serious game this means exploring what should be taught and what other messages the client wants to communicate to the players. Like stated above, resources can come from various sources and therefore it is important to identify the different stakeholders. After identification these stakeholders should be analysed and involved in the project according to Zowghi & Coulin (2005). Involving clients, players and other stakeholders will make requirements elicitation easier. Although these first steps are especially important when making large software products with many stakeholders involved, however also for small groups that want to make a software product it is important to know who is willing to put time and effort into the game to improve it.

In order to capture the requirements needed to create the scope of the game there are various techniques and approaches that can be used. The choice of the techniques used is dependent on the specific context of project and critical to success of the requirement elicitation process (Nuseibeh & Easterbrook, 2000). We explore some of them and discuss those that we believe are suitable for game requirement elicitation briefly.

- *Interview*. Interviews can be used to explore when there is little known about the domain. By conducting interviews the interviewee can get a lot of response to his/her questions. When exploring the domain and the needs for the solution a lot of requirements will be given implicitly. These can be recorded and function as a basis for further requirements gathering.

- *Domain analysis*. Domain analysis can be used to go through related documentation and applications to understand the domain to create an image of the domain and the requirements that should be satisfied. Going through other similar processes or documentation can help to get a lot of requirements early on in the process as the designer already knows what the basic needs are. This technique is often used complementary with other methods that are more in-depth.

- *Groupwork/requirement workshop*. Discussing the solution and its requirements in a group can stimulate the collaboration between stakeholders. The group can discuss the requirements they think are important and discuss them with each other. This often results in a discussion between parties about the most important requirements. In combination with a workshop, where the group is offered a structural method to come up with requirements, this can be a thorough technique in gathering requirements.

- *Brainstorming*. Brainstorming sessions can be used to explore more out of the box ideas. A group doing a brainstorm session can rapidly generate a lot of ideas and requirements without focussing on one in particular. Important here is to keep an open mind about ideas and not to criticise any of the suggestions. Brainstorming can be very helpful for exploring innovative ideas for example a new game that needs to be designed.

- *Prototyping*. Prototyping is a technique that can be used to get feedback on progress already made. This approach seems very suited for developing serious games. Prototyping pushes stakeholders in a direction and they can elaborate on what they like and dislike. Requirements that have been gathered before and those taken into account during the prototype can be evaluated whether or not they have been implemented the way they should be. Adjustments can be made and new requirements can sprout during this process. Prototyping can be used somewhat later in the process because there need to some preliminary requirements and some time to create a prototype in the first place. However it is a good point to discuss progress and gather additional requirements to perfect the artifact even more.

- *Scenario's*. Scenario's somewhat like prototypes as they describe the end product. Scenarios can be used to describe how end users should use the product. This will result in a description of what the solution must be able to do. When it becomes clear what the solution must do a lot of requirement will begin to come clear. This technique can be combined with group work where multiple stakeholders create scenarios in order to gather requirements from multiple views.

These (and more techniques) can be used complimentary or alternatively to gather requirements from the client (Zowghi & Coulin, 2005). With this brief exploration of techniques that can be used for requirement elicitation we have discussed a possible way to gather requirements that are important input for an Educational Business Game.

Lesson learned 2 **Doing a requirements elicitation will help to cover all the needs from the clients and will lead to an agreement between designer and client. Listing requirements will set the scope for both parties and guidance for the designer (45).**

4.2 Conception

Figure 6 depicts the different phases of concept design for effective serious games by Marfisi-Schottman *et al.* (2010). The concept phase is the phase of identifying which problem the game addresses, setting pedagogical goals and describe how the game will function and look like when finished. In this model the concept phase is broken up into 7 steps to guide the different actors through the process but not obligating them to do them in this order. They state that this model can be used to effectively design serious games respecting both educational and fun aspects. Also for each part of the process they provide tools and reusable software parts that might help other serious game designers.

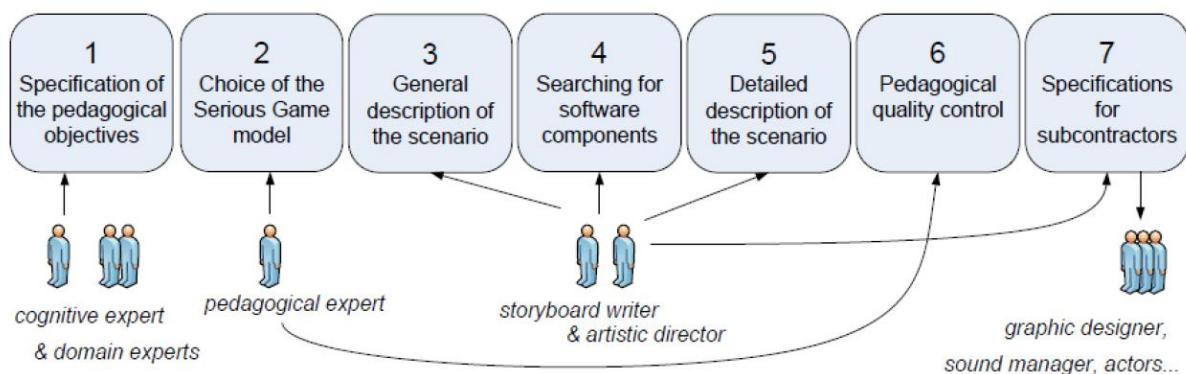


Figure 6, Concept Design process by Marfisi-Schottman *et al.* (2010)

The concept design process in Figure 5 corresponds with steps 1, 2 and 3 (Client’s needs, Conception and pedagogical quality check) of the global vision of serious game production (Figure 2). This model gives some more in depth information on the different aspect of serious game concept design. These sub steps of concept design will be discusses in this section.

4.2.1 Specification of Pedagogical Objectives

Marfisi-Schottman et al. (2010) describe the first step of the concept phase as defining the educational purpose of the game. Setting pedagogical objectives will ensure that the serious game under development pursues to become not only a fun game but more importantly an effective training tool. The purpose of the game should be the transfer of pedagogical content and therefore the fun elements should be built around the pedagogical objectives and not the other way around. Mitgutsch & Alvarado (2012) state that a lot of serious games try to teach but that its content is not always based on proven facts. There are different authors who explore the different aspects of setting pedagogical goals. Yusoff, Crowder, Gilbert & Wills (2009) propose a conceptual framework for serious games with the major components that will assist in ensuring the serious game will meet the learner’s requirements and expectations. Figure 7 depicts their framework that distinguishes capabilities, instructional content and intended learning outcomes that, combined, make up the educational part of the learning activities.

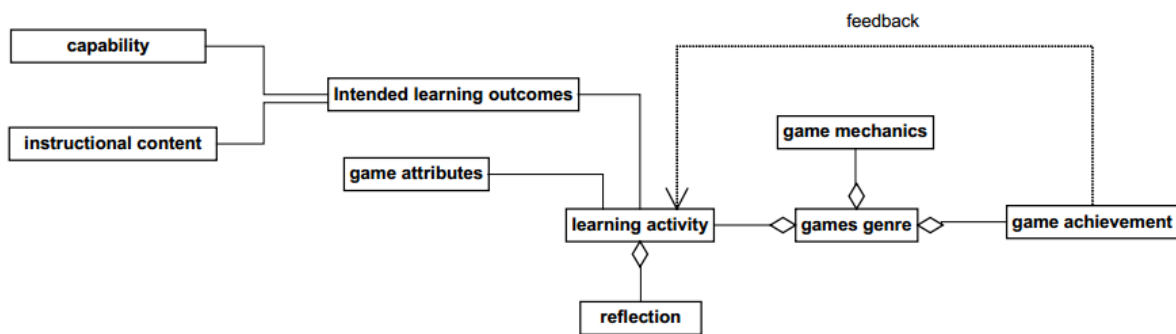


Figure 7, Conceptual framework for serious games by Yusoff et al., (2009)

Biggs & Tang (2011) also did research into the design of intended learning outcomes. Their procedure is basically the same as that of Yusoff *et al.* (2009) only they go into some more detail of creating the intended learning outcomes and making them clear and concrete.

According to Biggs & Tang (2011) six intended learning outcomes is the maximum per skill. More learning outcomes will make it harder to align them with learning activities later on in the game design. Also too, teaching too much content is a risk for achieving the intended learning outcomes as we explained earlier. Therefore it is better to keep the intended learning outcomes at a maximum of 5 or 6. To make the intended learning outcomes more concrete we need to look at what players should do with the content they learn. Knowing what they should do with the knowledge allows us to ask ourselves what the goals of the game should be.

Anderson *et al.* (2001) describe a revised taxonomy of educational objectives based on the work of Bloom (1956). This work basically describes different levels of understanding content and the verbs that are appropriate to use for the intended learning outcomes (Table 1).

Table 1, Taxonomy of intended learning outcome verbs by Anderson et al. (2001)

Remembering: can the student recall or remember the information?	Define, duplicate, list, memorize, recall, repeat, reproduce state
Understanding: can the student explain ideas or concepts?	Classify, describe, discuss, explain, identify, locate, recognize, report, select, translate, paraphrase
Applying: can the student use the information in a new way?	Choose, demonstrate, dramatize, employ, illustrate, interpret, operate, schedule, sketch, solve, use, write.
Analysing: can the student distinguish between the different parts?	Appraise, compare, contrast, criticize, differentiate, discriminate, distinguish, examine, experiment, question, test.
Evaluating: can the student justify a stand or decision?	Appraise, argue, defend, judge, select, support, value, evaluate
Creating: can the student create new product or point of view?	Assemble, construct, create, design, develop, formulate, write.

Once decided at what level the players should ‘understand’ the knowledge, the pedagogical team can start designing the intended learning outcomes. A concrete and clear intended learning outcome should satisfy three conditions according to Biggs & Tang (2011) which are:

- The right verbs are used that correspond with the appropriate level of understanding.
- The content that the verbs is meant to address.
- The context of the content discipline in which the verb is to be deployed.

An example of this could be: *demonstrate* Pythagoras’ theorem while calculating the last remaining side of the right triangle. The intended learning outcomes will be used for the evaluation of the game. With the design of the game we will first focus on the problem, the capabilities, the competences and the learning activities.

In creating learning activities that effectively propose a solution for the problem, Kessels, Smit, & Keursten (1996) describe a method that extracts the capabilities and the instructional content in practice. They propose the eight fields’ method that can be used to create a pedagogical basis for educational programs for organizations (see Figure 6). Their method passes through four levels in order to get the scope for the project clear.

We will elaborate some more on this method because this method generates a clear vision and goal for the creation of a serious game. Combined with some of the terms used by Yusoff *et al.* (2009) we will discuss the most important parts of pedagogical elements in serious gaming that will be used in the development of our own serious game.

The eight fields’ method consists of 8 steps that can be used to define learning activities and evaluate the impact of the activities on different levels. The first four fields (problem, work situation, competences and learning activities) intend to create a clear scope for both client and designer. The other four fields (Process, educational results, functioning and impact) are in place to check if the first four fields are satisfied.

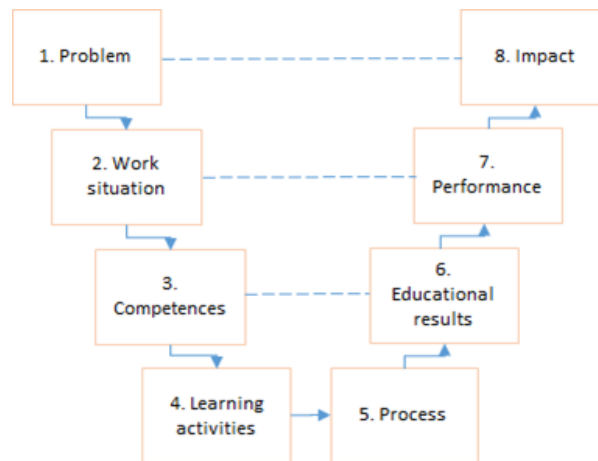


Figure 8, Eight fields model by Kessels, Smit, & Keursten (1996)

These latter fields are in place to evaluate the effectiveness of the game in multiple stages. The vertical dotted lines in Figure 8 define the evaluation of the left fields. They are dotted because they are not part of the process but indicate how they are linked. For example to see if the problem (1) is fixed the impact (8) has to be evaluated in the business. The same counts for the work situation (2), whether or not the desired situation has been met can be evaluated by looking at the performance (7) of the employees. The Competences (3) that has been taught can be tested by the educational results (6) of the game itself. The individual learning activities (4) of the game can be tested by going through the processes (5) and check if they can be played. Because this model can be applied in multiple steps of the game design process we will discuss the model in different sections. We will discuss step 1, 2, 3 and 4 from the eight fields' model here because they can be defined as the specification of pedagogical learning objectives. Step 5 is the evaluation of the learning activities and will be discussed in section 4.4, pedagogical quality check. Step 6 is the evaluation of the effectiveness of the game and will therefore be discussed in section 4.9. Steps 7 and 8 also evaluate the effectiveness of the game but in the long term. These are out of scope for this thesis research but will be discussed as well in section 4.9.

1. Problem. In order to get an effective game it is good to discuss the problem that the game needs to solve once more with the client. Although the client already told the designer more or less what he wants in the first step, *client's needs*, the problem needs to be clear in order to create a game that really solves the problem the client wants to see fixed. However, this problem needs to focus on what is going wrong in the organisation and should not bring a solution itself. A good example would be something like: *'to reduce the number of sick people'*. *'Employees should have more insight in...'* is a bad example because it implies that employees should get a training and is therefore more focussed on a solution. Taking a quick approach and skipping the problem can lead to failure.
2. Work situation. The second step in defining the goal of the game is describing the situation that is desired. So after the problem is clear it is good to describe what an ideal situation would be. This ideal situation shows the shortcomings and what capabilities are missing in the organization. A capability is the ability to perform or achieve certain actions. The problem shows that something is wrong and the desired work situation shows what capability(ies) the organization is lacking. Capability skills come in three different forms that can be taught, which are: cognitive, psychomotor and affective skills. Cognitive skills include capabilities like recall, analysis, synthesis and evaluation. Psychomotor skills are the well-timed physical skills like coordination, movement, speed and strength. Affective skills are the capabilities of identifying, adopting, and valuing appropriate attitudes and points of view (Yusoff *et al.*, 2009). Capabilities

can be seen as the high concepts that the teacher wants to be taught, an activity that successfully can be performed. In business language a capability is a unique activity that the business performs to achieve a specific goal. Basically this step is to find out what capabilities the game should teach in order to solve the problem. Of course it is not possible to include all capabilities in a game and therefore there should be a prioritization of which capability(ies) are to be included in the game

3. When the necessary changes are clear it is time to look into the competences the participants should acquire in order for the organization as a whole to master the capability. The focus here is on competences because knowledge alone is not enough to create the desired change. If the lack of skills is not the problem among the participants then teaching is not the solution. This step focusses on the capabilities and who is involved in carrying out the capability. So especially in an Educational Business Game, the different roles need to be identified that are partake in the capability that the game wants to train. The persons involved in carrying out the capability all have different competences that they need to master, as a team, the capability. So when identifying the competences the designer needs to know what functions will be involved in the educational business game, as companies have different employees doing different things, and what competences they should have for the specific capability.
4. The learning activities need to be defined here. They should allow the participants to learn the competences and make them their own. Also the learning activities should aim at reaching the desired situation and the solution to the problem that is underneath. Specific knowledge should be defined and put in the learning activity to teach the competences. The instructional content is the intended subject matter that the player should learn to master the skill. This is the knowledge behind the capability that can consist of facts, procedures, concepts and principles (Gilbert & Gale, 2007). The instructional content should be concrete in order to make them useful and should be based on proven knowledge. Also it is good to make sure that not too much content is embedded into the game because when teaching too much, players will not have enough time to go into things in depth (Gardner, 1993).

Intended learning outcomes are the goals that the teacher want to be achieved by the players when playing the game. This is the combination of the capability, competences and the instructional content. For example if a class of children needs to learn math as a skill than Pythagoras theorem, among other things, is part of what is intended to teach the children. A learning outcome could then be that these children should be able to calculate the last remaining side of a right triangle.

Game attributes are the last concept on the left side in Figure 7. The Game attributes are the gaming elements that should be kept in mind when it comes to game based learning. These elements support the learning activity and engagement in a game. These aspects are very useful in order to design a fun and engaging learning game. However we believe that this aspect is not explained well enough in the model of Yusoff *et al.* (2009). We will discuss the game attributes and other game design aspects in section 4.2.3.

Lesson learned 3	In order to reach a desired work situation, and with that, solving the problem (3), the designer needs to look at different important educational elements. The intended learning outcomes should help to solve the problem (1). The capability(ies) should be identified that wanted to be taught and the level of understanding that is aimed for (2). The underlying level is the competences (4) that make up the capability and the content that is needed to teach them should be defined. The content in the game should be realistic
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	and should have a reliable source (4). The competencies and its content describe the intended learning outcomes that need to be taught with the learning activities (5).
Lesson learned 4	Do not teach to much content as players might not have enough time to go into everything in-depth (6).

4.2.2 Choice of the Serious Game Model

The serious game model is how the learning activities are presented to the participants. The serious game model is based on the capabilities that need to be taught and the level of understanding that is needed to reach the desired situation. When defining the intended learning outcomes also the level of understanding is defined. In the case of our educational business game this is at the level of understanding and to some extension applying. We want the players to understand the problem and experience the difference if they apply the learned knowledge in the game. Biggs & Tang (2011) describe the models that are learning activities suited for 'understand' and 'apply'. Three learning situations they distinguish are *case-based learning*, *group work* and *workplace teaching and learning academy*. Some suit better in particular contexts than others and the best should be picked in the educational business situation at hand. We describe these in some more detail and which serious game learning model is best for our case.

Case based learning is presenting the learning activities in the form of a real life case or a by creating a situation that is near real. Case based learning is a method to create a bridge between theory and practice, between declarative and functioning knowledge, and is useful for professional education (Biggs & Tang, 2011). The player learns certain knowledge by investigating a certain situation and is asked to make decisions that he/she would take in that situation. This situation could be an event, a real life situation, a business with a problem etc. Players can learn from the case by giving their own opinions or trying to find a solution to the problem stated in the case. This however can be done individually and does not require player/learners to carry out the case themselves, merrily to rethink the decisions that were made or propose certain solutions.

Group work is a form that requires people to play together in reaching a goal. This is what we want with our Educational business game. People need to work together in order to get new knowledge insights, develop better judgement skills, understand other people's actions and can be used to apply theory in practice. Group work can be used to start a discussion and let people learn from each other by giving each other insights of things they never thought of before. Or to give players a subtasks that need to be completed to solve the main task (Biggs & Tang, 2011). Group work is a good method to let people learn from each other but does not necessarily mean that they should work together towards one goal. Group work could be used just as good for a brainstorm session and therefore not exactly what we are looking for in the development for this Educational Business Game.

Workplace teaching is a form of learning that requires the learner to be a part of the organization and to integrate in actual work. The learner, in most cases a student, is a long term intern in this teaching form. Although this is a very intensive, in-depth and good method to teach persons about complex activities in companies, this is not a good model for a game as it cannot be applied in games.

In the Educational Business Game requires the players to collaborate as a team in order to reach the goal of the game. Where case based learning can be used to present learners with a case that requires them to make decisions and find a solution for a real life case, the group work lets players work together. The optimal solution would be to combine these two worlds in order to create a teaching form that stimulates collaboration and trains people competences that can be applied in the

professional work place. A simulation is a teaching form that combines these two elements in a single teaching model (Biggs & Tang, 2011). In a simulation multiple players are not only giving suggestions or solutions, but actually ‘(re)play’ a certain situation or case. This enables the teacher to train a group to collaborate and reach a goal as a team and teach certain knowledge that is applicable in real life. The simulation simulates real practices and therefore makes the game a training tool that teaches players competences that they can apply in the workplace.

<p>Lesson learned 5</p>	<p>A simulation is good method to combine applying knowledge, collaboration and a realistic case that players can relate to in their daily work and on that account a good serious game model for the Education Business Game. This does not mean that a simulation is the best option for all Educational Business Games. In every situation it will be good to rethink the form of the game in which the content and knowledge is presented (7).</p>
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4.2.3 General Description of the Scenario

It is true that for an educational business game it is believed that setting educational goals from the beginning is important, but a game is more than some educational goals. In the general description of the scenario, the game elements are connected to the pedagogical goals. This is also the step where learning meets fun as game play elements are added. This section takes a closer look at play elements that can be used to create a more effective Educational Business Game. As Kiili (2005) notices, game play is the most crucial feature of game design, and good game play and can result in a more motivated player (Winn 2008). This also will make the serious game more effective because players will be increasingly motivated to continue with the game which makes the learning activity longer. Because ‘play’ and ‘fun’ play an important role in ‘traditional’ games and videogames, this section will discuss what is known about the design of the different elements in ‘traditional’ video games. We will highlight parts that play an important role in designing a more fun and engaging Educational Business Game. These *lessons learned* will form a new framework that we will use in the design of the Educational Business Game.

The general description of the scenario is defined by Marfisi-Schottman *et al.* (2010) as: ‘*The storyboard writer and the artistic director need to work together to structure the pedagogical scenario and match it up with a fun scenario. They mainly have to describe the elements of the virtual environment such as the storyline, the characters and the different places where the action will take place.*’ As described above before we can link the learning activities of a serious game we need to look at the game elements of the serious game.

What makes a serious game a game? Fullerton (2014) makes the distinction between formal-, systems- and dramatic elements. Formal elements create the game’s experience, they describe what the game does and how it is played. Dramatic elements engage the players emotionally by giving context to the gameplay. Dramatic elements are used to engage players and make the formal elements into a meaningful experience. There are many others that have investigated the different elements in game design. Salen & Zimmerman (2004) describe the design process of games like Fullerton does only with other terms. Hartevelde (2010) explores the both meaning and fun in games, but the game aspects stay limited in their explanation. Other examples are: Cohen & Bustamante (2012) & Rabin (2010) who explain how games can be designed in more or less the same way. Winn (2008) created the Design-Play- and Experience (DPE) Framework that depicts how designers can influence players through play, see Figure 9. The DPE Framework is a complete overview of the different elements in serious games and explains that the experience by the player is received by playing the game. The designer designs the game and the player plays the game. The designer has only direct control over the design and not

over the way a player plays the game and therefore also not over their perceived experience. This calls for prototyping and play testing, but before that a logical distinction of the elements in a Serious Game. This is what Winn (2008) does in his DPE Framework. According to Winn there are four subcomponents of Serious Game design, learning, storytelling, gameplay and user experience. The first subcomponent: Learning and how to achieve a pedagogical game, has been handled in section 4.3.1.

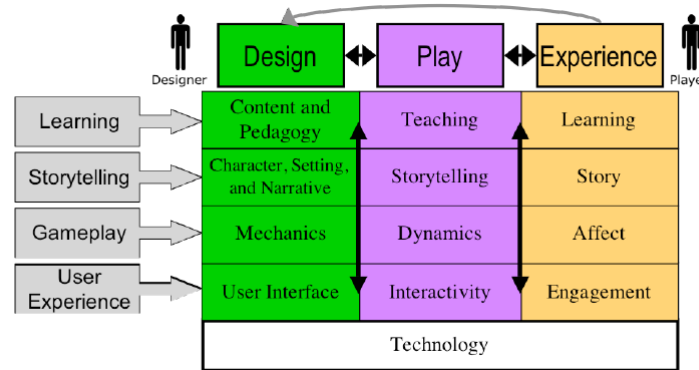


Figure 9, DPE Framework from Winn (2008)

Although Winn (2008) gives a complete overview of the elements in game design, we believe that other authors are more in-depth in these elements, making their knowledge more useful. Fullerton (2014) distinguishes basically the same elements but describes them in much more detail. The storytelling subcomponent is similar to the dramatic elements of Fullerton (2014) and the gameplay component is the same as the formal elements and systems dynamics combined. In this thesis we will follow Fullerton (2014) because the distinctions of the different elements is very clear, but also more in-depth than the work of Winn (2008). We will first discuss the formal elements because we believe that the dramatic elements are influenced by the formal elements.

Lesson learned 6	Games consist of many ‘game elements’ that all play important roles. These should be included when making a game. Fullerton (2014) is very clear on the distinction of different elements in game design.
Lesson learned 7	Although Winn’s (2008) model gives a complete overview of game design elements, it misses some in-depth explanation in order to create our own game. There are some extra elements that can be included to get better satisfaction for our educational business game.

Formal Elements

Game play can be defined by the following formal elements that are present in a game: Players, Objectives, Procedures, Rules, Resources, Conflict and Outcome (Fullerton, 2014). Formal elements define the setting of the game and how it is going to be played. All games, both traditional board games and video games are derived from these elements. By default, formal elements are also present in Educational Business Games as they are games just as well.

- The *Players* element is concerned with the role of the players, the number of players in the game and the way they interact in the game. The number of players and the way they interacts however defines how the game is going to be played. To define the number of players that can play together (or not, if it is a single player) depends on the type of game. For the simulation

game the number of players can easily match the roles that the designers want in the simulation. For a flight simulator this could be one player, the pilot, and for a military game this could be the whole squad. The number of players depends on the game and in case of a serious game on the capability that needs to be taught. The game can require multiple ways of interaction of different players. The game can be 1 versus the game (single player) but also player versus player (multiplayer). Figure 10, depicts different types of player interaction patterns that can be used to play a game.

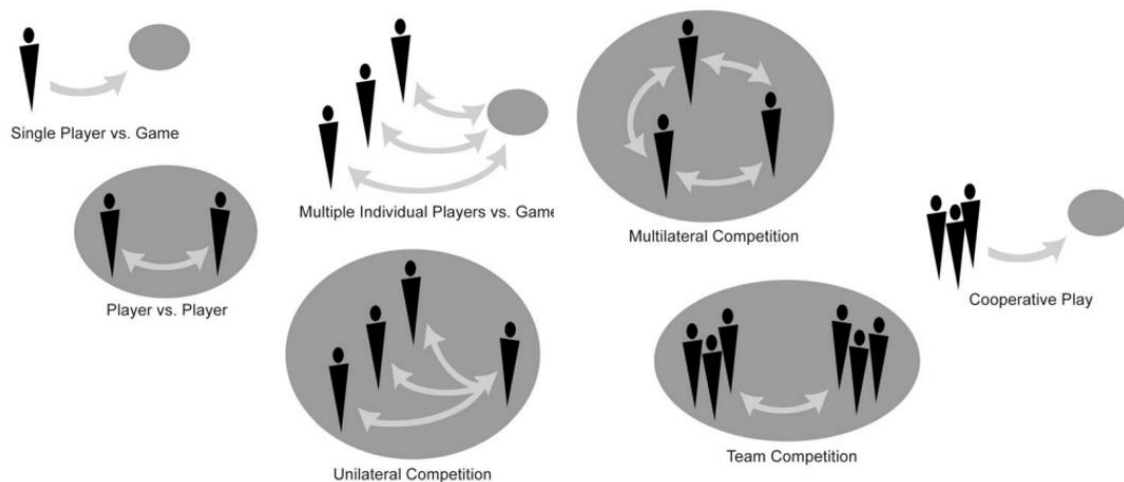


Figure 10, Players interaction patterns by Fullerton (2014)

Lesson learned 8

The design team should discuss what kind of players play the game. Who is going to play our game? with how many at the same time and why this many (8)? How do players interact with the game, will they play against the computer or against each other (9)?

- The *Objectives* element gives the players something to strive for and define what players have to accomplish. These 'goals' are the reason to play a game. A game has often one main goal but can also have multiple sub-goals. For instance when the player needs to capture the enemies base, and can get bonus points for killing a certain amount of enemies. This could make the game experience richer because there is more than one challenge for the player. Also a game that requires more than one player, the objectives of these players could be different. In the board game Ludo, all players have the same objective in the game, get all four tokens to the finish. However videogames like World of Warcraft do not have a clear objective that makes players win but requires players to have different objectives in the game in order to reach the main goal of the game. Business Games that tries to simulate a real company should have real objectives to create a more holistic tool. Among many others these could be profitability, market share, growth and shareholder value (Doyle, 1994). What the objectives are exactly depends on the specific game and its intentions. The Educational Business Game objectives should be a balance between challenging and achievability. A challenging objective creates fun and motivates players, however if the objectives cannot be reached the player loses this motivation because the objective is too hard to reach.

Lesson learned 9

All games should have an objective, also serious games or Educational Business Game. Objectives should be engaging but also achievable by players (10). Note that this objective is not the pedagogical objective but the game objective that makes the game fun and engaging to play. Different players can have different goals (12) or there could be multiple goals that make the game more interesting (11).

- A *Procedure* is a set of actions that are executed in a certain way. In a game these are the methods of play through which players achieve their objectives. The procedure has to be broken down in the different actions a player can undertake. In Ludo, the procedure is something like: throw the dice, if it is a six put a new token on the field (unless all tokens are on the field), for any other number move one of the tokens towards the finish. After this the turn of the player is over and the other player can throw the dice. Games can have different types of procedures during play: *Starting action*: how to put a game into play, *Progression of action*: Ongoing procedures after the starting action, *Special actions*: Available conditional to other elements or game state, *Resolving actions*: Bring gameplay to a close. These different procedures occur during different states of the game depending on the progress. In a game not all players need to have the same procedures, depending on their objectives and their roles players can have different procedures. When designing procedures it is good think about which roles needs different procedures and also who can use certain procedures. Different players might need different procedures and their procedures might be limited by place and time. Take into account where a procedure takes (limited by location) place and when (limited by turn, time of game state). Procedures in multiplayer games should also be balanced. This means that players have (almost) the same amount of stuff they need to do in the game. If a certain activity requires one player to do nothing for a half an hour he/she might lose interest in the game. The procedures of different players should intertwine to create a dynamic system, we will talk more about the games dynamics later. Another way of thinking about procedures is the way players access it. Directly or by physical interaction, or does this happen through a controller or other input device?

Lesson learned 10

For the Educational Business Game the different procedures for the various roles should fit together to create a realistic game (14). For Educational Business Games they should represent realistic business procedures in order for players to learn something they can use in their daily work procedures. For other games these game procedures do not have to be realistic but they should aim at acquiring the content (13). These procedures should be understandable for players and the design team should create procedures where all players are engaged in reaching the objective.

The procedures of the Educational Business Game should be designed in a way that the procedures of different roles fit together and are intertwined to form a holistic game. Procedures also require certain rules in when or where these procedures are available, when they start or when they finish. The Business Simulation Game need procedures that shape how the game is played. The different roles in an organization have different objectives and could therefore have different procedures. These different procedures need to be designed in such a way that they reflect some sort of realistic business procedures, but keeping in mind that the game should have engaging procedures for all the players. Engaging procedures means that they have actions that require the player to do something that engages him/her but also that

they have some activities throughout the duration of the game and not only, for example, at the end of the game.

- *Rules* regulate actions by players and also define what is part of the game and what is not. Rules can be object and concept defining, action restrictors or effects determining. Players need to know what to do *Rules* in games define the allowable with different objects and concepts in the game. Rules that define objects and concepts help players know how to play the game. For example, in chess, the queen can make certain moves. The rules about what moves she can make define how the game can be played. Rules can state what players can or cannot do, or they state that if 'x' is carried out, there is a rule that 'y' happens. Applying rules in games is necessary in order to create a fair and playable game. But when adding rules to a game the designer should think about how he does this. Rules can be laid out in a document that is typical for board games. For digital games they are often implicit in the program itself. It is good to think about how to enforce rules upon players. Keep the players in mind when designing rules. Too many rules might make it difficult for the players to understand the game. Leaving rules unstated might confuse the players as well. Creating rules can also help designers to lead people toward the learning intentions of the game. Some activities might be off limit to keep players in the learning domain.

Lesson learned 11

When designing an Educational Business Game, rules should be designed that create boundaries for game play. In a simulation these are limited to the existing rules in the business domain but also rules that limit the player even further because the game cannot simulate everything that can be done in real life. For serious games in general, rules are important to show boundaries of what is in the game and what not. This also limits the players of what is possible and forces them towards the leaning activities (15).

- *Resources* can be used to accomplish certain goals, in real life and the same counts for games. By definition, resources must have both utility and scarcity. If resources do not have utility they are useless. If resources are not scarce, they will lose their value and the game will be too easy to play. A good balance in how many resources the players receive or are able to get can make or break the game (Fullerton, 2014). Examples of resources could be: lives, units, health, currency, power-ups and time.

Lesson learned 12

The Educational Business Game should consist of realistic resources that limit the players and require them to make choices (23). The resources need to be designed in a way that they make sense and requires players to think about how to spend them. Resources in the game should fit in the context of the game, they can be part of the learning activity (16). If the game wants players to be more responsible with, for example, electricity, this should be one of the resources that is limited.

- The *Conflict* elements of a game, created with rules, procedures and situation, do not allow players to accomplish their goals directly. In a game a player can encounter *obstacles* that prevent players from reaching their goals. Like corners in formula 1 or mental puzzles in adventure games. A game can also have other players, *opponents* that create conflict. In addition to obstacles and other players conflict can arise from *dilemmas*. Dilemmas cause players to make choices on how to play the game without a clear best option. These conflicts make the game more interesting but also more realistic. In real life business organizations also

have to cope with conflicts like conflicting interests within the company or competition from other companies.

Lesson learned 13

The game should be designed in such a way that conflicts arise between the players, and between the player and the game (17). Conflicts should be engaging but also not too hard, it should strive to find the correct balance (18).

- The *Outcome* can be seen as the end state of the game that should be uncertain until the end in order to hold the attention of the players. The outcome of the game could be to win or lose, though this is not always necessary. Simulation games might not have a predetermined win condition but continue to reward players other ways than winning or finishing the game. Think for example about flight simulation games. But the training tool cannot continue forever. There should be a clear end state after which the simulation and actions of the players will be reflected up on. The outcome of a serious game should be that the players achieved something that requires feedback on the way the players played the game. The outcome of the game should be a certain point in time, or when a certain goals has been reached. At this point the game has been played and the results are the outcome of the game. This could be win or lose, Different play styles result in different outcomes. The outcome of a serious game should be dependent on whether or not if players have gained enough knowledge about the topic. The way the players play the game should have influence on the outcome which makes it uncertain what the outcome will be.

Lesson learned 14

The key in designing a serious game is that the outcome should give some useful insights for the players. This is what makes the game a training and a learning tool. The outcome should reflect on whether players have gained knowledge about the topic. Did they perform good or not, and also why they performed like this and what can be improved (19).

Systems Dynamics

Games are systems just like the human body. They have different elements that fulfil roles in order to make the whole work as a system. Systems dynamics describe how the different objects in a game interact. Systems dynamics can be divided into objects, properties, behaviour and relationships (Fullerton, 2014).

- System Dynamics starts with the *objects* that are in a game. Objects could be a game piece, an in-game concepts (like the bank in monopoly), the player himself etc. Objects in a game are interrelated with each other in games which makes it a system.
- *Properties* are qualities or attributes that define physical or conceptual aspects. Objects that have properties can do certain things that other objects cannot do. For example the rank of a chest piece or the Financial Manager's ability to invest money in a business game
- *Behaviour*. These are the potential actions an object can make. For example run, jump, shoot etc. In the Educational Business Game the intention is to stimulate cooperation between players. Interaction is behaviour as they can use communication as an action in the game. Their behaviour will reflect in the choices players make, there should be feedback for this behaviour. Spending money too fast will result in an angry boss, driving to hard will result in a police chase.
- *Relationships*. Objects can have a relationship to each other. An example could be a team of soldiers or a board of a company. Also the board with managers have a relationship. This

relation is different that board members amongst each other. These kinds of fundamental relationships need to be visible in the game.

Lesson learned 15

During the design of the Educational Business Game it is important to think of the game as a system in were different objects interrelate with each other. How the different objects are related should be identified when designing the game. Interrelations between objects should be a reflection of real organisations in order to create a life like simulation of an organization. The behaviour a player shows will need a proper reaction in order for the player to see that their actions and behaviour have impact (22). The designers should identify how players interact with each other to advance in the game (20), what their actions can be and what in-game actions they can use to help them in the game (21). For example, in the business simulation game, some players go over budget and can spend money where other do not have that ability.

Dramatic Elements

Creating dramatic elements in a game enables the designer to make the game more fun and engaging. A story might want the player to continue playing because he wants to know how it ends. Dramatic elements are *characters*, *the setting* and *narrative* according to Winn (2008). We added *challenge* as a dramatic element because a game needs to be challenging in order to make it fun and engaging. A game that is not a challenge will not be successful (Fullerton, 2014).

- *Characters*, Isbister (2006) identifies four layers that shape characters and the players experience through the eyes of the characters. These are *Visceral Feedback*, *Cognitive Immersion*, *Social Affordances* and *Fantasy Affordances*. *Visceral feedback* is the adaption of the player to the game world to the affordance of the powers of the character. In game characters can have powers that allow players to do things they cannot do in real life, this influences the way players play and how the character is designed. *Cognitive Immersion* is ability of the player to make decisions within the characters situation and therefore they need to consider what actions to perform. The player must map herself cognitively onto the character and think in the way of the game. Cognitive immersion calls for creating a smooth and intuitive cognitive immersion for the player. *Social Affordances* is the way a character is emerged into a social setting. It can be that the character has a clear social role and personality or that there are social cues in multiplayer situations. However the player will feel more immersed in the role of the character when the player will get his social role reflected at him/her. In the sense of the Educational Business Game this means that a player will be more immersed when his character perceives social affordance in the game. This happens through interactions with other players. If a player makes an undesired decision against social cues, other players will react to this. This will give the player feedback of their social affordance. *Fantasy Affordances* is the way a character can interact with fantasy and fictional elements in the game. It is believed that fiction or fantasy is an outlet for exploration and processing. A characters powers can speak to player's real-life hopes, fears or issues.

When designing a game these four layers can enhance the immersion of players into their characters. However not all games require all the four levels that enhance character immersion. The core game-play of some games can lead to irrelevance of some of the layers (Isbister, 2006). However, when designing the characters of the game it is good to focus on all

four the aspects in order to enhance the way a game can immerse the player into the game. This also counts for Educational business games because immersion might increase the learning power of the game. Based on the decision that was made in the selection of the Serious Game model the shape of the characters immediately take their forms. A simulation of a business for business training requires the characters or roles in the game to be just ordinary people. Typically, Educational Business Game have some roles that represent functions from a business. These roles are in themselves the characters in the game.

Lesson learned 16

In the creation of the different characters in the game, the designers should carefully think about the abilities of the characters and how they fit with the character (24). The characters should be designed in a way that their abilities with the expectations of the players (25). In an educational business game this means that characters should fit with the roles that exist in real organizations and the corresponding abilities and interactions with other characters. Characters relations should fit the social setting (26), a boss that get bossed around by his employees will not add to the social affordance, the other way around however could represent the daily routines a lot better. We also saw that fictional elements can be good for people to escape reality and explore their desires in a secure environment (27).

- *Settings* can be very distinct in games. The setting can shape the characters and the narrative of the game. Without a setting the game would become too abstract. The setting could be part of the story when it is important. If the player portrays a pirate the setting of a supermarket would not make a lot of sense. Or playing football in space would be an interesting idea but might not be what everybody is expectation from a football game. However playing a football game without a setting would make it to anonymous. In these cases the designer wants to add a stadium to the game in order to make the experience richer. The setting does not always have to be realistic, it can also make the game more engaging if the setting is not of the capability that is thought. Teaching math for example does not need a classroom as a setting, this could even make the game less effective. However for Serious games it would be better to think about the setting and if it adds to the learning activities. In an Educational Business Game that simulates an organization the setting is basically fixed. The setting of the game will be an organization that faces typical business problems within the domain that is set for the game. However the setting can be enriched by the narrative around the setting (discussed after this). Also here applies, creating an educational business game were people have to come up with realistic solutions for a company where players have to kill dragons will not give the players the idea that they learn something for their daily lives.. The game should in this case simulate an organisation that has to make decisions. The setting should give the people the idea that they are actually involved in a company.

Lesson learned 17

The setting is an important factor for placing the players into a perspective. This setting can influence the effectiveness of the game (28). The setting in an Educational Business Game is pretty much fixed if the characters are business employees with certain functions, which is, an office.

- *Narrative* or story can be used to make the game more appealing to the players and give context to the things they need to do. It is very important to keep the progression of the story uncertain. If the outcome of the game is already know it might demotivate players to play the rest of the game. The problem with games is that the story has to be resolved by the players.

In movies or stories the director tells the story, however the way people play games is different and therefore the story can be different. Using this way of storytelling, affected by players influence, the game unfolds itself in a branching story structure. The story alters by decisions the players make and this will give them a different story. Some games only need a backstory that gives the player some momentum. The progression of the story does not depend on the choices of the players. What kind of story the designer chooses depends heavily on the game genre. An adventure game is more likely to have a branching story because the player chooses his/her own path. A simulation game however needs little or no story because it simulates real events (flight simulator). For an Educational Business Game, that will simulate a company, it would be smart to create a background story of what the organization is doing. This will give the players some context to what they are doing. The story in the simulation game will not change based on the decisions the players make. The outcome of the game will change based on the decisions that will make each play unique but the story stays the same. For example the players are not allowed to choose that the organization starts a football match. This would alter the story greatly but does not make it an effective training tool. When designing a (background)-story for a game it is important to follow a certain story path that begins with introducing tension but builds up toward an event or main happening in the game. Figure 11 depicts the story over time. In conflict the tension in a game gets worse before it gets better, resulting in a classic dramatic arc. This implies that the game should work toward a big event that keeps the player playing the game. This could be killing a boss in the end of a game or it could be an event in a business simulation that needs to run smoothly or it will have disastrous impact on the company.

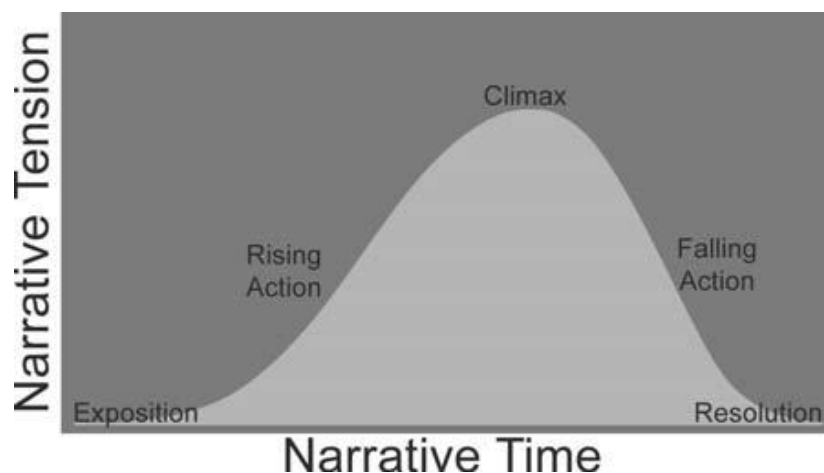


Figure 11, The classic dramatic arc of storytelling (Fullerton, 2014).

Lesson learned 18

Serious games have narratives that bring players toward an engaging momentum to play the learning activities (29). An Educational Business Game needs a background story that positions the game and let players know what they are doing. It is a background story because this is not as important as the activities that they should do. The narrative is only there to engage them into the activities they are doing. The narrative, and its activities, should have a dramatic arc which states that the story should have a climax later on in the game (30).

- *Challenges* are tasks that need work to accomplish. Not just difficult tasks that need a lot of work, but just the right amount of work so players find them satisfying and enjoyable to complete them. Fullerton (2014) identified some points that challenges in games should satisfy. First of all the game should generate ‘flow’, a term coined by Csikszentmihalyi (2014). When people begin an activity, their ability is usually low, if the challenge then is high they cannot complete the task and they will get frustrated. If their ability rises, but the challenge stays the same, the people will get bored of the activity and stop continuing. If, however, the level of the challenge rises as the ability rises the person will stay in balance between frustration and boredom that is called flow. Flow can produce an experience of achievement and happiness. This concept is very interesting for game design because the balance between challenge and ability is exactly what a game should achieve through gameplay. Also in games that want to teach stuff it is good to match the challenge with the abilities of the player in order to make it an enjoyable game and let them to play longer and learn more effectively. The concept of flow is depicted in Figure 12.

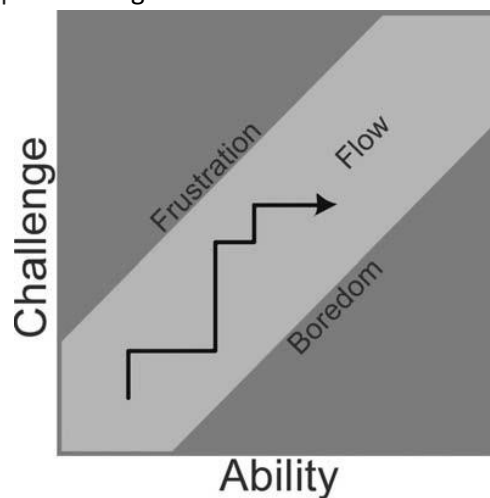


Figure 12, Flow diagram by Csikszentmihalyi (2014).

Flow can be achieved by creating challenging activities that requires skill. If players have to complete tasks that require no skills, the task will be meaningless. Tasks should be a challenge for players in order to engage them and keep it interesting for them to play because they have the feeling they achieve something. Another way to get players into the flow is letting them use all their relevant skills that are important for game play. Multiple skills challenges players, they will have the feeling that they can show their skills. To promote flow even further in the game the designer has to set clear goals and give feedback. In real life we do not always have clear goals, but in the flow experience we know what we have to do. This enables us to do the right things, and if players fail, they will receive feedback from the game. This enables players to adjust their actions in order to achieve and progress. Progression is important because if players get stuck to long the challenge is too high and they will get frustrated. Setting clear goals and giving feedback is therefore an important part of keeping players into the flow of the game. Flow keeps players concentrated on the tasks at hand that enables them to complete the task. For serious games flow can make the game more effective as players are more engaged and pay more attention to what the game is teaching them (Winn, 2008). Challenging activities that balance between frustration and boredom are important for making an effective Educational Business Game. This part will also need some play testing in order to see what parts are too hard or perhaps too boring for players. The gameplay can be made

more fun keeping these points in mind that will likely make the game more effective. The Educational Business Game will not only be good teaching tool but also fun to do.

Rewards might not really get people into the flow of the game but it is a way of keeping people playing the game as it gives them an extra motivation to keep playing. Not only making progress and solve problems and puzzles but now they also receive a reward of the job they did. It is also a way of encouraging players to do a better job. For example, the game could give extra rewards for better results. Winn (2008) states that a designer usually want to balance reward giving in such a way that most rewards will be awarded during the most challenging parts of the game (See Figure 13). This to keep the players playing but also to motivate them to learn and overcome challenges in the game.

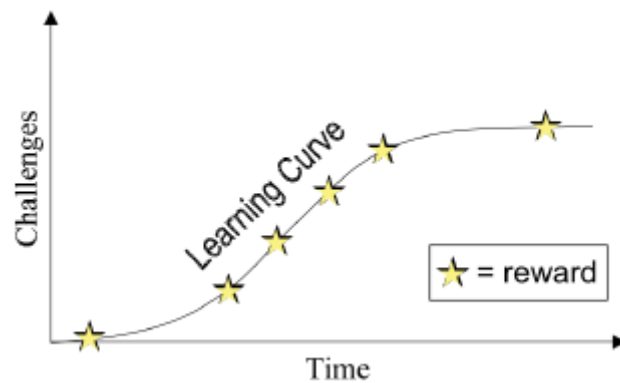


Figure 13, Balancing rewards during game play (Winn, 2008).

Corresponding with the increasing number of rewards is that the designer should pay attention to the amount of challenges are put into the game at certain points. Figure 14 shows that the number of decisions players have to make should be limited at the start.

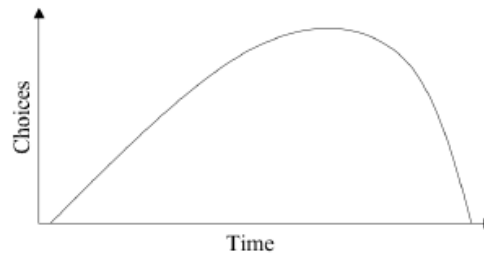


Figure 14, Choices span in game play over time.

With a limited amount of choices in the beginning of the game the challenge of the game starts at a lower level. More options and choices means a tougher challenge. With too many choices in the beginning the same happens as the challenge is too hard. Players will stop playing because too many choices confuses them and makes the game to difficult.

Lesson learned 19

In creating an educational business game that needs to be an effective training tool, creating balanced challenges, flow (33) and rewards (31) are very important in motivating and engaging players. Challenges to give them achievement, rewards to stimulate them and not too many choices in the beginning to keep them from getting confused. Challenges should remain balanced between frustration and boredom, choices should increase as the game advances (35) as well as the rewards (32). The overall difficulty should also increase when gameplay advances, this can be done by including more choices but also by presenting more barriers or challenges (34).

User Interface

The user interface has probably the least to do with gaming in this thesis but it is the most visible part of the game seen by the player. The user interface is important because it makes the formal elements and the dramatic elements accessible for the players. If this does not run smoothly or the interface confuses players, they might stop playing the game and the game elements will not reach their target. The user interface encompasses everything the player sees, hears and interacts with and how the player can interact with the system. A good user interface should basically explain itself. The player should not be busy with figuring out how to interact with the game but they can direct their attention to the gameplay, the story and the learning. And while many can be said about interfaces, the user interface is not the most important aspect of this thesis. User interfaces will be discussed shortly but certainly not every aspect will be covered here. In the creation of our Educational Business Game we aim to create a simple game interface that, at least, is not interfering with the game play. So it is not the aim to create the best possible user interface for the pilot version of the game, but it should be easy accessible.

Schneiderman (1986) gave 8 golden rules for designing user interfaces: according to him interfaces should be.

- *Strive for consistency.* Similar sequences of actions should be required in similar situations.
- *Enable frequent users to use shortcuts.* Frequent users should be able to reduce the number of interactions to increase the pace. This can be done with function keys, hidden commands.
- *Offer informative feedback.* For every operator action there should be system feedback. Operators should see that their actions have had impact and that the system is responding.
- *Design dialog to yield closure.* Sequences of actions should have a beginning, middle and end. Operators will have the satisfaction of completing a sequence. The operator knows that what he started is completed and can now drop this set of action from their minds.
- *Offer simple error handling.* Design it in a way that no major errors can be made by users. If they are made the system should be able to detect it and offer simple explanations to fix the error.
- *Permit easy reversal of actions.* All actions can be undone, this will encourage the user to explore unfamiliar options.
- *Support internal locus of control.* Users are the imitators of actions and they are in control of the system.
- *Reduce short-term memory load.* Limit the human information processing by keeping displays simple, explain what page they are on and show information that they would need to take complete the action.

Benyon, Turner & Turner (2005), extended this list with some principles. They believe that all user interfaces should have:

- *Visibility*. The system should make all the things visible so that users can see what functions are available.
- *Consistency*. Similar sequences of actions should be required in similar situations.
- *Familiarity*. The system should use language and symbols that are familiar for the intended audience.
- *Affordance*. Things are designed in a way that it is clear what they are for. For example, buttons also look like buttons and like they can be clicked.
- *Navigation*. Easy navigation and the system provides support to enable users to navigate around the different parts of the system.
- *Control*. The system makes clear that the user is in control.
- *Feedback*. For every operator action there should be system feedback. Operators should see that their actions have had impact and that the system is responding.
- *Recovery*. All actions can be undone, errors can be recovered easily.
- *Constraints*. The system should have constraints to prevent people from making errors.
- *Flexibility*. The system allows multiple ways of doing things. This allows users to personalize the system to their behaviour.
- *Style*. The system should be stylish and attractive.
- *Conviviality*. The system should be polite, friendly and pleasant.

Both lists have some overlap but are still of added value to each other. Therefore they can be used alongside each other as a simple and quick way to focus on a nice and simple design without having to go through the complexity of all there is known about designing user interfaces. Because the focus is not the design interface this is enough to work with in designing the user interface for our game. However these simple rules will guide us in creating a nice interface and protect us from making obvious mistakes.

Lesson learned 20

The user interface should be smooth and easy to understand (36). The design of the user interface should focus on creating an interface that needs no explaining and enables the player to solely focus on the content of the game. Following the golden rules by Schneiderman (1986) or the design principles by Benyon, Turner & Turner (2005) can help to focus on a simple user interface.

Meta-gaming

Additional to the DPE framework created by Winn (2008) there are some other elements that we believe to be important to serious games, which are not discussed by Win (2008) and Fullerton (2014). Designers can create more motivating serious games and game-based adaptive training systems by designing for learner discovery experiences before, during, between, and after game play (Raybourn, 2007). How games interface outside of game play is referred to as a meta-game (Salen & Zimmerman, 2004). In normal games this would be considered not so good because players take advantage of knowledge outside of the game in order to win or make progress in the game. In serious games the time before, between or after the game can be used for learning that makes meta-gaming something designers want to have in their game. Salen & Zimmerman (2004) state that additional activities as reflecting on strategy, discussing what went wrong in the previous round, sharing stories and lessons learned, can help the people to improve their play and learn from their previous decisions. Supporting

meta-game activities are a crucial component of serious games because players get real-time feedback to update ones understanding. This understanding can then directly be tested in the remainder of the game. Meta-game activities during and after the game can be a way to steer players into the right direction in order to teach them what the designers want to teach. If a player plays the game and does not succeed, and also does not alter its strategy or not in the right way, the player will not see the solution that the designer wants the player to see. Designing the game with meta-game activities can enable the designer to provide the players with valuable insights. The meta-game can be in themselves also be learning activities. The instructor of the game could give away some of the insights that could lead to the solution in the game but letting the players discuss and reflect on their decisions makes this an learning activity as well (Biggs & Tang, 2011).

Lesson learned 21

Using meta-game activities that will help people reflect on their play can increase the effectiveness. If players are able to revisit the content outside of the game will extend its reach (37).

Digital and physical aspects in one game.

Another important element, especially in the design of Educational Business Games, is the digital and physical aspects of the game. If the simulation game is played with multiple people there is a good chance that there is also physical communication. In the business domain communication is very important to create a good decision-making process and to achieve the goals of the organization instead of the goals of independent functions within the company. In order to teach them to cooperate the game might not only consist of digital elements. On the other hand it could well be that the game that is under development does not involve physical aspects because the game can suffice with only digital aspects. However we think that considering physical aspects are valuable for serious games in order to train people certain skills. Especially in Business Game we want people to perform the skills and raise awareness of what they do in the game can also be applied in real life.

We already see that more and more games make use of physical aspects in gaming, also called mixed reality (You & Neumann, 2001; Ohta & Tamura, 2014). This could also be interesting for serious games where physical aspects could enable players to physically apply or create what they have learned. An example of this could be simulations for soldiers were they simulate the battlefield with virtual reality helmets, and not only have to interact with the game but also with each other while physically moving on a virtual reality treadmill. We know that with Educational Business Games the physical aspects are not that spectacular but the mix between digital and physical could be valuable in a game and therefore we want take it into consideration in the design of the Educational Business Games.

This section is not specifically based on how to mix physical and digital elements but to identify whether or not mixing them both in one game will enhance the game experience and maybe improve the effectivity of the game.

Raybourn (2007) states that for teaching complex problem solving approaches such as critical thinking, conflict mediation and planning in stressed environments, can best be learned experientially using face-to-face exercises, role-plays or life action simulation. However, he also states that life action exercises are costly in terms of money, time and human resources. The limits of live action show the advantages augmenting traditional methods of experimental learning with digital technology. Business Education are often complex problem solving problems calls for expensive methods, if done in real-life. As mentioned in section 4.2.2, workplace training is a good method in business teaching, but indeed very time and money consuming. It also requires a teacher that put a large amount of effort in

training the learner. Combining physical and digital aspects for simulations games where, critical thinking, conflict mediation and planning is required seems to be a good practice in order to combine the effectiveness of real live training and the durability of cheaper and less time consuming digital tools. Where Raybourn (2007) states that combining the two can increase the effectiveness, we still need a way to evaluate this. We need to investigate the evaluation of the increased effectiveness of combining physical and digital aspects in the Educational Business Game. This will be mentioned in section 4.7, where we explore how to assess the effectiveness of the game.

Lesson learned 22

Physical elements or mixed reality can enhance serious games even more because not everything that a game might want to teach is best taught digital (38). Mixing digital elements with physical elements can enhance the effectiveness of teaching the desired physical competences.

General overview of the scenario

Like stated at the beginning of this section, the general overview of the scenario will combine the learning goals with the play elements. This section described the elements that are present in games and elements that can be used to create more effective games as they motivate players to focus more on playing. These learning activities mixed with game play and other game elements will be described in the overview of the scenario. The document that describes the scenario can be called the game pitch document that describes what the game will be, the requirements and how the game is going to be played (Fullerton, 2014). This document is created to get approval from the client prior to creating paper/physical versions of the game. The designers could also choice to make a small mock-up of a small part of the game already in order to get approval of the client. When approval from the client has been granted the designer can start creating physical representations of the game in order to play-test the game.

4.2.4 Searching For Software Components

It is stated by Marfisi-Schottman *et al.* (2010) that before the team designs the all the elements from scratch they can go through their (or others) database to collect software components that could be reused. Because we design a serious game based on scientific work we are not sure if we can reuse elements of other games. This can only be done if the scientifically basis can be identified. However, game engines that have been used in the creation of other serious games can be useful to save time and money.

Reuse of software components can be done by using software that was developed by the design team in previous work. It could also be that work of others can be reused to create a new game. This all depends on the previous, if there are any, games that the team have made and if software is applicable for the new serious game. Reusing software components might save work but could also have some limitations. Reusing software components from other games could limit the design team in the functionalities they want to implement in the new game because the software does not support them (Furtado, Santos, Ramalho & de Almeida, 2011). The team should decide between saving time or additional or more favoured functionalities. Furtado *et al.* (2011) state that game designers should not 'waste their time repeatedly performing menial and routine tasks'. However, in this project there are no routine tasks as we design a serious game from scratch and explore how to create an effective game based on scientific work. All game elements receive the necessary attention in order to secure the scientific basis. A game engine, that might be freely available, can be used to run the game elements. We will not go into detail about how to search for software components as this is unique for each project. We will describe what we did in this project in chapter 6, the case description.

4.2.5 Detailed Description of the Scenario

In this concept step a detailed version is created of the deliverable that is produced in 4.2.3. This needs no further theoretical basis than already described in the general description of the scenario. The detailed description of the scenario will result in a second pitch document (see pitch document that was created for our game in Appendix 9. Game Pitch Document) and a more detailed mock-up of the game that can be used for play-testing. (Fullerton, 2014)

4.2.6 Pedagogical Quality Check

This will be described in section 4.3 because the pedagogical quality check is also a part of the global overview of serious game design (Figure 3).

4.2.7 Specifications for Subcontractors

This step of the conception phase is mainly focussed on making the step between concept and production go smoothly. The actors that will work on the actual production of the game need to know the precise specifications for the game. However in this research we are not interested in this part of serious game design. This could be very helpful in situations where games are produced by a big team. In our case it is done by the same person and therefore unnecessary to fill in the specifications for the different actors as they are all one and the same person. This does not mean that documenting each step is not needed. Only that it is not necessary to specify the different tasks between different subcontractors if there are none.

4.3 Pedagogical quality control

The global overview of the serious game design process by Marfisi-Schottman *et al.*, (2009) does not elaborate much on the pedagogical quality check. In the Concept Design process (Figure 6) by Marfisi-Schottman *et al.* (2010) we see that they propose a pedagogical quality check before the game goes into actual production. They suggest a pre-evaluation before the actual production begins in order to make sure the game has no dead ends and that all the players will acquire the main pedagogical objectives. However we want to stress that the game also needs to be tested on the other elements that we discussed in the description of the scenario. All the game elements should be play tested. We will elaborate more on this in section 4.7.

In order to make sure that the learning activities help players to reach the targeted learning outcomes Kessels *et al.* (1996) propose that designers should make sure that:

- There are enough moments in the game in which the player can learn the intended competences.
- There should be enough information for the players about the competences.
- There are sufficient feedback moments that enable the players to adapt their behaviour and allow them to improve.
- There is a 'teaching climate' that enables players to experiment with the newly learned competences and skills.

The pedagogical quality check is needed to identify if the learning activities are good enough to teach the aimed capability. Manin, George & Prévot (2006) describe the usage of virtual learners to identify problems in Educational Business Games. Their tool simulates different kinds of learners that play the game automatically. Their play data is recorded in a history log which gives important data on how players might have played the game. This could save developers a lot of time in testing the game. Where normally waiting for user feedback could take months, a player simulator could give a lot of interesting insight on how the game can be played by players. The tool simulates all kinds of players that enables designers to see what paths players can take and if the desired path is played enough or

that players get stuck on the wrong track. This seems like an interesting method to do a pedagogical quality check. All different kinds of players are simulated and all possible paths of the game are tested. However, the tool cannot check if the desired learning outcomes are in the game. Something that is not there cannot be tested. Also to use such a tool to simulated learners behaviour requires a game that already is developed while in this stadium the game is still in the conceptual phase.

In this thesis we will perform a pedagogical quality check according to Kessels *et al.* (1996) because we also use their method to create the pedagogical objectives.

Kessels *et al.* (1996) state that the effectiveness of the learning game can be tested in two ways. Observations and interviewing the players. Because this phase happens prior to the development of a 'real' game, this implies that the game should be tested with paper models or mock-ups of the game. Observing players can help identify if they are concerned with the right objectives in the game and at what points they struggle and cannot progress, or the opposite, like what points where to simple. An observation could help identifying if users make the right decisions and what could be done in the real game to make sure that they are pushed towards the right direction. Interviewing users can give useful information on what users think of the process in the game. Users can be asked if they have learned something and if it was useful. Also to point out what was clear in the game and what was not that clear. This feedback can be used to create better learning activities.

Problems in the design that cause the players to have issues with receiving the pedagogical objectives can be restored much easier in an early phase (Kessels *et al.*, 1996). The designers can easily adapt the (paper) models of the game and redesign the learning activities. After redesigning the learning activities another round of play-testing is advised. Whether or not the players reach the sufficient level of the serious game's intentional goal, should be tested as well. This is something different then if the pedagogical goals are taught. Whether or not the players reach the wanted level can be tested in-game with activities that test if the player can execute the activity correctly and hereby determines if the player has sufficient knowledge. Shute, Ventura, Bauer & Zapata-Rivera (2009) suggest even that in-game testing of achieving intended goals is particularly useful in serious games giving players appropriate feedback and making the assessment part of the experience. Like stated before, play testing can be used for other elements of the game as well besides if the pedagogical objectives are reached. Play testing might also uncover other issues that can have influence on the game's effectiveness. We will elaborate more on this in section 4.7.

Lesson learned 23

In order to validate the learning effectiveness of the game, the game's quality should be tested early on in the process (46). The game can and should be tested with (paper) models of the game and with real players. Experts on learning/gaming can be used to comment and give feedback on the game so far.

4.4 Production

The game development is where the actual creation of the game starts. All that is learned in the previous steps should be taken into account during the development. A lot of the game is already clear due to iterative sessions with the client and play-testing sessions with the use of a mock-up model of the game. There are several parts that need to be taken into account during the development of a game. There is not much literature on the development process of serious games. This might be due to the fact that what defines a game as 'serious' is created in the conception phase. The development

phase of serious games is not significant different from the development or 'regular' games. They both execute what has be designed in the concept phase and what is detailed in the documentation that has been used to get approval from the client. Although the development phase can be seen as creating what has been defined in the concept phase, there are still some choices that have to be made in the development of games. Claypool (2006) discussed some important aspects that can help and support the development process. Al lot of this applies to large scale projects with multiple developers. This is out of scope for this thesis and will therefore not be discussed. We will discuss some aspects briefly that do apply to this project. All that is discussed below originates from the lecture notes from Claypool (2006) and the book from Rabin (2010).

4.4.1 Tooling

Tools can be used to support the development process in two ways. Software tools can be used to support the technical aspects of the game to enable quicker development. Other software tools support the social aspects of game design. The usage of these tools are more or less depended on the scale of the project. These tools support development management, collaboration and planning. In small teams there is often no need for these tools are the planning and management of requirements and resources is not so complex. But with larger games it might be very useful to keep track of progress, the planning and requirements with the help of software tools. There are tools that can help with the documentation and tracking of bug fixes. In large game it might be useful to track what bugs are known in the game and if they are fixed properly. These tools can make the game development process easier as they help the development team to keep track of process and simplifies their work.

4.4.2 Game Engines

Game engines are systems for the creation of videogames. Engines combine the different parts of code and bring them together into a working game. Game engines execute the different functionalities like sound, code, AI and animation into a real playable game. We will not go into detail on how game engines work but solely want to state that a lot of game engines are available in the market that make the development process a lot easier. Existing game engine will provide a lot of functionalities that need less technical programming. This saved a lot of time, money and human resources. For serious games and Educational Business Games there are a lot of game engines that enable designers to build working games. This saves time that can be used to perfect the design of the game itself.

Lesson learned 24

There could be some useful tools and game engines that support the development process (47). Finding useful tools that can help shorten the development time can make the process more cost and time efficient.

4.5 Coherence Control and Debugging

Debugging a game is absolute crucial prior to launching the game. A buggy game will not be sold or played as it might frustrate people and keep them from playing further. However, we think that debugging can be seen as game testing (section 4.7) which also tries to identify bugs in games. Debugging requires colleagues, experts and users to play the game, identify bugs and report them in order to fix them. In the next section the different kinds of play-testers are being discussed and we will therefore not elaborate any further on debugging here.

4.6 Test on test group

Testing the game on players is a valuable and essential part of game design (Fullerton, 2014). In this thesis we distinguish two types of testing, tests to evaluate if the game works properly and evaluating if the game is an effective education tool. The latter is interesting for serious games that are used as

educational tools but the first one is necessary for all game as broken games will not be sold or used. This section describes the first kind of testing because this should be part of every game design process. Testing here is the same as for normal games, that is, testing if people like it and if there are parts of the game that they do not understand or where they get stuck. Serious games differ here because they need to be effective as a training tool. Although we believe that serious games should be effective in what they aim to teach, many still lack knowledge on their effectiveness (Mitgutsch & Alvarado, 2012) and do not make validating the effectiveness part of the design process. Because not every game is designed with the validation of effectiveness included, we distinguish the testing of the game and the effectiveness of the game. However because there is some overlap between game testing and evaluating the effectiveness of a serious game, like methods on how to test them and how to select testers, we will continue with the evaluation of the effectiveness in the next section (4.7).

We have already mentioned that game testing should occur not only at the end of the process but as an iterative practice that happens throughout game design. Figure 15 depicts the iterative play testing that is proposed by Fullerton (2014). He states that iterative game design enables the designers to stay focussed on the intended goal. Game design can be a long process, validating the game only at the end of the process might cause problems as the game might turn out different than expected.

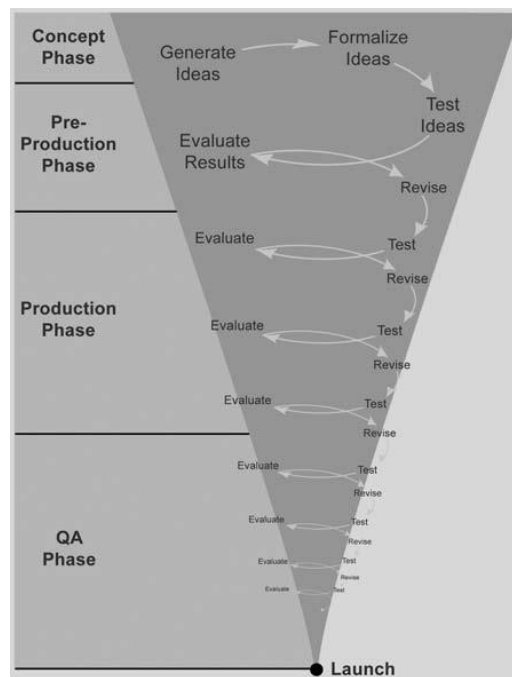


Figure 15, Iterative game design with multiple test phases. (Fullerton, 2014)

Lesson learned 25

Feedback on the game should be as frequent as possible (48). During the development of the game, but also during the design phase. Early game testing can help identifying errors and issues in early phases and can prevent doing a lot of extra work.

Because feedback is essential the game should be tested from early on in the game and in different phases. In the global overview of the design process game testing is described as ‘test a game on a test group’ and also Marfisi-Schottman *et al.*, (2009) position it at the end of the development process. Of course is testing important before the game is launched but like Fullerton (2014) states testing should start as soon as there are ideas in the concepts phase. This means that testing should happen in the

concept phase (test the ideas), the pre-production phase (physical prototype), in production (digital prototype) and prior to the launch (alpha and beta versions). We follow this view on testing and we will therefore explore different test methods focussed on game elements (not educational effectiveness) that are applicable to the different phases in game design.

4.6.1 Selecting Play-testers

Testing games requires play testers that can help to get insights in how the game functions and how users perceive the game. Fullerton (2014) describes three different types of users:

- First, the designers themselves are testers of the game. Especially in the beginning of the design process where the designer and its colleagues test various concepts and go more in depth of what can be used or not in the game. However, as the game progresses the feedback of outside testers will be more important to gain accurate understanding of the game that is created.
- Play-test with acquaintances is what can be done in the next step of play-testing. This allows the designer to test the game on people that are not familiar with the game yet. The benefit from acquaintances is that they can test the game with a fresh look on it and they will uncover things the designers themselves have missed. Acquaintances can be used pretty early on in the process because they are more patient with and the prototype will likely be incomplete and might need some extra explanation. Acquaintances are more likely to excuse the designers for incomplete games. However, also here, if the game matures other play-testers are needed. The reason is that acquaintances have personal relationships with the designers and are therefore biased. They can be either too harsh or too forgiving on the design.
- In order to get broad, objective criticism that is needed to take the next level the game should be tested with strangers that have no personal relations with the designers. These type of persons can be very effective for feedback because they do not have anything to lose or gain with giving their honest opinion. It is however important to choose strangers that are at least motivated to play. This will ensure that the feedback that is received also adds to the creation of a better game. It is therefore important to select strangers that can be identified as the target group of the game. The target group players have interests in playing the game and are willing to give good feedback. These persons are the ideal play-testers as they give far more relevant feedback than people who are not interested. They know what they like and dislike, and they can tell why they have these opinions in detail.

Lesson learned 26

Test subjects should be chosen carefully (49). Both acquaintances of the game designer should test the game and unknown people. This will prevent biased feedback on the game.

For testing serious games, and in this case an Educational Business Game, also professionals that know the content of the game are persons that should play-test the game. However they know if the content of the game is correct and if it can be used for an effective educational tool. Using professionals as play-testers is therefore discussed in section 4.7.

4.6.2 Play-test Session

A play-testing session that is held with people other than the designers self should have some structure. According to Fullerton (2014) a common mistake is that designers start talking about the game and how it works. This would interfere the fresh perspective of play-testers. Also when the game is released the designers will not be there for every player to explain the game as well. The designer should only observe and document what is happening. Players making mistakes is a good thing in the

sense that this is valuable input for improving the game. In order to prevent giving away too much information a script can be made that structures the play-test session. A structured play-test session should include (Fullerton, 2014):

- *Introduction.* Welcome for the play-testers and a thanks for participation. Here the designers should introduce themselves. A brief explanation of the play-test process and why their input is valuable for the improvement of the game. This should not take more than 2-3 minutes.
- *Warm-up discussion.* A warm-up discussion can be used to get some additional information about why they like certain kinds of games, what is most important in these games and why they would play the game. These questions could be predefined in order to start a discussion. This step should take like 5 minutes.
- *Play session.* After that the play-testers can start playing the game. It is important to explain that the game is still under development and that their feedback is used to improve the game. Here the designers observe what players are doing. An important aspect is that players should be thinking out loud as the decisions they make are valuable to know. The play session should take about 15-20 of observation. If players have difficulties with proceeding in the game they might be helped by the observer in order to move the session forward.
- *Discussion about the game experience.* After the play session the observer should interview the player with some predefined question about their opinions of the players. An example of the questions that can be asked after, but also during the game can be found in appendix 1.
- *Wrap up.* In the wrap up of the play-test session the designers or observer should thank the players for devoting their time. In some cases this is also the moment where tokens of appreciation can be given to the testers. Think of a t-shirt with the game's name on it for example.

Lesson learned 27	Playtest sessions can benefit from following a structure (50). This structure can prevent receiving either too little or too much information from game testers.
Lesson learned 28	During game testing sessions the designer should not talk too much about the game. In order to receive unbiased feedback it is important that the testers are not influenced prior to testing (51).

4.6.3 Play-test Methods

There are several different methods that can be used to test games on what people think of the game. Depending on the game that is being developed the test method can be different. For generating ideas it is better to work in groups, however evaluating ideas can be done better in a one-on-one situation (Fullerton, 2014). In some cases testing the game with a group is necessary. In creating an Educational Business Game where multiple people have to play together also testing the game likely requires group testing. Some methods of testing games are:

- *One-on-one.* This is the structured approach that has been described in the previous section.
- *Group testing.* Allow players to play together. This can be done only if there are more computers available if the prototype is digital. For physical prototypes this is no limit.
- *Feedback forms.* Players can be asked to fill in a form after they played the game. This is a great way to gather quantitative information about the game. This allows designers to let people play the game and fill in an online feedback form that can be made with, for example, google survey.

- *Interview.* A face-to-face in-depth interview of the play-testers opinion. A qualitative method that allows the observer to get more information out of the tester. However this is also more time consuming and therefore less interviews can be taken than feedback forms.
- *Open discussion.* This can be a one-on-one discussion or a group discussion where the designer takes notes after the testers have played the game and discussed what they liked and did not like about the game.
- *Data hooks.* Data hooks are software tools and techniques that gather information about player's movements and decisions. This quantitative method can be used to get large amount of data that can be analysed in order to investigate where players get stuck or taking too much time.

This section described some of the important aspects of testing the game on a test group. In section 4.7 some methods are discussed that can be used to evaluate the game's effectiveness on both game elements and the game as a learning tool.

Lesson learned 29

Playtesting can be done in different ways. It will be good to explore more than one test method in order to increase the validity of the tests (52).

When the game has undergone multiple playtesting sessions and the improvements have been implemented, the game production process can proceed to launch. Like stated before, the use and maintenance phase of the game is out of scope for this thesis. It is also not of interest as the focus lies on the effectiveness of the Educational Business Game and not the implementation. In the following sections we will discuss the customizability and the validation of the game's effectiveness. These aspects are not part of every game design but play an important part of this thesis research. They will be discussed here because they influence game design.

4.7 Assessing the Educational Business Game's Effectiveness

Although not completely different from the last section, assessing the game on its effectiveness requires the observer to take a different look at game testing. In order for the game to be successful for scientific reasons, and even more important, for the game to be used as a training tool, the game must be effective which makes evaluating the game's effectiveness crucial to this thesis. We will explore what should be evaluated and which different methods of serious game effectiveness validation exist that can possibly be used to assess an Educational Business game. This section will elaborate on the evaluation the game's effectiveness as a training tool for educational goals. How the game scores on other aspects like, fun and engagement is often included in assessment tools for serious games. Where section 4.6 mostly discussed how to select a test group and how to test, this section will discuss some methods for serious game assessment. Evaluation the game's effectiveness also requires playtesters. What play testers can be used has been discussed in Section 4.6.1.

4.7.1 What To Evaluate?

Evaluating the Educational Business Game in terms being an effective training tool is one of the objectives of this thesis and it is a crucial part in finding out if this research is of added value for other Educational Games. This includes that the learning activities should lead to educational results, but also that the game has the elements of fun and engagement to motivate players into learning. In order to know where to start the evaluation of a serious game we go back to the eight fields' model by Kessels, Smit, & Keursten (1996), see Figure 8. This is the same model that was used to define the problem and formulate the right learning activities and we choose it here once more for that same reason. The first four steps were discussed in section 4.2.1 for the creation of pedagogical learning

activities. Steps 5 till 8 of this framework can be used to find out what can and should be evaluated as it comes to the teaching aim of the serious game. We will first briefly discuss the last 5 steps of the model based on the work of Kessels, Smit, & Keursten (1996).

- *Process*. In order to see whether or not the learning activities are in themselves useful, one can go through the process of the learning activity. This is basically identifying where and why players get stuck in the game and what prevents them of completing the activity. An incomplete activity cannot transfer the intended learning outcomes. When including learning activities in a game testing and fixing processes can be seen as fixing bugs or alter the activities to prevent players from getting stuck.
- *Educational results*. Step 6 suggests that the educational results should be tested that are gained from executing learning activities. Testing the player's educational results will give insights in what competences the player learned and how well the player learned them. The level of understanding that a player needs to reach is depended on the aim that the designers had for the game. There are different levels of understanding that might be taught to learners like stated in Table 1, the taxonomy of different levels of understanding by Anderson *et al.* (2001). Educational results can be tested directly in the game by letting players solve in game problems for which they need the newly learned competences, or for example by questioning them afterwards about the content. How to test educational results will be discussed in more detail after this. If the educational results meet the intended learning outcomes the game as a tool is effective in at least transferring the competences in the right way. Step 6 is therefore close to what we need to evaluate in the serious game in terms of effectiveness. We want to evaluate the game's effectiveness as a teaching tool, this requires the players to achieve educational results. We state that it is close to step 6 because the model does not consider effectiveness in terms of motivation, fun and engagement that games can offer.
- Step 7 and 8 are more long term evaluation criteria and are out of scope for this thesis project. For a really effective serious game the content that is being taught should not only result in competences that can be used in the game, but also in the player's daily routine. For example, if the business game teaches players to communicate more with each other the intention of the game should also be that they communicate more in their daily work (step 7). This could be evaluated by monitoring the players in how they altered the way they work in real-life. When they positively altered their work attitude and started communicating more, the most important question is, if the problem that was the reason for starting a learning process has been solved. Has the impact of going through the process of learning activities, requiring the competences and altering the performance positively really solved the problem (step 8)?

Both step 7 and 8 are useful to really investigate if the serious game satisfies its goals but are needed to be carried out far after the game itself has been played. We limit ourselves in this thesis to finding out if the Educational Business Game can effectively transfer competences to players by evaluating the educational results.

Lesson learned 30

The effectiveness of the serious game's capability to teach can be assessed on multiple levels (40). If there is enough time the effect of the game should be measured over different times. This will make sure if the game really forms a solution to the problem identified early on in the process (40).

Next to the learning experience in serious games we can investigate other kinds of experiences players can have in games. Like discussed earlier, serious games have the aim of both educating and entertaining which both have to be evaluated (Bellotti *et al.*, 2013). On the quest for investigating in

what ways (video) games can influence people, Callele, Neufeld & Schneider (2010) came up with three different types of experience: (1) Emotional experience, (2) gameplay experience, which can be divided into cognitive and mechanical experience, and (3) sensory experience, that can consist of visual, auditory and haptic (touch) experience. In the next section, evaluation of different kinds of experiences will be explored.

4.7.2 Evaluation and Serious Game Assessment Methods

Evaluating serious games on their effectiveness can be done in multiple ways. This section will discuss various methods that can be used for the evaluation and assessment of serious games on their effectiveness. Hays (2005) states that learning is a complex construct that is difficult to measure and determining the effectiveness of a serious game a complex, time consuming and difficult process. It is however a crucial part of this thesis and according to Bellotti *et al.*, (2013) all serious games should undergo assessments to provide an indication of the game's pedagogical effectiveness. We propose different ways of evaluating both the usability and gameplay of serious games.

In game results. First of all, in assessing games, the distinction can be made between summative and formative assessment. Where summative is conducted at the end of a learning process like with for example a math test, and formative where the assessment is implemented in the process and presented throughout the entire learning process (Boston, 2002). Shute *et al.*, (2009) suggest that formative assessment is particularly useful in serious games giving players appropriate feedback and making the assessment part of the experience. The effectiveness of the serious game becomes clear when players pass assessments with skills they learned during the learning activities.

Game heuristics and cognitive walkthroughs. In order to avoid making a lot of standard mistakes the game can be tested by the designers self or other experts on the game's heuristics. Game heuristics can help with evaluating the playability of a game. Desurvire, Caplan & Toth (2004) propose a set of heuristics that can be used for evaluating playability. Using such a checklist can help improve the game if it is used by colleagues or other experts when reviewing the game. These authors have proposed that playability should be checked on game play, game story, mechanics and usability (See Appendix 2). Experts can also be used to do a cognitive walkthrough of the game or the scenario's with the focus on learning. As next to fun the game should also be educational the experts could walk through the scenarios guided by three questions:

- Will the correct action be sufficiently evident to the user?
- Will the user notice that the correct action is available?
- Will the user associate and interpret the response from the action correctly?

If encountering problems, the experts should document these in order to make improvements.

Self-report measures. Self-report measures can be used to let users answer a set of questions about the game and rate it. Self-report measures often give a range in which users can give their answer like the semantic differential scale (how well did you like the story from 1 to 5, 1 representing not at all and 5, I liked it a lot) or Likert scales (I liked the story?: strongly disagree – disagree – neutral – agree – strongly agree). An example of a standard questionnaire can be found in Appendix 3. Self-report measures can also be used to score the emotional experience of players by asking them how they feel during different points in the game.

AAR (after action review). Like discussed in section 4.6 players can test the game by playing it in game test sessions. By conduction in-depth after action review the observers can get detailed feedback from players. This feedback can be used to improve both the usability and gameplay of the serious game.

Comparing the game to other games. Comparing the game under assessment to other serious games can give useful insights. Particularly if the other serious game is a successful and useful tool already. Testing still is needed because games are complex systems and many factors can influence how players perceive the game.

Evaluation framework. These methods describe evaluating serious games in a quite generic way. Mitgutsch & Alvarado (2012) propose a model for evaluating serious games on their effectiveness. Their framework consists of 6 core components that form a conceptual structure underlying the serious game, see Figure 16.

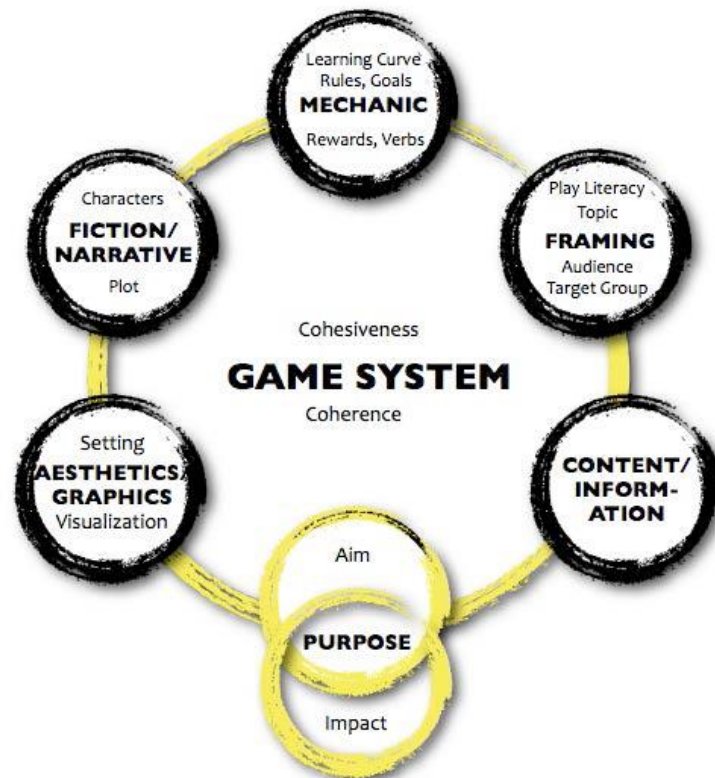


Figure 16, Serious game design evaluation framework by Mitgutsch & Alvarado (2012)

The different core components will be described briefly and what points should be evaluated.

- *Purpose.* The game should have a purpose beyond the game itself and this purpose should be made clear during the game. The designer's intentions are to impact players in a specific way. If a serious game has no impact on the players in a real life context, the game misses its purpose. The purpose is depicted differently than the other core components because the purpose should acts as a driving force throughout the game that shapes the dynamic and coherence of the game as a whole (Mitgutsch & Alvarado, 2012). A critical side note is that the purpose of a game can be experienced differently by games than intended by designers. Because the purpose can never be transferred directly designers should incorporate the fact that players can experience the purpose differently.
- *Content.* The content, facts and data that is used to make the game 'serious', should always be presented to players in an approachable way. The information that is available in the game should also be relevant. Games should not have too little information, but surely also not too much information that can overload players. The content needs to be correct and unbiased.

- *Mechanic*. Mitgutsch & Alvarado (2012) explain that game mechanics are “methods invoked by agents for interacting with the game world”. They need to be working correctly in order to have good gameplay. This is what is tested with gameplay test that we described in section 4.6.
- *Fiction/Narrative*. In the framework narrative/fiction focusses on how it relates to the game’s purpose. Fiction and narrative involve settings, story, scenario, characters, etc. which are discussed in section 4.2.3.
- *Aesthetics/ graphics*. Mitgutsch & Alvarado (2012) argue that the aesthetics and graphics play a fundamental role in the introduction of the game’s purpose and its impact on the players. Because the aesthetics and graphics present the game to the player from the first image on.
- *Framing*. The framing of the previous five components should be considered in terms of the target group. Often in serious game design, the target group and its play literacy gets completely overlooked (Mitgutsch & Alvarado, 2012), where it can crucially influence the gameplay experience. This means that the designer should have kept the target group in mind and the way they interact with the game’s controls. But also questions like: What skills are needed? Are they too difficult or too easy to acquire? What genre of game is referenced and might cause particular expectations? Are the difficulty levels balanced in relation to the audience’s needs? Serious games should both offer easy access to players but also engaging game play experience.

Lesson learned 31	The effectiveness can be assessed in many ways (53). Combining these methods with different test subjects can increase the validity of the effectiveness tests.
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Different methods of evaluating game are worthless if not conducted in the right way. We will discuss a serious game evaluation approach in the next section.

4.7.3 Serious Game Evaluation Approach

In order to evaluate serious games Rogers, Sharp, Preece & Tepper (2007) have proposed a framework that can be used as a checklist for conducting an evaluation. The DECIDE Framework that they propose can be useful to this thesis in order to execute the Educational Business Game evaluation smoothly. We will explain the DECIDE Framework briefly.

- *Determine the goals*. Like stated in section 4.7.1, the evaluation should start with knowing the objectives of the serious game that is under assessment. When the objectives or goals of the game are defined in terms of what the game is teaching and at what level of understanding, the objectives should be made measurable. For example, if the goal of a game is to improve the understanding of a certain subjects, it is needed to know of what concepts the game wants to improve understanding, but also what improve means. How well should it be improved, for how long after game play should it be improved and who’s understanding should be improved? When it is clear what needs to be measured the serious game can be evaluated on its effectiveness. The goals of the game and what is expected of the evaluation influences the methods that are used later on (Rogers *et al.*, 2007).
- *Explore the questions*. What questions are needed to be asked during the evaluation? The evaluation in this thesis is concerned with the effectiveness of an Educational Business Game as a training tool. So the questions that we need to ask could be: how effective is the Educational Business Game as a training tool, which can then be divided into how engaging is the game and how well its learning activities are able to train players. But also in our case, how to evaluate the mixed reality in serious games of combining physical and digital aspects.

- *Choose the evaluation methods.* The evaluation method will describe a procedure of how data is collected, analysed and presented. Some evaluation methods for serious games have been described in the previous section. It is possible however to combine multiple methods to improve the validity of the results.
- *Identify the practical issues.* The practical issues are typical problems that researcher encounter prior to starting the evaluation. Finding evaluators, selecting users or equipment. This has been discussed as well in section 4.6 because this is also a problem when testing the game itself. We will follow the same rules for finding users for the evaluation of the game's effectiveness.
- *Decide how to deal with the ethical issues.* There could be some ethical issues that need to be considered. Some of these could be that participants have a right to: know the goals of the study, know what will happen to the findings, privacy of personal information or that they can leave when they wish
- *Evaluate, analyze, interpret and present the data.* The execution of the method(s) that are chosen will result in data that needs to be analysed, interpreted and presented.

Lesson learned 32

The evaluation of a serious game is a 'serious' matter and should therefore be treated as a research on its own. It would be wise to conduct the evaluations as a research with a proper methodology (54).

4.8 Customizable design in Educational Business Games

Customizability can be interpreted in many ways. One could see it as altering things in general but if we look closer we can define customizability on many levels. In this thesis we distinguish these kinds of customizability. The first allows the game to be easily customized to a new setting or context in order to secure the long term use of the game. Easy customizability should be incorporated into the games code in such a way that the code itself can be changed easily for different contexts or scenarios. This allows designers to easily adjust game functions, like adding roles, adding events and altering algorithms that makes the serious game longer interesting as an educational tool because the game can be adjusted to fit new insights, knowledge and maybe even completely different competences. We refer to this form of customizability as *Customization*. The second form of customization allows the players or game leader to adjust some of the game functions like: how many player partake in the game, or how large the budget is at the start of the game. This is customization that is created into the game and which can alter game play but it has to be filled in manually by the players or the game leader prior to playing. We will address this as *configuration*. The last kind of customization will be addressed as *adaptivity*. Adaptivity or personalized gaming (Lopes & Bidarra, 2011; Bakkes, Tan & Pisan, 2012) is the customization of the game that happens during game play. This means that the game alters itself according to the way users play. This is done in order to better fit the playstyle or learning style of the players. For example, the game itself could have built in mechanism that checks if the players need tougher challenges or need some help with progressing. How these three kinds of game altering methods work is depicted in Figure 17.

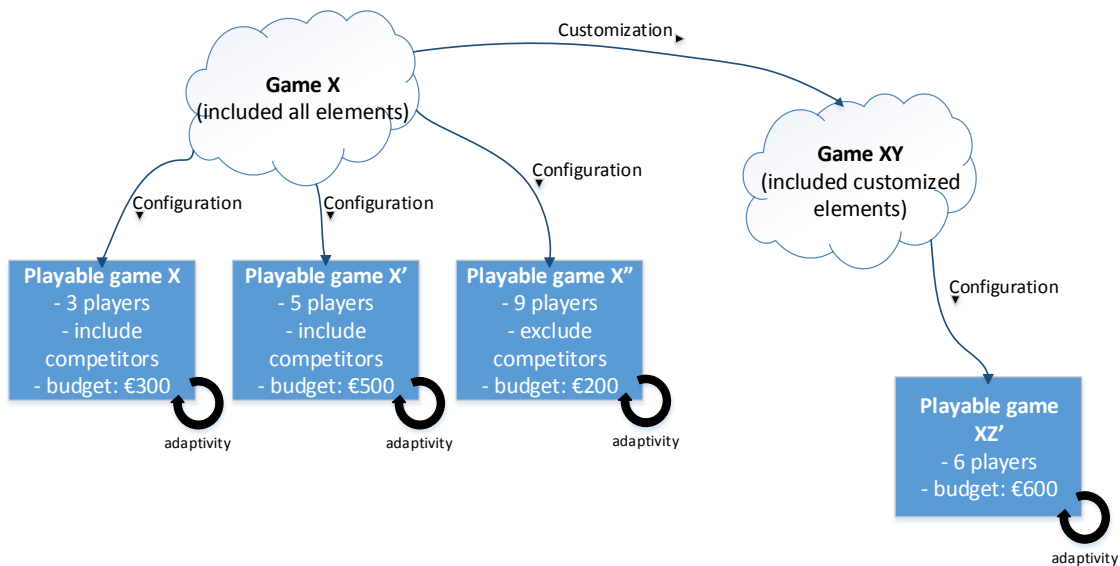


Figure 17, Customizability in games on three different levels.

As Figure 17 displays, there is a game, Game X, and at this state there are only all the game elements that could together form a playable game. In order to play the game, the player or game leader should execute some configurations in the game's user interface. As the figure shows this could be for example the number of players that are going to play, or if some major parts of the storyline should be included. The configuration can be different for each game play (Playable game X, X', X''). Next to the configuration of the game, all the different playable games can be adaptive. The game itself can change the play according to how the players play the game. If the systems figures out that the players are making progress to easy the game can execute a more difficult event. Customization might be needed if the game should be adapted to a new setting, this creates a new game with different functions. Game elements from Game X will be customized into the new context, other names, other story, new roles, different objectives, etc. This requires the elements of Game X to be customized easily in order for the game to be reused for other purposes or to be effective longer with new features. We will discuss the three forms of customizability and how to include it in the game design.

4.8.1 Customization

Customization is useful for serious games in the long run. If the game's elements, functionalities and knowledge can be easily altered, removed or added the game can be used in other situations as well, or in the same situation but with new information that is crucial in learning the intended skills.

Originated in software development, product lines, were used to satisfy business needs like, high quality, quick time to market, low cost production and mass customization (Northrop & Clements, 2001). Northrop & Clements describe software product lines as 'A software product line is a set of software intensive systems sharing a common, managed set of features that satisfy the specific needs of a particular market segment or mission and that are developed from a common set of core assets in a prescribed way'. If a software product is created in such a way that its features can be reused and adapted, they can be used for a different, similar product. This is the same for games. If a serious game is developed according to software product lines, its features can be reused in different setting. In software product lines the products that are created have the purpose to satisfy a specific market or target group, see Figure 18.

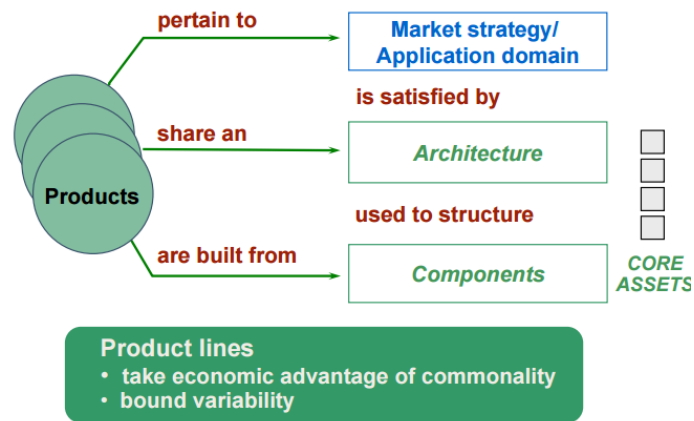


Figure 18, Software product lines (Northrop & Clements, 2001)

The different products in the product line share the same architecture which are a set of core assets that can be put together. It is not necessary that all the architecture elements are included in all the products, but piecing the different core assets together allow a new product to be made in a shorter time due to the reuse of older components. Variability allows the product in a product line to be different. Altering the components and putting them in the new product will result in different versions of elements that have the same interface but different behavioural or quality attribute characteristics (Northrop & Clements, 2001). Variability or, how we call it, customization can be done in games, but if taken into consideration during development of the game, it can be made easier to customize the game later.

Clements (2002) discusses that designers can develop an easier to customize game by applying the following mechanisms in the game:

- *Extension points*: these are identified places in the architecture of the game where additional behaviours or functionalities can be added. One could think of adding new roles and algorithms that define the players, or events that change the game.
- *Reflection*: this is the ability of a software component to manipulate data on itself or its execution environment.
- *Overloading*: this is reusing a functionality to operate on different levels. If the algorithms that are used in the game's code can be easily adjusted it will help the game to be easily customizable. Algorithm can be reused but with different numbers. This will result in a game that forces the players to take different decisions. For example an Educational Business Game that is based on a bank there could be an event, let's say 'event #3'. This event states that: the main competitor 'Global World Bank' has released a new product that affects our sales by 20%. Both the name of the competitor in this case should be easily adjustable and also the 20% impact. For a different setting where the player is not part of a bank but an airline company. The name could be altered to for example 'Global Airline Initiative' and the impact of their product release to 15% because this could be a more realistic impact of new products in this domain.

When developing Educational Business Games, designers can use product line approaches in order to allow long term customization of their games. Creating an architecture that has core assets can be reused in different settings. Also creating extension points in software elements that allow additional functionalities, or inserting easy to adjust algorithms that allow the game to fit in a new domain should be taken into account when developing serious games.

Lesson learned 33

Customization can be built into the game in order to make it easier adjustable to completely different situations. Large parts of the game can be reused without having to rebuild a new game. Also new components can be implemented even after the game has been finished (41).

4.8.2 Configuration

Gameplay configuration is not that spectacular in terms of complexity. Configuration allows the player, or game leader in the case of a simulation, to define, prior to starting the gameplay, a couple of variables that can influence the game. Like stated before, if the game can be played with multiple people, which is the case in our Educational Business Game, the game leader is required to alter the number of players that are partaking in that particular gameplay session. In order to add configuration the designers should identify: what variables need to be configurable prior to starting the game and what values these variables can have.

Lesson learned 34

In order to make the game better suitable to a certain group of players, the designers can implement some configuration options in the game. The game master can adjust the game's settings to fit better with specific players that might need, for example, more challenge (42).

4.8.3 Adaptivity

Lopes & Bidarra (2011) discuss adaptivity in both entertainment and serious games. Where for entertainment games, fun is essential as a purpose. The authors stress that adaptivity in entertainment games, so far, is often limited to one dimension of engaging fun: Challenge. In the search for more adaptivity, some researchers show that there is room for adaptivity beyond only focussing on challenge. Because players have widely different reasons for playing games (Magerko, 2008), also adapting them in different ways will engage more players who are looking for different things in games. Creating games that can adapt better to player's wishes and likings can result in more effectiveness in games. For serious games, that have more purposes other than fun, motivations for applying more adaptivity is even clearer. If the purpose is to teach and train players, adaptivity will need to steer towards effectiveness of knowledge transfer between the players and the game (Magerko, 2008).

One approach of reaching a better knowledge transfer in serious games could be through the recognition of different types of learners. Magerko, Heeter, Fitzgerald & Medler (2008) identified three player-learner motivation types that are particularly of relevance in designing serious games. The first are the intrinsically motivated *explorers*, who want to explore the game because they are curious. The second group are the extrinsically performance motivated *achievers* who want to reach the maximum score (or perform best possible). The last group they identify are the extrinsically avoidance motivated *winner*s, who want to win to avoid losing. These three types of players should be approached differently in a game to support them in learning more effective. An example of this is given by Magerko *et al.*, (2008) and is depicted in Figure 19, where achievers play heavily on time, and explores, motivated by themselves to explore the game and its content, are given an explore mode and additional objectives. In order to see what kind of players users are Magerko *et al.*, (2008) suggest that a questionnaire is being filled in by the users prior to playing the game which should determine what kind of playstyle is desirable.

	Intrinsic	Extrinsic	
	EXPLORER	ACHIEVER	WINNER
		Performance-Approach	Performance-Avoidance
Explore Mode	Yes	No	No
Bonus (extra Trivia)	Yes	No	No
Timer (speed bonus points)	No	Yes	No
Leader Board	No	Yes	Yes
Trivia Qs (show me option)	No	No	Yes
Tutorial	No	No	Yes

Figure 19, Example of game features mapped to player types.

Magerko learning styles approach is promising but besides different styles in learning there are other factors that influence adaptivity, like player's knowledge that is already present before they start playing the game. Where in entertainment games adaptivity can focus on more than challenge alone. Reaching the balance between skill and challenge remains relevant for serious games, since the purpose of serious games is delivering skills to players. Reaching the perfect balance between the challenges and the *skill level* of the player will engage the player more and thereby make the more effective for that person. How skill and challenge should be balanced depends on the skill level of specific players. Adaptivity that is focussed on reaching the optimal balance for specific skill level is also called *personal skill proficiency* (Peirce, Conlan & Wade, 2008) (Niehaus & Riedl, 2009). If the players personal skill is higher than what is taught in the game they might lose interest and the game does not fit them.

Niehaus & Riedl (2009) tackle this problem with intelligent technology that can adapt scenarios and can add or remove events from the scenario that relate to learning objectives. The 'Scenario Adaptor' alters scenarios in order to create the desired set of learner-specific learning objectives for players. Another approach Lopes & Bidarra (2011) discuss for adding more adaptivity in serious games is using game log data from past performances. Digital games can gather a lot of data on how games are played that can be used to adapt the game better to the preferences of players. However they also state that this domain still needs a lot of research in order to create useful, proven models that can be inserted in games.

From a user's perspective, games can be adaptive at all the elements that are considered in design. *The setting, mechanics, AI, Narratives and scenario's/quests* can all change based on individual players performance in order to create a more personal experience (Lopes & Bidarra, 2011). Already discussed above here is the fact that for serious games the balance between skill and challenge is more important than a rich full experience in fun. Whereas these adaptive game elements try to create the best possible experience for players based on their interests in order to create fun (and not aim creating a better fit for learning), some can still be useful to improve player's engagement that should be considered in the design of serious games. Not all the elements should be adaptive because the serious game has a purpose and should stick close to reality (Lopes & Bidarra, 2011). What game elements can be adaptable in games depends on the serious game that is designed. For Educational Business Games one could imagine that setting of the organization should stay the same. Also the narrative should stay the same because the story is tied to the intended learning outcomes. If players could alter the narrative based on the way they play and want to play, the game might exceed the purpose of the game. On the other side, there are opportunities to include adaptive AI in what computer based events present to players based on the way they play. Also the scenario's/quest that are handed to the players could be different and fit better to their actual performance, opposed to presenting the same activities

in every gameplay. Changing mechanics have already made adaptive in a lot of games as they influence the difficulty of the game. This can be done in many ways like assist players in shooting, or to stay in business term reduce costs of a needed product in order to make it easier assessable.

There is still a lot of research needed in the area of adaptivity in serious games. This subject in the Educational Business Games could be a thesis on its own. However some interesting research has been done in the field of adaptivity that could form, besides multiple difficulties, input for the design of our Educational Business Game.

Lesson learned 35

Adaptivity can be built in the game in order to make the game fit better with the playstyle of the players (43). During game play, the game system, or if needed the game master, can adjust the game. Implementing this as an option in the serious game can ensure that the learning effectiveness is better met through a better fitting gameplay for the players. This could be objectives that adjust to the player's level or events that form are more challenging for players.

In the following chapter we will discuss all that we have learned in this chapter in order to create our Educational business game.

5. Design and Development

In Chapter 4 we discussed the many aspects of serious game design. In this chapter we combine that what was learned into a new model as a framework for the design and development of our Educational Business Game. Also all the identified 'lessons learned' will be gathered to create a list of important aspects that will help serious game designers to identify the game elements and important aspects in more detail.

5.1 Educational Game Design Framework

We propose a new framework that combines different important aspects of serious games to be used as a tool for our serious game. We combine different elements that have been recognized by others as well (Fullerton, 2014; Winn, 2008) with new elements that we believe could be important for all serious games.

Figure 20 depicts our proposed Educational Game Framework which contains all the relevant elements for the design of Educational Business Games. We named the framework the 'Educational Game Framework' because we believe it is not only useful for Educational Business Games but Educational Games in general. This is done because none of the discussed elements are business domain specific but apply to games in other domains as well. This framework stands apart from other frameworks in the domain because of its completeness and detail into all the elements. The framework (together with the checklist discusses in Section 5.2) gives an overview of all the elements that we think should be considered present in Educational Games, but also gives in-depth information on how to do this. Every part is based on scientific sources that suite best on that element. This framework did not come to existence in the process of designing a game but from combining existing methods from literature. This makes this framework not something that worked good in one case but a framework with multiple sources that were used in many different contexts. The model does not really explain the chronological order of a design process except for the client's needs in the beginning and the evaluation at the end. It is correct that we followed a serious game process chain for chronological reasons in order to describe all the underlying parts of game design. However this thesis explores how effective a serious game is when it is build up from literature knowledge. This has not so much to do with the chronological order in which game design happens as with what elements a serious games consists. Therefore this model does propose an approach that can be followed to make a serious game but a framework of building blocks that can be used to create the content of the game.

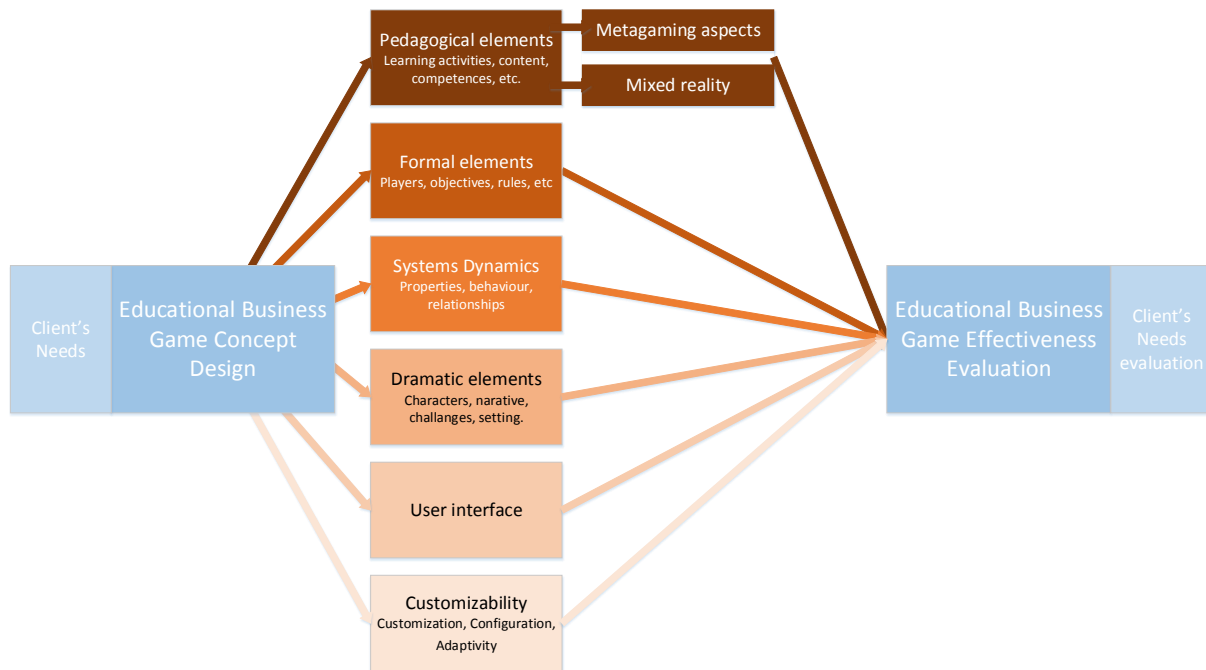


Figure 20, Proposed Design Framework for Educational Games.

This framework does not imply that all aspects are necessary for every serious and/or Educational Game, but it is important to address all the aspects and make a well-considered decisions about every aspect of serious game design.

The framework starts with the client's needs, which should give a general direction of where the game should be about and what the intentions are of creating a serious game. This is where the Educational Business Game concept design starts. Although the framework does not propose a specific chronological order, the first rectangle at the top of the framework is placed there for a reason. It is wisely to start with the pedagogical elements as this influences the game elements (for effective serious games at least), but pedagogical elements can of coarse be (partly) altered later on in the game. Marfisi-Schottman *et al.* (2010) showed that the purpose of a serious game should be the transfer of pedagogical content and therefore the fun elements should be built around the pedagogical objectives and not the other way around. The formal elements, systems dynamics and dramatic elements are the basic game elements that make up the game. The user interface is what combines all elements and communicates the game to the players. An important part of game design as the user interface can make or break the playability and accessibility of the game. The framework up until here is more or less the same as the framework proposed by Winn (2008). Our framework includes some extra steps which are, in our opinion, useful for the creation of effective serious games. We believe that both meta-gaming aspects and mixed reality should be part of the Educational Games' design framework. They are placed behind pedagogical elements because both mixed reality and meta-gaming can be used to improve the learning effect of the game. They might not be mandatory for every serious game but it can add to the learning effectiveness of the game and therefore it is good to take these in consideration when designing a serious game. Also customizability can help to improve the effectiveness of the serious game as a learning tool. First of all both configuration and adaptability can be used to match the game's learning activities with the level of the players. Also for the long term developing the game in a customizable way, can ensure that the game can be altered to new insight so it can be effective in the future without building a completely new game. The framework brings all

the elements together for evaluation. The figure depicts the design process and the evaluation process opposite of each other, because the design process consists of various elements that can all be tested during the evaluation of the effectiveness. Again the client's needs are depicted at the end because also the client's intention of the game should be evaluated. Also the evaluation of the effectiveness is an iterative process and should not only have to take place at the end of the development process. However in order to assess the game there should be a game, which implies that the different elements are in place, although they still can be altered.

5.2 Educational Game Checklist

The Educational Game checklist depicted in Table 2, Table 3, Table 4, Table 5 and Table 6 explains the Educational Game design framework presented in Section 5.1 in further details. The Checklist is created to provide more in-depth information to Educational Game design that cannot be found in the proposed framework. All the elements that are depicted in Figure 20 appear in the checklist. Having a checklist for educational game design could contribute to the field of gaming, according to us, in three ways:

- First, it can be used by game designers to help them to design their game.
- Second, as a tool to do a self-evaluation of their game and start a discussion with others to improve the serious game. Therefore a 3 step scale is added to make clear if that part of the game is not, partially or fully applied in the game. Using the checklist can help making the evaluation assessments with play-testers more efficient, as it lists the many important aspects that might influence the effectiveness of your game. Also if the designers are not testing the effectiveness of the game on real people, this checklist can help them to explain what they did to address all aspects that in theory make a good game. This does not say that you can skip testing your game on real people, as its impact is a combination of many factors and therefore a complex matter, but it gives them a change to explain how thoroughly they designed the game and addressed all the different game elements. The Educational Game Checklist is merely a tool that designers can use themselves to explain how they satisfied each aspect, additionally playtesting will give insights on how players perceive the game. However it could help to reduce the number of iterations in play-test sessions needed as a lot of researched aspects are already in the checklist.
- The third and last purpose of the checklist could be to use it to evaluate other games on their strong and weak points. For comparison it is also convenient to be able to point out if the game has not, partially or fully implemented that part.

The Tables are split up into the different sections of elements that makes the checklist easier accessible. All the requirements are retrieved from the lessons learned in Chapter 4 and the tables make a reference to where the specific point was found in the previous chapter. Table 7 is an extra table with lessons learned that is useful for designers that want to use the checklist as a guide for the process. Table 7 is less interesting for self-evaluation or evaluating other games as it does not evaluate the effectiveness or elements of the game. Most of the points mentioned in the checklist are mandatory for every Educational Game, however there are some requirements that are good to have but stay optional because they cannot be applied in every game. However we believe that designers should consider these optional requirements and include them if possible. If not they should be able to explain why they do not include it in their game. Optional requirements are indicated with **(O)** for optional. For all the guidelines there is a source included that proposes a model, technique, information or tool that can help with this specific part of game design. Many of them come from Fullerton (2014) as he describes many of the game elements in detail and this proved to be a good source of information.

Having all the requirements in place, with optional requirements excluded, will result in having a higher chance of designing a more effective game. Because all the lessons learned that are found in literature are satisfied. However leaving out some of the requirements does not mean that the game will then be less effective. There is on this moment no proof to make statements about how many requirements must be implemented to create an effective game. For most statements one could see that it would greatly affect the effectivity of the game. Like, for example, statement 1, the learning outcomes. If there are no learning outcomes the game cannot be called a serious game and therefore cannot be an effective learning tool. But other requirements are less clear on the effectiveness they add. Adding sub goals next to the main goal of the game for example. We explored that the game will be more fun and engaging when there are also sub goal that players can satisfy. However at this point there is no indication that a serious game without sub goals will be less effective. The checklist does not work as a maturity that indicates how effective the designed game is if, let say, 70% of all the requirements are implemented. Therefore the checklist can be used to get some sense on how well the game is designed and if all aspects are thought over and taken into account during the design process. If all the requirements are implemented in the game the game satisfies all the important aspects found in literature. If not, there is room for improvement. But still, knowing what requirement are really necessary and how every requirement influences the efficiency of the game would give a better indication to how effective the designed game is. If the game could receive a score on how many requirements are satisfied it could be measured how effective the game would be but this would be a very interesting topic for further research, see Section 9.3.

Pedagogical Objectives

Table 2, Checklist with important pedagogical aspects for Educational Game design.

No.	Elements in the game	Originating lesson	Not applied	Partially applied	Fully applied
1	The game has intended learning outcomes and they are clearly defined. It is good to list the outcomes and explain how they are addressed by the game. (Source: Biggs & Tang, 2011)	Lesson 3			
2	It has been designed according to a specific level of understanding, for example, players must be able to <i>apply</i> the content after playing the game or perhaps only <i>recognize</i> similar settings as in the game. (Source: Biggs & Tang, 2011)				
3	It has been developed with a clear vision of the problem it tries to overcome. This means that all the elements in the game have been created towards the intended learning outcomes. (Source: Kessels <i>et al.</i> (1996)				
4	The competences that are needed to reach the desired situation are defined and the content used is based on proven sources or scientific grounds. (Source: Kessels <i>et al.</i> (1996)				
5	The learning activities are aimed at satisfying the intended learning outcomes. (Source: Kessels, Smit, & Keursten, 1996)				

6	The game provides the players with enough time to master all the content that the game offers. (Source: Gardner, 1993)	Lesson 4			
7	The genre of game chosen by the designers is supporting the pedagogical objectives, for example, a shooter makes sense for training marines but not for office people. (Source: Biggs & Tang, 2011)	Lesson 5			

Formal Game Elements

Table 3, Checklist with important formal aspects for Educational Game design.

No.	Statement about the game	Originating lesson	Not applied	Partially applied	Fully applied
8	The number of players in the game suits the (pedagogical) purpose of the game. (Source: Fullerton, 2014)				
9	The way players interact with the game supports the pedagogical goal of the game. This can be one vs. the system or multiple players against the system, even players against each other if this suits the learning purpose. (Source: Fullerton, 2014)	Lesson 8			
10	The players know what the objectives of the game are because they are clearly defined. The objectives in the game suite the pedagogical purpose that is aimed for. The objectives are challenging but also achievable. (Source: Fullerton, 2014)				
11	The game has sub-goals next to the main objective to make the game more challenging and to give it more story. Also these are engaging and achievable. (Source: Fullerton, 2014)	Lesson 9			
12	Designers have given the players different goals that create more challenge. These sub goals fit with the game and the overall pedagogical goal. (Source: Fullerton, 2014)				
13	The game has procedures that that fit the setting and support the content that is taught. (Source: Fullerton, 2014; Winn, 2008)				
14	Procedures for multiple players allow the players to have interaction with each other. This interaction supports the learning activities and the different procedures fit well together. This also means that players have activities throughout the game. (O) (Source: Fullerton, 2014)	Lesson 10			
15	The game has rules that regulate gameplay to keep it fair and playable, but also define what	Lesson 11			

	is part of the game and what not to keep players focused on the goal of the serious game and its learning intentions. (Source: Fullerton, 2014)				
16	Resources are limited throughout the game that makes it challenging. Also the resources fit the context of the game. (Source: Fullerton, 2014)	Lesson 12			
17	The game has conflict in the form of barriers, opponents and/or dilemmas that can be overcome with the content learned or that draws them towards adjusting their behaviour. (Source: Fullerton, 2014)	Lesson 13			
18	Conflict is balanced in a way that it is not too easy to overcome but also not that hard that it prevents players from finishing the game. (Source: Fullerton, 2014)				
19	The game has a useful outcome that makes players more conscious about the subject of the game. (Source: Fullerton, 2014)	Lesson 14			

System Dynamic Elements

Table 4, Checklist with important system dynamic aspects for Educational Game design.

No.	Statement about the game	Originating lesson	Not applied	Partially applied	Fully applied
20	The relationship that is created between players, or the player and the system supports the pedagogical purpose of the game. This means that the relationships are familiar to players and realistic. For example the relation between a marine and his platoon leader should not be all too friendly. (Source: Fullerton, 2014)	Lesson 15			
21	Players have abilities that can help them achieve their goals, these abilities are relevant to achieving the goal and do not allow players to achieve their goals without a struggle. (Source: Fullerton, 2014)				
22	Their stimulated behaviour in the game is focussed on the learning activities and the game gives the players feedback on their behaviour. (Source: Fullerton, 2014)				

Dramatic Game Elements

Table 5, Checklist with important dramatic game aspects for Educational Game design.

No.	Statement about the game	Originating lesson	Not applied	Partially applied	Fully applied
23	The resources in the game are realistic. Often serious games teach something that requires managing resources. Resources in games are the limiters and should therefore fit the learning purpose. (Source: Fullerton, 2014)	Lesson 12			
24	The game has characters that fit within the story, they can be fictional or realistic as long as they do not disrupt the learning activity. (Source: Fullerton, 2014)				
25	The game lets players make decisions within the characters situation (cognitive immersion). (Source: Fullerton, 2014)	Lesson 16			
26	Characters are placed in a social setting (social affordances). (Source: Fullerton, 2014)				
27	Characters have the ability to interact with fantasy and fictional elements (fantasy affordances). (Source: Fullerton, 2014)				
28	The designers have picked a setting for a reason to support the learning activities or the setting is used to create a more fun and engaging game. (Source: Fullerton, 2014)	Lesson 17			
29	There is a story that draws people into the game and which positions the learning activities in a fun and engaging perspective. (Source: Fullerton, 2014)	Lesson 18			
30	The story has a rising tension that falls at the end of the game. (Source: Fullerton, 2014)				
31	Players get rewards that will motivate them to perform better on the learning activities. (Source: Fullerton, 2014)				
32	Reward gained are increasing as the game advances. (Source: Fullerton, 2014)				
33	The game uses flow to balance between frustration and boredom. In other words the game is not too hard, but also not boring that people stop playing. (Source: Csikszentmihalyi, 2014)	Lesson 19			
34	The game has an increasing degree of difficulty as the game advances. (Source: Winn, 2008)				
35	Decisions in the game are limited in the beginning of the game, but are increasing as the game advances. Near the end of the game the number of choices are decreasing. (Source: Fullerton, 2014)				

Additional Elements that improve Effectiveness

Table 6, Checklist with additional important aspects for Educational Game design.

No.	Statement about the game	Originating lesson	Not applied	Partially applied	Fully applied
36	For the interface the designers can explain that they have satisfied the golden rules by Schneiderman (1986) or the design principles by Benyon, Turner & Turner (2005). This will help to improve the user interface of the serious game. (Source: Schneiderman, 1986; Benyon, Turner & Turner, 2005)	Lesson 20			
37	The game designers have used meta-gaming aspects by enriching the learning effect after the game is played and so being influential after the game. (O) (Source: Salen & Zimmerman, 2004)	Lesson 21			
38	The game uses both digital and physical aspects that enable players to play the game in their physical environment also. (O) (Source: Raybourn, 2007)	Lesson 22			
39	The serious games' effectiveness has been tested. How it has been tested can be shown in order for others to replicate the results of the game's effectiveness. (Source: Rogers <i>et al.</i> , 2007)	Lesson 30			
40	The serious games' effectiveness has been tested over the long term to ensure its impact. (O) (Source: Kessels <i>et al.</i> , 1996)				
41	It can easily be customized in order to create a serious game of which the content can be easily adjusted for other goals. This can give the game a longer lasting effectiveness span. (Source: Northrop & Clements, 2001)	Lesson 33			
42	The game has more than one difficulty setting that allows it to fit with more or less capable players. (Source: Bakkes, Tan & Pisan, 2012)	Lesson 34			
43	Adaptivity is built in the game in order to make the game fit better with the playstyle of the players. This means that the game adapts itself to the playstyle of the players. (Source: Lopes & Bidarra, 2011)	Lesson 35			

Other Lessons Learned

Table 7 does not discuss game elements and is therefore not as useful for evaluating games. The following lessons do not contribute to the serious games effectiveness per se, and are therefore not required to be answered if the checklist is used for the evaluation or discussion of a game. But they could be important lessons to keep in mind for designers before designing a serious game.

Table 7, Checklist with other lessons learned for Educational Game design

No.	Statement about the game	Originating lesson	Used
44	Although following a step by step approach, try to use iteration during this process to enable quick fixes that prevent the designers from starting all over again. (Source: Garris, Ahlers & Driskell, 2002)	Lesson 1	
45	Requirements elicitation will help the design team to get the wishes from the client clear. This will also need some iteration but a structured approach will help. (Source: Zowghi & Coulin 2005)	Lesson 2	
46	After most of the learning activities are installed, do a pedagogical quality check in order to see if the activities fit the purpose of the game. (Source: Kessels <i>et al.</i> (1996)	Lesson 23	
47	Explore useful tools that are out there that can help you to create your game. Using existing tools will reduce the time needed to create the game. (Source: Fullerton, 2014)	Lesson 24	
48	Use feedback as frequent as possible as it can prevent a lot of work. (Source: Fullerton, 2014)	Lesson 25	
49	Test the serious game with multiple types of testers. Experts, acquaintances and strangers should all be included. (Source: Fullerton, 2014)	Lesson 26	
50	Play test sessions should have a structure to be as beneficial for the designers as possible. (Source: Fullerton, 2014)	Lesson 27	
51	During play-test sessions, try not to talk too much about the game, let players create their own opinion about it. (Source: Fullerton, 2014)	Lesson 28	
52	There are different ways of conduction play-test sessions. Pick them out carefully and try to combine multiple approaches. (Source: Fullerton, 2014)	Lesson 29	
53	Also for evaluating the effectiveness, there are different ways of evaluating the effectiveness. Choose a method carefully and try to combine multiple approaches to increase the effectiveness tests. (Source: Mitgutsch & Alvarado, 2012; Desurvire, Caplan & Toth (2004)	Lesson 31	
54	Try to see the evaluation of the effectiveness as a research on its own. The better this is carried out the better one can say something about the effectiveness of the game. (Source: Rogers <i>et al.</i> , 2007)	Lesson 32	

In Chapter 6 the entire checklist will be used to discuss the Educational Business Game that has been designed for this thesis.

6. Demonstration

6.1 Anderson MacGyver

Anderson MacGyver is a young consultancy company founded in April 2013. Focussed on aligning business and IT within companies they often have cases that could benefit from better cooperation. They wanted to explore how games could help them to do this. They already use Educational Games provided by third parties but these methods do not fully correspond with their own models and view of how IT should operate within the company. This asked for a tool that could be used to teach their views in an effective way. Because they already had some experience with games they knew the impact of these games in practice. This was the beginning of the idea for an Anderson MacGyver game.

6.2 Educational Business Game Process

In this section we will shortly go through the process we followed during the design and creation of the Educational Business Game that was made for this thesis. The origination of the game and its theme will be explained and what we did prior to the design of the game elements. We will not discuss all the elements of the game as this will be explained in more detail in Section 6.4.

6.2.1 Clients' Needs

The first step of the educational business game design process was to identify the client's needs. The first meeting with the clients from the case company was meant to create a scope of the game and a domain in which the game should be played. The case company is an advisory company that focuses on Business and IT and therefore the game requires to be played in this domain as well. This meeting took place with 4 members of the case company with experience in teaching, training, games and the domain.

This meeting started with the intention of identifying the capabilities that were intended for the game. Domain experts within the companies joined the meeting in order come to a joint concession of what the game should look like in the broad sense. The basic idea of the game is that it should train their clients in the IT domain.

We found out that the goals of the game are pretty much intertwined with the way the game is structured and what the form of the game will be. We identified that game should be based on three main processes within a company that are important coming from an IT perspective. The motivation behind the game will be the motto of the case company: *create value through IT*. Their vision on how to do this is the basis for game and is focussed on three processes that we will discuss briefly.

The first layers that needs to be involved in the game is that a business should *innovate* with the usage of technology. This layer is mainly about innovations that happen within a company can come from many sides. Somebody in the business comes with an idea, the IT department see that processes can be made easier or maybe a supplier has an innovative service that makes the company better. This Idea however is only the start of the innovation. In order to create real value there is an ideal situation of working together between different parties. But there are many ways of getting an innovation into the company (forced by the business without communication for example).

The second layer is *change* and is about the pressure of change within the business. How to react to change and making decisions that are in line with the business strategy. This step involves practices like portfolio management and projects. The innovation from the layer above has turned into a change that needs to come. How does this fit with the processes we have? Or with our resources? Or other projects that also need to happen but with the restriction of time and money? These problems can be encountered here, also here it is important to have collaboration with the right people.

The last layer is *operate* and this concerns the daily operational processes of the organization. These are the processes about the real services of the company. The IT department supports the business with information systems and tools. These processes should be in line with what the business needs. Communication here is needed to focus effectively on KPI's.

These three layers in an organization involve three different parties that have to work together in creating value through IT. These are: the IT department, the Business and the suppliers. The combination of the three layers and the three parties result in a matrix that consists of nine tiles within the game that makes up our fictional company of which the context has to be defined later. These nine tiles may consist of multiple roles that all need other capabilities or competences with each their own a specific knowledge need and also intended learning outcomes. The game's aim is to train the players how each role should behave and in an ideal play through it would turn out in the maximal outcome (Goals in the game, discussed later). Figure 21, Shows the nine different tiles and the different initial roles. Roles are sure to be changed or deleted later as the capabilities the game trains are not defined yet. The functions were filled in by the case company.

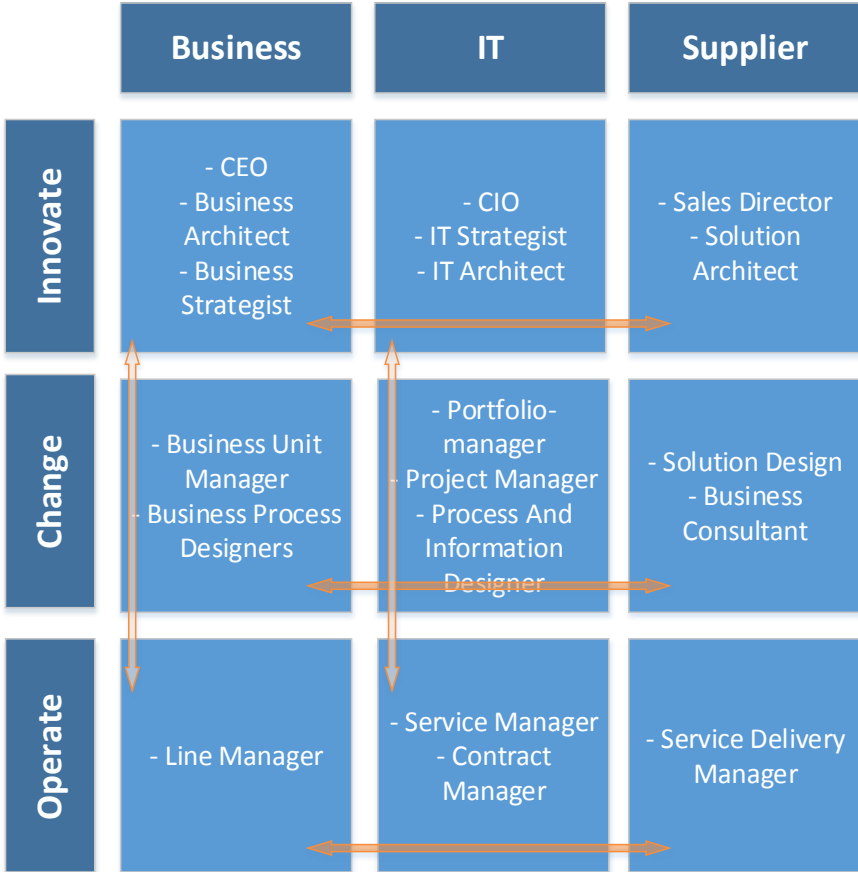


Figure 21, Innovate-Change-Operate Framework that forms the basis for the Educational Business Game.

The framework will be used to define the problems in this domain, what the ideal situation would be if all the employees would perform optimal or how the organization as a whole should function. With the desired situation clear the different competences for the different roles in the game can be made clear. How they should act and what they should learn from the game. The competences can then be used to create learning activities that actually teach this in the game.

Eventually after many iteration sessions the roles in the game were a little bit altered. Also we chose to include less roles in the pilot version to test parts of the game first prior to including all the roles and functions.

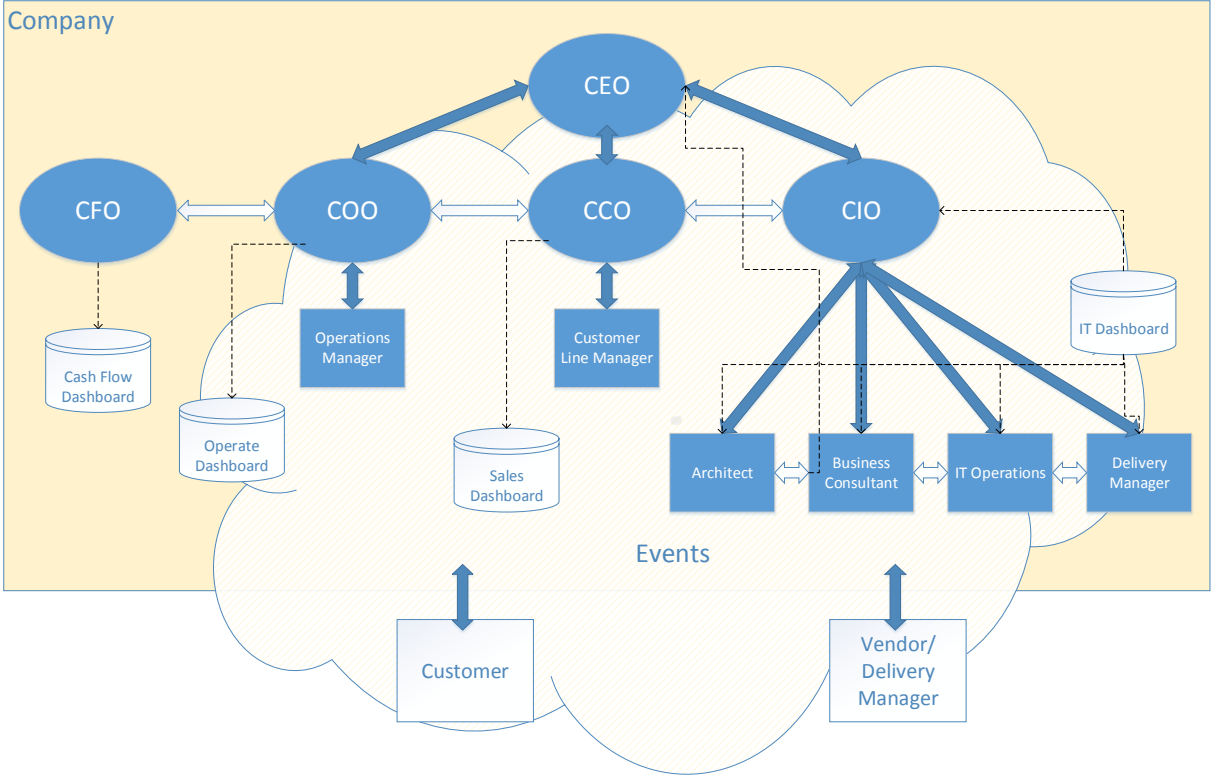


Figure 22, Roles and functions used in the actual game.

Figure 22 shows the domain that is used for the game that was created. In the pilot version 5 roles were used to create part of the game. These are the CCO, COO, CIO, IT operations manager and the delivery manager.

In explaining the needs of the game a lot of requirements were coined. These were included into a list of requirements in order to reach a consensus between the developer and the client. An initial list of requirement can be found in Appendix 6.

6.2.2 Specification of Pedagogical Objectives

Following the 8 fields model (Figure 8) by Kessels, Smit, & Keursten (1996), we identified the problems and the ideal work situation where employees behave in a way that the problems do not arise.



Figure 23, Problem identification session

Problems

To identify the problems some of the domain experts within the company were given post-it notes on which they could write down the problems they often saw in the given domain (Business – IT domain). The post-it notes were then mapped on the framework in order to identify where the most and urgent problems could be found in this domain (see Figure 23). Mapping the problems into the framework created the focus point for the educational business game and. This resulted in +/- 30 problems that could then be mapped upon the framework (see Figure 24). With the problems defined we discussed the most occurring problems and the capabilities that would fix these problems. The capability that the game would revolve around should aim at solving the problem(s) that occur the most. This was a prioritization process that the Anderson MacGyver team had to make. Looking at Figure 4, the most problems seem to occur in the top left four quadrants. These four quadrants will be the focus of the educational business game. Some of the problems were filtered out because they are not in these quadrant and therefore not within the scope of the project. It could be however that some problems are included in the game as an event to teach players that certain problems can occur in real life situations. These problems are however not the main focus of the game. All the identified problems and the capabilities that are needed to overcome the problems are explored below.



Figure 24, Frequent seen problems mapped upon the framework.

Work situation

To define the capability that we wanted to teach in our game, the problems gathered in the previous step were clustered and given a label. Labelling the problems to cluster them will make it easier to identify the capability we want to teach in the game. This method will not only identify the capability of the game but also which roles and competences the game should focus on. Table 8 depicts all the problems labelled to the business activity they address. The table tries to cluster some of the problems into specific activities in order to find the area that the game should address as a main capability. Some problems do not really apply in one capability and are therefore classified as 'overall'. The labels will identify what is the biggest problem according to the problems. The biggest problems should become the main theme of the game.

Table 8, Problems and the activity that is needed to overcome the problem

Problem Statement	Activity	Description
Business doesn't know what the operations do and operate layers does not know what the Business wants.	Overall/ Communication	Communication lacks in the company, this problem can be part of any capability
Collaboration between Business, IT & supplier isn't good.	Overall/ Collaboration	Collaboration is a quite general term that needs to be applied everywhere. In this domain it is applicable for this capability where the Business and IT need to collaborate in creating value through finding balance.
Business does not steer on IT effectively (Innovate, Change & Operate are not in balance)	IT governance	The Business not know the value of IT and is keen on investing in innovations and not in use systems for example.
Employees aren't aware of the effectivity of dashboards.	Overall/ Effective Decision-Making	This has to do with communication of information that is critical in all layers of the company. This information can give better insight on the value certain activities have and can help in better decision-making.
The Business does not know why IT cost so much money, and are tend to only look at costs and not the added value.	Effective Decision-Making/ Manage IT/ Dispose of ICT	Sometimes IT costs too much because the systems are not optimal, but cutting cost will not add value here. Making the right decisions to balance between costs and value is important here.
The Business does not know what the possible opportunities are of IT in creating value for customers.	Procure And Develop ICT	The Business is looking for new innovations but might forget to include IT in this process while they might see the needs of the customer.
The Business is insufficiently capable in responding to the needs of the customers.	Procure And Develop ICT	This is also in the domain of being able to scout for innovations and making the organization change to meet the needs of the customers.
The Business is stuck in old habits to realize change and growth.	IT Governance	In the domain of Business IT, this has mostly to do with not seeing opportunities in technology that is beneficial for the company
The importance of an architecture is not recognized by the Business sufficiently.	Procure And Develop ICT/ legacy vs innovation	The Business can have a successful business model for an innovation but it might not fit in the existing architecture
The power balance between the central organization and business units is not balanced.	Overall/ Effective Decision-Making	
IT approach is not flexible enough to cope with the speed of change the business wants.	Change Management	The IT approach can be very reluctant in change were the Business might need this to satisfy the customers' needs
Employees are not aware of available change models (Projects vs. Agile/ sprint)	Change Management	The successfulness of an innovation depends on this.
Successful actions are not recognized and reused in other parts of the business.	Manage ICT/ Develop ICT	Sometimes successful activities in parts of the company are not reused in other parts which is a missed opportunity.

The IT does not really know what the added value is of their services.	Manage ICT/ Evaluate Effectiveness/ Dispose of ICT	How effective are our services is an important question in order to see if systems are still worth keeping or what changes are needed.
Insufficient long term planning (lifecycle management)	Manage ICT/ Dispose of ICT	Systems tend to get older in time and
IT organization does not act as the party that controls the services but as the operational IT department	Procure And Develop ICT /Manage ICT/	IT has to act more as the party that controls the services from suppliers. This calls for some managerial skills like decision making.
No prioritization between conflicting interests	Overall/ Effective Decision-Making	This problem is always important in all kinds of decision making, also in innovation and change in ICT.
Collaboration between parties business 'owners', IT & suppliers is not good enough.	Overall/ Collaboration Between Parties	Not really a capability but an important part of ICT- Procurement, Management and Dispose
Innovative ideas that originate from external suppliers are not sufficiently recognized by the Business.	Decision making/Procure And Develop ICT	The Business is not focussed on new innovations from third party suppliers.

Most of the identified problems address decision making in activities like procure and develop, manage and dispose of IT. The capabilities procure and develop, manage and dispose of ICT combined in the light of the three layers (innovate, change and operate) make it a logical choice to focus on IT Governance in the Educational Business Game. As IT Governance is basically about decision making processes and the people involved to ensure that the organisation's IT sustains and extends the organisation's strategies and objectives. People in an organization have to take decisions about the direction and usage of IT. According to Weill & Ross (2004) IT Governance encompasses five major management related decisions:

- IT principles: high level decisions about the strategic role of IT in the organization.
- IT architecture: an integrated set of technical choices to guide the organisation in satisfying business needs.
- IT infrastructure: shared IT services providing the foundation for the enterprise's IT capability.
- Business application needs: business requirements for purchased or internally developed IT applications
- Prioritization and investment: decisions about how much and where to invest in IT, including project approval and justification techniques.

Also because IT Governance is not only decision making in the IT domain but also concerned with the value of IT systems. Some problems of Table 1 focus on the effectiveness of IT or the fit of IT with the needs of the costumers. IT Governance is also concerned with these topics. Different components of IT governance are (Weill & Ross, 2004):

- Creating financial value
- See the impact of IT investments
- Getting insights on the value of IT for the business
- Get insights on the changes of the market
- Minimizing risks
- Specifying a formal division of tasks and roles in decision making
- Align Business and IT

IT Governance is concerned with most of the problems depicted in Table 8, plus IT Governance is positioned in the higher management functions that matches the mapping of the problems in the left top corner of the Innovate-Change-Operate Framework. Problems here with respect to decision making and creating value with IT can be categorized as IT Governance.

6.2.3 Choice of the Serious Game Model

In section 5.3.2 we discussed the different serious game models that could be used for 'apply' games. In the case of our Educational Business Game we want to make a game that shows in a short time what the impact is of decisions on IT in an organization. This can be done by making a simulation game that let people play this scenario as realistic as possible. As discussed in section 5.3.2 also case based learning and group work have some strong points. Therefore we will combine these two in the simulation. Both case based learning and group work are used because players can easily recognize the situation and have to work together to get the optimized result just like in the real world. Group work could therefore also be seen as a learning goal of the game.

6.3 The Resulting Game, Hotel California

The resulting game, called 'Hotel California' that was designed will be explained in this section. The pilot version of the game consists of 2 of the 5 intentional rounds due to the time that was available. The game consists of rounds because there are no levels and each round represents a year. We also choose to develop part of the game instead of developing the entire game and maybe find out that the results of this research are not positive. The last 3 rounds have been partially designed to create an overview for the complete game but are not in the created artefact and are also not evaluated.

"Hotel California Group (HC group) is not the biggest hotel chain in the world, but it is a global player and they have grown a lot in the last 10 years. Their hotels are in the biggest cities in the world in Europe, North America, South America, Asia and Africa. Now it's time for a new team to take over the wheel at HC group."

Hotel California is a game where a team of players will be in charge of the IT related changes of a Hotel chain. It is their job to prepare the Hotel Chain for the future and increase profit and make it the best hotel in the world according to their customer satisfaction. The team in this pilot version consists of a COO, the CCO, the CIO and within the IT Department the IT Operations Manager and the IT delivery manager. Together they should decide what the best course is for the organization to invest in. Where mainly the COO and the CCO want to invest in new things that require IT (like a new website or new systems) and the IT operations manager has to maintain the day to day operations and the delivery manager has to plan all the new projects that are requested by the organization. The CIO has a function in between to facilitate the link between these two domains, the Business (traditional business functions, in this case the COO and CCO) and the IT department. They have a budget, a number of FTEs and network capacity to divide among different IT investments. The goal of the game is to increase profit and earn points by implementing projects required by the strategy. The idea behind the game is to perform as good as possible and manage all the resources effectively. To be really in control as an organization all information should be collected centrally, and communicated among all players. Only when this happens the team can make good decisions as a whole.

The game will give the players a strategy (partly shown in Figure 25) that roughly sets out the course of the organization in the upcoming years. The strategy roughly contains the increase the sales, lower the cost of operations and invest more money in smart solutions. However how this is done is determined by the players who are deciding the course of the game with their investments. So in this game the players will receive possible projects the organization can carry out to invest in IT related projects that can help their organization. There will be more options to invest in than resources can

allow, and not all options are needed. Some options do not satisfy the organization as a whole but might satisfy personal targets of players. Choosing these options might look beneficial at first but will not make you reach the main objective of the game.

Hotel California Group

Ronde 1/ Year 1

- Main event: the main event this round is the fact that the CEO wants to make the HC group hotels operate more uniform. This means that the CEO wants the COO, CCO and CIO to steer more on working in the same way. The requirements that he has for this event to succeed is:
 - Hotels should operate in the same way to boost efficiency. Some hotels are operating on a different systems
 - Hotels should be accessed by Customers and guests in one singular way.




Figure 25, Round 1 introduction with strategy for that round

Each round has its own ‘main’ event that requires some actions to be implemented. If the team pays attention to the information they receive and they manage to implement all the required actions to satisfy the main event, they will not only see the sales go up and the costs of operations go down, but they will also receive points. These points will indicate how well they listened to the strategy of the company and pursuing to become the best hotel in the world. The game is played on a website that displays all the projects that a person can choose. Figure 26 depicts a screenshot of a main page from one of the roles. Players can see their targets, character info and projects available.

DIGITAL VERSION OF THE GAME

Hotel California

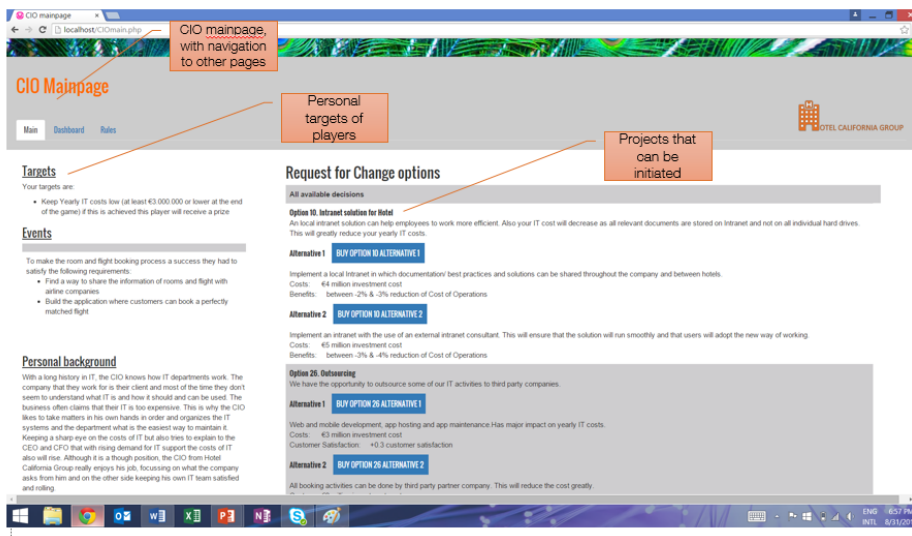


Figure 26, Screenshot of Hotel California

In order to make good decisions the players will have to: pay attention to their personal targets, pay attention to the organizational goals and wishes, gather information on the different options available, negotiate with other parties in the company, prioritize options and divide the available budget. In the next section the game will be explained in more detail using the Educational Business Game checklist.

6.4 Self-evaluation of the Game According To the Checklist

The Hotel California game will be explained in detail according to the checklist. All elements will be discussed and why our game satisfies it. All the checklist requirements will be explained. For our research we try to encompass as many fully applied requirements as possible. We address every requirement even if we cannot satisfy it and why this is the case.

6.4.1 Pedagogical Objectives

1. The game has intended learning outcomes and they are clearly defined. It is good to list the outcomes and explain how they are addressed by the game. (Fully applied)

The intended learning outcome of the game is to get people to 'understand' and give 'insights' about IT Governance. Hotel California has been designed with the purpose of teaching in mind. The goal of the game is to give people more insight in the how an organizations' IT department and the business work together to create more value for the company as a whole. By letting them experience that communicating with the right people works better in satisfying everybody's needs, players will come to realize that the IT department has other concerns than the business. But when these parties communicate and work together instead of against each other more people will be satisfied. In the literature, this is called IT governance, meaning that the IT department is in harmony with the business and where the organization creates more value by working together. So the goal of the game is therefore to give players more insights on IT governance. For the game we used the objectives of IT governance according to Weill & Ross, 2004, who state that IT governance includes:

- *Creating financial value with the right decisions.* Our players have to make the right decisions in order to create value for the organization. Some decisions might harm the organization and prevent the team to reach the highest score possible.
- *See the impact of IT investments.* In our simulation game all the investments have an impact, this might be on sales or costs of operations, but also on number of employees available, maintenance cost per year and the network capacity of the organization. The impact of their choices can be found back in the dashboards they can access with valuable information for their role. Here they can see whether or not their decisions created value. Also like stated earlier, players will receive points for implementing the right projects required by the main event or the strategy. They will get feedback on the points gained after each round and why they did not accomplish to receive them all.
- *Getting insights on the value of IT for the business and inspire people to change.* The game shows that, if you want to survive in the future, you have to invest in new IT solutions. This is not made up, but the strategy used, comes from a real Hotel Chain. The game wants to show that IT is a key part of innovation and that the IT department has a crucial role in fulfilling this task.
- *Get insights on the influence of changes on the market.* In the game the players will experience main events. These main events can occur from inside the organization, but also from outside the organization. New market trends that are on the rise will come along and players will have to decide if they want to invest in them and seize the opportunity.
- *Showing possible risks and how to minimize them.* The game shows the risks of not communicating with others by letting them make the wrong decisions, forgetting about important pieces of information and chase their personal interests. The game will give

feedback after some round in how the risks can be minimized and the organization can perform better.

- *Specifying a formal division of tasks and roles in decision making.* Again here, the goal of the game is to show players how to communicate and with whom. The game will show players the best possible flow of information in order to make good decisions.
- *Align Business and IT.* The game is played with the business roles CCO and COO who desire all kinds of innovative IT solutions. On the other side there is the IT department with the IT operations manager and the IT delivery manager under the leadership of the CIO. The business requires things from the CIO but there is only limited money, people and capacity. So they should all align their wishes and create an implementation plan together.

2. It has been designed according to a specific level of understanding, for example, players must be able to apply the content after playing the game or perhaps only recognize similar settings as in the game. (Fully applied)

The game has been designed to make players understand the concepts of IT governance and give them insights on this subject and tries to create awareness so they can apply it to their own situation. The game does this by letting the players experience many of the different events that can take place. The game let players experiment how to cope and manage the situation. This will allow them to recognize situations in real life and how to act on them. This will make them more conscious about the issues and hopefully motivate them to explore IT governance in their own organization. The game forces players into a sort of trial and error game play, where in the first rounds they are not really communicating and cannot really pick the right solutions. However after some rounds of playing they will understand that they need each other to make the best decisions.

3. It has been developed with a clear vision of the problem it tries to overcome. This means that all the elements in the game have been created towards the intended learning outcomes. (Fully applied)

The game was created because the case company for which the game was made, saw a lot of issues in this domain. So during all the meetings with the case company the design of the game was focussed on making a game to overcome this problem. The problem is that in companies the collaboration between the Business and the IT department is not always optimal, while in these times IT is a lot more than only supporting the business. A lot of sales and marketing happens online now and therefore the value IT can add to the company is increasing. This games shows players the importance of the IT department by letting players experience that innovations are IT based and that this generates income. However, it is not enough to recognize that IT is important, also how this is managed has influence on the organization. Hotel California lets players experience that by showing them that communication and collaboration between departments will add the most value for the organization as a whole.

4. The competences that are needed to reach the desired situation are defined and the content used is based on proven sources or scientific grounds. (Fully applied)

Already discussed under statement 1 the intended learning outcome is to give insights in IT governance. The competences that are needed to be mastered to reach good IT governance are also partially explained under point 1, but are listed here again for completeness.

- Capable of Creating financial value with the right decisions
- See the impact of IT investments
- Capable of seeing the value of IT for the business
- Capable of seeing the influence of changes on the market
- Capable of minimizing risks

How the game does this is already explained.

5. The learning activities are aimed at satisfying the intended learning outcomes. (Fully applied)

The learning activities all revolve around IT governance and the subparts or IT governance. Like explained the players will have to address all the competences that are needed for good IT governance. Table 9 depicts the learning activities and the intended learning outcomes they satisfy.

Table 9, Learning activities in the game and the intended learning outcomes they satisfy.

Learning activity	Intended learning outcome	description
Pick actions	Capable of Creating financial value with the right decisions	Players need to pick out the actions that will add the most value for the company.
Estimate and evaluate risks of decisions	Capable of minimizing risks	Actions have risks, players will find out what happens if they choose one action instead of the other.
Prioritizing projects	Capable of Creating financial value with the right decisions	There are more options than resources, prioritizing is needed. Picking the right ones will have influence on the outcome of the game
Communicate and collaboration with other players	Capable of seeing the value of IT for the business, Capable of seeing the value of IT for the business	By communicating with other players that have other goals, players will be able to find out how they can do what is best for the company.
Allocate budgets	Capable of Creating financial value with the right decisions	Budgets for investments are divided between players, however they will have to ask each other for the budget they are missing.
Create a formal structure for decision making	Capable of Creating financial value with the right decisions	Having a good structure in IT governance the organization as a whole will benefit by making better decisions.
Act on incoming events	Capable of seeing the influence of changes on the market	Events will happen that disrupt the organization, players will have to act on these issues in order to keep the organization running.

6. The game provides the players with enough time to master all the content that the game offers. (Fully applied)

The game is aimed at people understanding the importance of IT governance. We believe that this can be reached in a game that takes around a half a day to play. Of course for players to master IT governance and to implement it successfully in their organization will need more time but that is out of the scope for the game.

7. The genre of game chosen by the designers is supporting the pedagogical objectives, for example, a shooter makes sense for training marines but not for office people. (Fully applied)

For the game we choose to create a simulation game. This form for the game is perfect to our opinion to let players learn to interact in a safe setting. We choose this form according to Biggs & Tang (2011) who state that in a simulation multiple players are not only giving suggestions or solutions, but actually '(re)play' a certain situation or case. This enables the teacher to train a group to collaborate and reach a goal as a team and teach certain knowledge that is applicable in real life. The simulation simulates real practices and therefore makes the game a training tool that teaches players competences that they can apply in the workplace.

6.4.2 Formal Elements

8. The number of players in the game suits the (pedagogical) purpose of the game. (Partially applied)

The pilot version of the game consists of 5 playable roles. This number is not the ideal number of players that we wanted to have in the game as there are more roles and functions in the organization that play a role in IT governance. In a real organisation more than 5 roles influence IT governance. For example the CFO has to watch budgets, in our pilot version there is no CFO, while we do want to have one in the real version of the game. 5 players can be used to simulate the problems around IT governance but with more roles the issues will become more complex and realistic. More functions will have requests for the IT department and have to 'fight' each other to get what they want. This will also make the game harder in finding the best way communicating together but also make it more realistic. Due to the period of time available for creating the game we decided to pick the most important roles that are needed to simulate this.

9. The way players interact with the game supports the pedagogical goal of the game. This can be one vs. the system or multiple players against the system, even players against each other if this suits the learning purpose. (Fully applied)

In real life the roles that are represented in the game should communicate with each other face to face and using for example email. In the game the players can do just that. This has been built into the game because that is how it will be in a real organization. So during the design phase we thought about how we wanted players to interact with each other and also when this should happen. So how players interact with each other has received the needed attention.

10. The players know what the objectives of the game are because they are clearly defined. The objectives in the game suite the pedagogical purpose that is aimed for. The objectives are challenging but also achievable. (Fully applied)

The objective of the game is to become the best Hotel chain in the world and win the World Luxury Hotel Award. This can be done by implementing specific projects, innovations, systems and services that are required to become the best hotel in the world. All the required actions will give the team points, if chosen, that will count up to a score of 100 points (30 in the pilot version). Achieving 100 points will mean that the game has been successfully played for 100%. The game will explain to players what kinds of implementations the organization needs to reach this goal. However they do not know exactly how this translates into the specific actions that can be taken. Not all decisions that can be taken will help them to achieve the main goal. Some can be nice to have and help players to achieve their sub-goals or increase income but do not help them win the game. Next to the points that can be

gained, the players will also have to keep the sales and costs of operation in mind. The total end score will be the number of points collected for the required options and the total profit at the end of year (round) 5. Therefore they are required to balance between organizational performance and the way they carry out the strategical plan that was presented to them. This is done to prevent that players will only go for points and ruin the company, or go for profit only and do not care about the points.

11. The game has sub-goals next to the main objective to make the game more challenging and to give it more story. Also these are engaging and achievable. (Fully applied)

Next to the profit or the collection of points, all the players will have their own specific targets that they should achieve. These are partially in line with the overall strategy, but sometimes possible options that they will get are not required by the company but does satisfy the personal target of the player. See Appendix 9 for a more detailed description on the sub goals for characters.

12. Designers have given different roles in the game different goals that fit with the game and the pedagogical goal. (Fully applied)

Each player has its own individual target that is focussed on a different aspect. This creates challenge in the game because each player has a different objective. For example the target of the CCO is to:

- Increase sales by 10% (at least sales up to €1.348.600.000 or higher which corresponds with a total of 10% points) if this is achieved this player will receive a prize
- Achieve a customer satisfaction of 6.5 (currently 5/10) this will result in a profit bonus of €30 million

See Appendix 9 for a more detailed description on the roles.

13. The game has procedures that are logical for the setting and support the content that is taught. (Fully applied)

When designing the game we wanted to keep it as close to the real situation as possible. Therefore the players will not sit together at one table but preferable in two groups in different rooms. The CCO and the COO in one room, as they do not communicate with IT personnel. The CIO, IT delivery and operations manager are sitting together as they are in the same department. Mostly the CIO will have to communicate with the COO and CCO as happens in a real organization. Therefore we also have a conference table where people can invite each other to talk and discuss options. Players can invite each other through in-game email or visiting each other face to face. The procedures that have to be followed are based on real organizations. If the COO wants something from IT he should discuss it with the CIO, if he does not do that, then he does not follow the optimal procedure but that is what the game is trying to teach. The game wants people to find out what the best procedure is.

14. Procedures for multiple players allow the players to have interaction with each other. This interaction supports the learning activities and the different procedures fit well together. This also means that players have activities throughout the game. (Fully applied)

All the players have part of the information and therefore need each other. In the beginning of a round all roles will receive some possible options that they can implement. The players that have an IT roles will have to make decisions about IT operations and CXO's about strategic decisions. However all strategic decisions needs some IT work and therefore they should contact the IT department. The CIO should collect all the projects that the organization wants. The Operations manager knows how much the maintenance cost of the project will be when it runs, and how much capacity it will take from their network and the Delivery manager knows how much FTE it will costs to start the project. This forces

the players to work together and their procedures to be intertwined. Because finding out the best procedure is part of the game, the intertwining of the players' procedures will not be that necessary in the first round.

15. The game has rules that regulate gameplay to keep it fair and playable, but also define what is part of the game and what not to keep players focussed on the goal of the serious game and its learning intentions. (Fully applied)

The game has a set of rules that is presented in the beginning of the game. These rules are here to give the game boundaries but also to keep players on the path of learning. Some of these rules are:

- If a player (CCO, CIO, COO, IT operations manager and IT delivery manager) does not make any decisions in a round it will affect the company. Standing still is going backwards.
- The IT backbone capacity is 200 in the beginning of the game. This is upgradable.
- The IT department has 30 FTE for innovations and change. Extra FTE's can be bought for a fixed price per year. FTE's can also be fired.
- The CCO, COO and CIO have part of the budget for IT investments. They do not have to invest everything they have.
- Players will receive possible actions that have consequences for the organization. These can be: investment costs of the action, IT operation cost per year, FTE usage, IT capacity usage, risk of IT issues, influence on sales, and influence on the Hotels' cost of operations.
- High customer satisfaction will result in extra sales. (Customer satisfaction 7+ will result in 5% more sales.)

16. Resources are limited throughout the game which makes it challenging. Also the resources fit the context of the game. (Fully applied)

The resources we used are tested on balancing using two methods. First we used Machinations by Dormans (2011) to simulate the game. This was useful to adjust the consequences of each action that can be taken in the game. Figure 27, shows Machinations and how the tool was used to simulate the game. This tool made it possible to balance the game by one person and not have to play through all the possible options with a team. Also the tool automatically calculated the outcomes. This is very helpful if a game, just like Hotel California, has many variables.

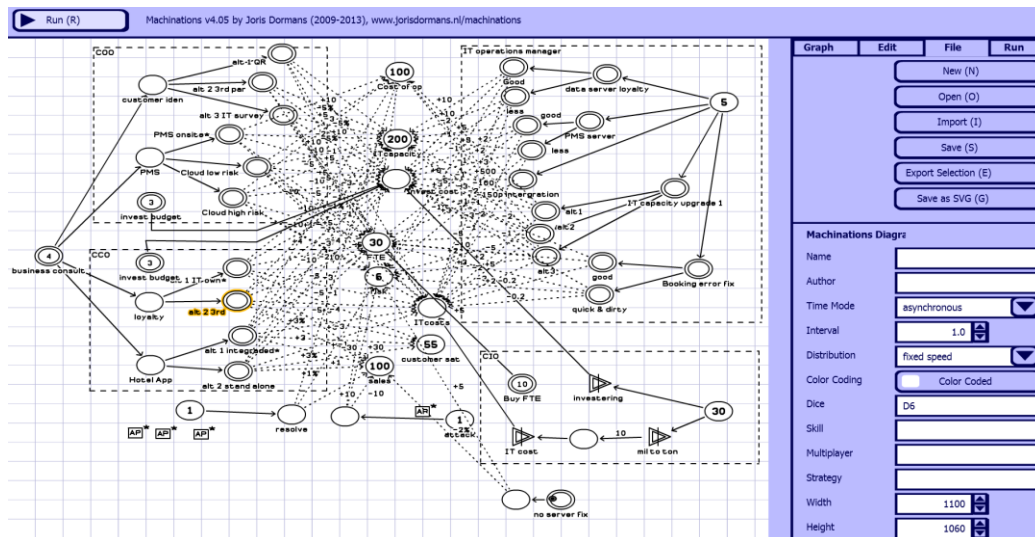


Figure 27, Game balancing using Machinations by Dormans (2011)

After that we used Excel to create a tool that calculated the costs and benefits of all the actions that a player can choose combined. Where Machinations was good to create an initial simulation of the game, Excel was more powerful. We used Excel to simulate multiple rounds instead of one (like in Machinations) which could also calculate outcomes and depict graphs. The different variables that the game knows are directly projected into a graph that shows the progress of the company over time. This is used to balance out the possible options to create a game that is not too easy for players to win. It was also used to make round one somewhat easier, and round two harder to manage. A screenshot of the excel file of our game can be found in Appendix 5.

17. The game has conflict in the form of barriers, opponents and/or dilemmas that can be overcome with the content learned or that draw them towards adjusting their behaviour. (Fully applied)

The game features a lot of conflict. Of course there is a conflict over the lack of resources. All players need money and employees however there is just not enough to do everything. There is also conflict between different parties. The CCO from marketing wants innovations that help to stimulate sales, the COO wants to cut costs. They have different targets and are fighting each other for their own interests. In the beginning of a round all roles will receive some possible options that they can implement. The players that have an IT roles will have to make decisions about IT operations and CXO's about strategic decisions. However all strategic decisions needs some IT work and therefore they should contact the IT department. The conflict starts when IT roles have their own operations to run and need to carry out innovations that were decided upon by CXO's. If not communicated in a good way this will supries them and conflict will rise. Along the way the players will encounter some issues within the company. Something will break or extra investments are needed, this creates extra conflict because it puts the strategy under pressure and budgets and people have to be reallocated in order to keep the organization from losing sales and customer satisfaction.

There will be conflict about investing in the long term, the players will know from the beginning of the game that in year 5 a large event will happen, they can start planning upfront. But each round will also have its own 'main event' that requires attention. This forces the players to think about short term gains or long term ones.

We also use something we call budget tables. Players will see that the actions they want to implement requires investment budget. Most of the time they only have a small part of this budget and they need

some more. For each action that is selected all the players (that have budget) will receive a budget table for that option. Players can fill in the amount of money they are willing to spend on that option that might not be the best option for themselves. For example, player 1 selects option number 1. However option 1 costs 4 million euro and player 1 only has 2 million. He sends out the request for the initiation of project one and a table is created that is send to all players (see Table 10). Players can give budget to other players' options. The CIO should give away budget more often because he has the biggest part of the budget. However he should decide how much he wants to spend on that option while he has also other options to grant permission. Also here, if players communicate efficiently the budget tables will be no problem and as soon as they request the option they want they already know who will be funding their missing budget.

Table 10, Example of budget table used in the game Hotel California

Option 1. We need a new website for our hotel. Needed 4 million euro.	player	Budget invested
	Player 1	2 million Euros
	Player 2	-
	Player 3	2 million Euros

If players communicate correctly they can better address issues and find a solution because decisions are made together and budgets are shared. Players will see that helping each other will make the game easier to play.

18. Conflict is balanced in a way that it is not too easy to overcome but also not that hard that it prevents players from finishing the game. (Fully applied)

As discussed in the previous point, there is a lot of conflict between players and the goals they want to reach. How well they can cope with the conflict results in the outcome they achieve. If the players cope with conflict well the end result will be better. Conflict has been tested during playtest sessions where players were asked how they liked it. Next to that, tools like machinations and Excel were used to try out different strategies and scenarios to balance the amount of conflict. For example, conflict emerges when multiple players want something but not all can be satisfied. Simulating this with the use of Excel, we could see when some players did not have enough decisions they could pick from or when resources were not limited enough.

19. The game has a useful outcome that makes players more conscious about the subject of the game. (Fully applied)

The game will have feedback points that hint players towards the right direction. At the end of the game the players will receive a detailed feedback of their play-through. This enables them to see what they did wrong and reflect on how it could have done better.

6.4.3 System Dynamic Elements

20. The relationship that is created between players, or the player and the system supports the pedagogical purpose of the game. This means that the relationships are familiar to players and realistic. For example the relation between a marine and his platoon leader should not be all too friendly. (Partially applied)

This has been partially applied because the pilot version of the game has not all the desired roles. This forced us to create a game with less functions and therefore some relationships are a bit different than in real life. However the players are in balance and are explained to the player in order to regain some of the logic behind the roles and the relations between them.

21. Players have abilities that can help them achieve their goals, these abilities are relevant to achieving the goal and do not allow players to achieve their goals without a struggle. (Fully applied)

The abilities of the players are mostly the resources they can allocate. These are balanced and discussed above.

22. Their stimulated behaviour in the game is focussed on the learning activities and the game gives the players feedback on their behaviour. (Fully applied)

How players behave is up to them, however the game requires them to behave in a certain way. Their behaviour will get feedback in terms of the consequences of their decisions. They will see the consequences in the financial numbers, the customer satisfaction and points they receive. Their behaviour will also get feedback in the form of a reward or punishment. If they do go they will receive a money bonus if they perform bad they will suffer budget cuts.

6.4.4 Dramatic Elements

23. The resources in the game are realistic. Often serious games teach something that requires managing resources. Resources in games are the limiters and should therefore fit the learning purpose. (Fully applied)

We used resources that are clearly from the business environment like money, time and people. These are the same resources they also would have in real life. They have to manage these and see the struggle with resources just like they would in a real organization, only now they can play with them in a safe environment.

24. The game has characters that fit within the story, they can be fictional or realistic as long as it is not disruption the learning activity. (Fully applied)

The characters are based on real organizations. We have, in the pilot version, we have 5 roles:

- The Chief Operations Officer (COO)
- The Chief Commercial Officer (CCO)
- The Chief Information Officer (CIO)
- The IT delivery manager
- the IT operations manager

These roles are logically involved in the IT governance discussion in a real company, therefore these roles fit within the story and do not disrupt the learning activity.

25. The game lets players make decisions within the characters situation (cognitive immersion). (Fully applied)

The characters have their own role with their own targets. The players aim to please these targets and are making decisions based on this. Their characters have a role in the company and they need to act in their behalf. Making decisions that their characters should make is part of that.

26. Characters are placed in a social setting (social affordances). (Fully applied)

Players have a function within an organization so they have a social setting. They work with their colleagues and are in an office building. This will make them feel as being part of an organization. Also the decisions that they can make are in line with their function.

27. Characters have the ability to interact with fantasy and fictional elements (fantasy affordances). (Partially applied)

The office is not an environment of fantasy. However the game supplies the players with a fictional domain where they can experience their mistakes in a safe environment. They will play the game as a game and not as a real company, however they will play the game as themselves and their real behaviour will show.

28. The designers have picked a setting for a reason to support the learning activities or the setting is used to create a more fun and engaging game. (Fully applied)

The game is set in a Hotel organization. The hotel setting was picked because the organization where players had to make decisions for had to be catchy and everybody had to understand the basics of what the company sells. Because everybody has been on vacation we created the story around a hotel chain that wants to grow. It fits the learning activities because IT governance takes place in an organization. Hotel California is an organization.

29. There is a story that suits the setting and the competences that are to be taught. (Partially applied)

The story is not that important in the simulation game. It is just there to emerge the players into the game. They have to make the right choices. They could have done that as well without the story maybe. The story only supports the learning activities by emerging players into the game.

30. The story has a rising tension that falls at the end of the game. (Fully applied)

In the first round the story is thin, players will get to know the game and they can see how the game works. This feels quite comfortable and there are not many decisions to take. However in round 2 the story will unfold and the strategy of the company will be presented. Players will see that the organization has many ambitions and that they are the ones to accomplish this.

31. Players get rewards that will motivate them to perform better on the learning activities. (Fully applied)

Like stated earlier, players will receive rewards for managing the Hotel in a good way. They will receive personal rewards in the form of investment budget if they reach personal target and they will get points in reward for implementing actions that satisfy the main events.

32. Reward gained are increasing as the game advances. (Fully applied)

The players will get more money in reward at the end of the game, also the number of points they can collect will increase as the game advances. This means that in round 1 players can get, max 10 points, in round 2 max 15 points, in round 3 20 points, etc.

33. The game uses flow to balance between frustration and boredom. In other words the game is not too hard, but also not boring that people stop playing. (Partially applied)

We used machinations and Excel to create realistic and fun options that players can pick to implement. But also here it is really hard to see if the game has a good flow if the game has not been tested fully yet. We have played the game a couple of times and the players identified that the game was fun to play, not boring and also not too hard to finish. However in order to really say something about the flow of the game more tests are needed. After the evaluation of the game we found out that players liked the game but that the game could use more conflict. This is valuable feedback to increase the fun and make the game less boring. See Chapter 8 for all the evaluation results.

34. The game has an increasing degree of difficulty as the game advances. (Fully applied)

The game's difficulty increases as the game advances. In the beginning of game there are less possible options to choice from. The budget and FTE's needed is not a real problem. But as the game advances there will be more options, more planning and communication is needed and resources like money and people will be limited.

35. Decision in the game are limited in the beginning of the game, but are increasing as the game advances. Near the end of the game the number of choices are decreasing. (Fully applied)

Our game is one that revolves around the choices players make and as discussed in point 35, the decisions players have increase in round 2, 3 and 4 and drop in round 5. In the pilot version they are few decisions to be made in round 1, but many more in round 2 to increase the tension.

6.4.5 Additional Elements

36. For the interface the designers can explain that they have satisfied the golden rules by Schneiderman (1986) or the design principles by Benyon, Turner & Turner (2005). This will help to improve the user interface of the serious game. (Partially applied)

We have tried to use a clear interface that feels like a website. For this also counts that it need to be tested and the feedback can be used to improve the interface. Also the interface was not the main priority during the creation of the game for this thesis. Following the golden rules by Schneiderman (1986) or the design principles by Benyon, Turner & Turner (2005) helped to focus on a simple user interface. This could have been done more rigorously, however the game was still in the pilot phase and it is not logical to put too much time and effort in the 'finishing touch' of the game when many things have to be altered after game testing. Also time restrictions allowed us to prioritize actual game play over the user interface.

37. The game designers have used meta-gaming aspects by enriching the learning effect after the game is played and so being influential after the game. (Partially applied)

The game will offer players feedback on their performance and more information on how to successfully apply IT governance. There will be feedback sessions during the game and the game masters will explore the real problems after the game is played. This could give the organization (client) insights on where the problems are in their company and what can be done to fix them. The real influence of the learning effect is in the follow up assignment for the consultancy company.

38. The game uses both digital and physical aspects that enable players to play the game in their physical environment also. (Fully applied)

The game uses digital parts on the computer, like getting notifications and selecting the options. The physical environment is used for communication face to face and discussing the best solutions. The combination of both digital and physical is needed because this also happens in real organizations. We want people to communicate and this is easier to do in a face to face situation.

39. The serious games' effectiveness has been tested. How it has been tested can be shown in order for others to replicate the results of the game's effectiveness. (Fully applied)

The effectiveness has been tested as explained in Chapter 7.

40. The serious games' effectiveness has been tested over the long term to ensure its impact. (Not applied)

Due to the scope of this thesis project there was not time to test the effectiveness of the game on the long term. This is something that we want to do in the future.

41. The designers have explored customization in order to create a serious game of which the content can be easily adjusted for other goals. This can give the game a longer lasting effectiveness span. (Fully applied)

The options that have been used can all be reused and adapted to new situations. If the game has to be played in a new setting the designers can just create a new story, put in new actions and play the game with the same resources, variables and outcomes but for new situations. For Hotel California we used a database (MySQL) to store all the projects and actions that could be played (see Figure 28). The game requests the data from the database and displays the correct data to the player that needs to see the data. All this information can be easily customized by adding, deleting or adjusting the options. This enables the designers to add more information. Create new options or delete irrelevant options. This makes the game easily adjustable and new insights on IT governance could be implemented into the game without creating an entirely new game.

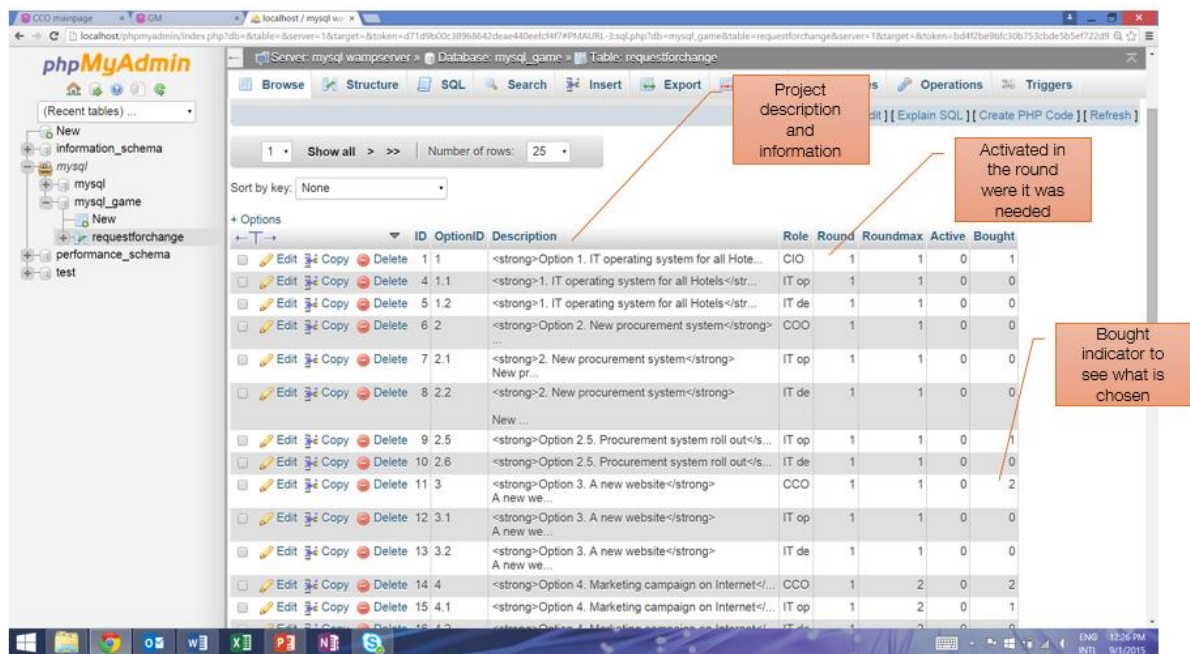


Figure 28, MySQL database that contains information that is requested by the game

42. The game has more than one difficulty mode that allows it to fit with more or less capable players. (Partially applied)

We have designed a 5 round play on hard difficulty setting but we have not made it into the pilot yet. But with the creation of the options we have kept in mind that the game has to be played in more than one difficulty setting.

43. Adaptivity is built in the game in order to make the game fit better with the playstyle of the players. This means that the game adapts itself to the playstyle of the players. (Partially applied)

The pilot version is not able to see how players are doing, in the future the game will be able to see this and give players extra options if they are completing the game to easy. In the pilot version this can only be done manually by the game master that follows the game on his master dashboard and can see what players do. He can decide to play some extra events that disrupt the win streak of the players.

7. Evaluation

This chapter will discuss the evaluation procedure of assessing the effectiveness of the Educational Business Game, 'Hotel California'. First, we describe how the evaluation has been conducted. After that we will present our evaluation results.

7.1 Evaluation Approach

The evaluation approach was treated as a research on its own by following Rogers et al. (2007) discussed in Section 4.7.3 who discuss the following points:

- *Determine the goals*
- *Explore the questions.*
- *Choose the evaluation methods.*
- *Identify the practical issues.*
- *Decide how to deal with the ethical issues.*
- *Evaluate, analyse, interpret and present the data.*

The evaluation for the Educational Business Game will be discussed step by step.

7.1.1 Determine the Goals.

The goal of the evaluation is to find out the effectiveness of the game on teaching insights on IT governance. This will be based on the objectives that are identified by Weill & Ross (2004) on what IT governance should include. The goal of the game is to give players more insights on what IT governance is, what is important in IT governance and what kind of situations should you be able to recognize like:

- Creating financial value with the right decisions
- See the impact of IT investments
- Getting insights on the value of IT for the business and inspire people to change
- Get insights on the influence of changes on the market
- Showing possible risks and how to minimize them
- Specifying a formal division of tasks and roles in decision making
- Align Business and IT

These objectives are the main targets of the evaluation. After playing the game, the play-testers should have gain insights in these subjects, should be more aware of the struggles and get some idea of how to cope with all the issues concerning IT Governance.

7.1.2 Explore the Questions

There are two sets of questions, on question list for the target group evaluation and questions for the domain experts. The evaluation of the game was set out to test its effectiveness. This is done in two ways: testing how effective it is in transferring the pedagogical content discussed in Section 7.1.1. Besides that the game should also be fun and engaging. Therefore the participants of the evaluations will also be asked questions about what they liked about the game. The different questions for the target group are as follows:

- *Pre-test/Post-test* (testing the teaching power of the game). Players will have to answer some questions prior of playing the game on their understanding on IT governance, and afterwards in order check what they have learned after playing the game. For the pre-test questions open questions are used to let people give their own interpretation of what is important in the IT governance domain.
- *Questionnaire on pedagogical content* (asking them if they learned something from the game). This questionnaire is filled in by the participants themselves after playing the game.

They can explain, on a scale from 1 to 5, if they thought the game was effective on the specific aspect of IT governance. This was used to make it easier for the participants to express their feelings about the game and its effectiveness.

- *General questions about the gameplay.* Additional questions were asked about the other aspects of the game like whether or not it was fun to play. This does not directly test the game's effectiveness in transferring knowledge but fun in a game has influence on how the player perceives and receives the knowledge and therefore also important for the effectiveness. There are some open questions in this questionnaire can be answered on a scale from 1 to 7. This scale was used to give the participants some more room to express their opinion.

For the domain expert evaluation the questions were different:

- *In game discussion.* Throughout the game the domain experts could give their opinions on the game. They could write down their thoughts on notebooks that were handed out. After each round there was a discussion round where the experts could give their comments and talk to each other and the designer about the game.
- *Semi structured interviews.* After the game-playing session some of the domain experts were interviewed. During the first half of the semi-structured interview they were asked if they thought the game could give other players the insights of good IT governance (see Section 7.1.1). The rest of the interview contained general questions about the gameplay. They were asked to rate some of the aspects of the game on a scale from 1 to 7. This scale was used to give the participants some more room to express their opinion.

All the questions for both evaluations can be found in Appendix 4.

7.1.3 Choose the Evaluation Methods

Because the goal of the evaluation is to see if the game is effective we propose two sets of questions for different groups. Like mentioned in Chapter 4 the evaluation should contain participants from various backgrounds. Each different set of participants gives different insights on the effectiveness of the game. According to Fullerton (2014) different participants could be: experts in the domain, game design colleagues and people unknown to the designers. For each set of participants the results might give different insights that are valuable for this research. First of all we play-tested the game with a group of experts on IT Governance and teaching. These people can help us answer the questions whether or not they think that the game can be effective for the target audience because they know what is important for the target audience to know about IT Governance. Secondly we play-tested it with people that have affinity with IT and the IT domain and could therefore be considered as the target audience of the game. Figure 29 depicts the two groups that were used for the evaluation of the game.

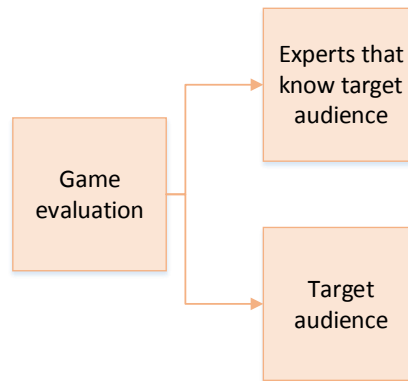


Figure 29, Different groups used for evaluation.

Having different groups of play-testers also means that different participants might require a different assessment approach. We will explain how this was done with the two different groups of play-testers.

Unknown target audiences, the first group consisted of people within the target audience of the game that were not known to the designers of the game. We choose to conduct a playtest sessions with people who had affiliation with the IT domain as we were not convinced that playing it with people who have no affiliation at all would give us reliable data on the effectiveness of the game. Players with no interest or affiliation with IT and IT governance will not be able to play the game because possible they will not understand the basics of the game that are needed to play it. The play through of the game will stagnate just because the players do not know how the basic knowledge of the domain that is needed to play the game. Then again the game is aimed at teaching players that have affiliation with the IT domain and not just random players. Respectfully, play-testers should also be conform that category. For the target audience we used players that have affiliation with IT. Figure 30 depicts the evaluation approach used for the target audience play-testing session.

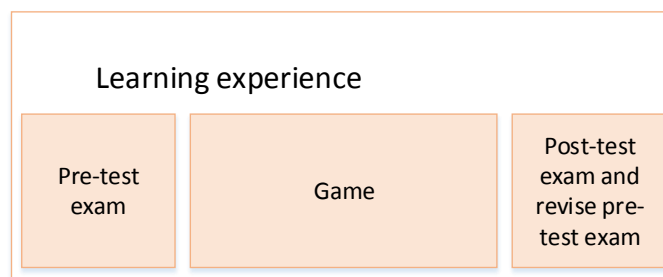


Figure 30, Target audience evaluation approach

The intention of the evaluation with this group was to see, with the pre- and post-test, if their knowledge about the subject was increased. Also some open questions were asked them if they gained more insights on the subject. At prior to the playtest session we asked them to answer a couple of multiple-choice questions in a survey about IT governance on how they would act in some situations concerning IT Governance. These questions were asked to identify their level of understanding on IT Governance. After the pre-test questionnaire the participants were invited to play the game and they receive an introduction to the game that did not reveal what the intensions of the game were but only the story and the background of the game in order to place the game into context. The participants were unaware of the exact intended learning outcomes, only that it would be IT related (Due to the pre-test questions). During game play players were observed in their behaviour and how they played, but also on other game elements like if they knew what they had to do or where they got stuck (which also influences the effectiveness of the game). After playing the game the players had to redo the pre-

test multiple-choice questions and they were asked to rethink their earlier given answers. This can be seen as an exam that the players got afterwards to see what they have learned from the game. Although there were 5 participants, only 4 tests were recovered as one participant was not able to hand in the pre-test. The results of the target group evaluation of the games effectiveness is discussed in Chapter 8. Both the pre-test and post-test players also got questions about how they liked the game and what they least liked. This was used to make an assumption about the fun of the game as this is important for the effectiveness as well.

Unknown domain experts, are experts that have expertise in IT governance and some of them in creating learning activities. We decided to do a game trial with domain experts because just as in regular school programs, the content and the learning activities are not tested on students but rather evaluated by peers and then presented at students. Figure 31 displays the evaluation approach used for the domain experts.



Figure 31, Domain experts' evaluation approach

The intention of the evaluation with this group was to ask them, after they played the game, to what extent the game was effective in teaching our intended learning outcomes. Therefore there was no need for a pre-test with these people, because there was no need to test their knowledge on the subject. The game play session consisted of playing the game and discussing each round and their thoughts. These participants, unlike the target group, got some information on what the intended learning outcomes were for our game so they knew what the aim was for our serious game and what they needed to pay attention to. Afterwards the experts were individually interviewed about how the game addressed the various objectives of IT governance and if they thought that the game would help players to understand the different subparts of IT governance. The semi-structured interview was done with the experts to retrieve more valuable information from these participants and how they think the game will be successful and what was missing. Also we asked them if they thought that the game could have impact on the daily work of the end users of the game. Their opinion on how useful the game is for teaching the purpose of the game will help us to identify the effectiveness of the game. Next to questions about the effectiveness of the game we also asked them about other elements of the game. Three interviews were held with afterwards due to the time available. Some of the domain experts were not capable of giving detailed feedback in form of an interview. The evaluation results are presented in Chapter 8.

A third groups of *Known experts*, from the case company were used for testing the game as well. These however are excluded from the evaluation of the game as they might be more biased toward a positive outcome. We play-tested the game in order to see if the game could be played and get most of the flaws out of the game to be sure it could be played rather smoothly. We also asked them some questions about how they liked it and what they were missing, however this was more internal iteration.

7.1.4 Identify the Practical Issues.

In the search for participants that could test the effectiveness of the game we needed persons who have affinity with IT. We found these people using the personal network of employees at Anderson MacGyver. The company selected some interesting persons that matched the criteria for partaking the effectiveness test and then emailed them with the question of participating in our research.

Another issues was the place and time for testing the game. The location had to have more rooms that can be used to separate the players. We used the office of the case company to fulfil this task. This office has a nice two room area and a main conference room for meetings. This location suited the research perfectly. Because many participants are working people with little spare time during office hours, we decided to invite them to the office on an evening.

7.1.5 Decide how to Deal With the Ethical Issues

No ethical issues where encountered. The participants were recorded on camera but only after they were asked if this was allowed. Their names and personal details remain anonymous. Furthermore all names were anonymized.

7.1.6 Evaluate, Analyse, Interpret and Present the Data

This step of Rogers *et al.* (2007) corresponds with the Communication step that we use in our design science research approach. The evaluation results and analysis of the data are therefore discussed in the following chapter.

8. Analysis of the Results (Communication)

Like stated before we conducted two evaluations for our Educational Business Game. One with participants that can be seen as the target group for the game and one with domain experts who can assess if the game meets the established targets. For easy reference, we will refer to the game's evaluation with the target group as 'session 1' and the other one with domain experts as 'session 2'. This chapter will analyse all the data collected in the evaluation process. We will first present all the results of the game evaluation with the target group and after that the results of the domain expert evaluation. This is done separately because both evaluations had different objectives and were therefore also executed in a different way. We will begin with discussing some remarkable observations that were made during both evaluation sessions in Section 8.1. After that we will discuss the pre-/post-test that we did for the target audience group in Section 8.2 and the semi-structured interviews that was conducted with the experts of the second evaluation session in Section 8.3. In Section 8.4 we will compare some of the results from the two evaluation sessions. There will be referred to statements and answers of participants. All the evaluation questions, tests and semi-structured interview protocols can be found in Appendix 4. All the filled in questionnaires and interviews transcripts can be found in Appendix 7 and 8 respectively.

8.1 Overall Observations for Both Evaluation Sessions.

In session 1, the participants were physically located in different rooms, based on their role, resembling the layout of a real organization. The roles from the IT department together and the CCO and COO together in another part of the room. This was also the case in *session 2*, but here we even created little offices for the players in order to enhance the experience even more. Figure 32 shows the layout of the 'playfield' during session 2. Like mentioned before we wanted to separate the players in order to get a more realistic balance between the roles. Where in a real organization these roles will not be in the same room, and sometimes not even in the same building, we wanted to create this distance between players here as well.

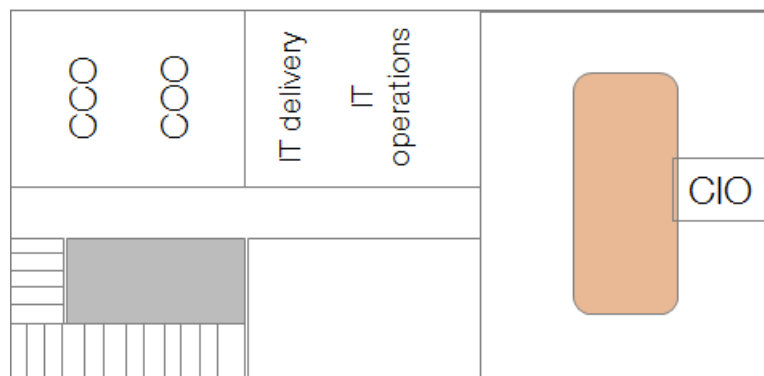


Figure 32, Layout of the player's start location.

While in session 1 the players were in 1 room, session 2 proved to be not only more realistic but also better for the game because players were not able to share critical information about the game instantly. One of the domain experts stated that it was better to divide the players and put them in different rooms because this would simulate the physical limitations of asking each other questions. He stated: *'it is good to separate players because, I as a CCO, operated isolated and made decisions that I wanted to have without involving the influenced IT department. In real organizations we also see that departments that decisions isolated'*. Separating players in rooms is not something discussed in our checklist specifically, but in the proposed framework for Educational Games we address the

possibility of mixing digital and physical elements (see guideline 38 of the checklist). In our case this was a valuable addition to the digital part of the game.

Because the serious game we made is a multiplayer game, the way players interact with each other is never the same. We noticed very different gameplay styles in the two sessions. Players from session 1 were really structured in decision making. They decided to sit together and go over all the possible actions that were available for the different roles. In session 2, the players however operated almost completely isolated in round one of the pilot version and we noticed that players made mistakes in the first round. This resulted in far worse results than the group of session 1. In terms of this game that is not a negative result as the game almost invites players to make mistakes they can learn from. Players are not located near each other and they all have different goals that require them to act in their own interests which does not invite them to collaborate. So not playing optimal is part of the game that is being improved by the feedback sessions and discussions between players after each round. Also in the evaluation sessions players were asked what could be improved. Discussing the game and how to play resulted in more communication between players about the information they needed and decisions they had to make. For both sessions the results of communication were immediately obvious in the second round were they knew better what to do and how to play the game. There was a lot more communication between the roles although it still was a bit chaotic. Session 1, whose players already worked together, communicated a lot more efficiently that was needed because there were more decisions to be made. In Session 2 the CIO took the lead in collecting all the necessary information for him to make decisions. Both teams had not created a formal structure for communication yet because the communication was still too chaotic. The intention is to improve this behavior in the real version of the game that contains more rounds.

As mentioned before, the target group was really structured in their decision making and communication already at the start of the game. Only they were unaware of all the information that was available in the game and that was also needed for accurate decision making. In the first round they played, they went over budget due to incomplete information. However the pilot version was not capable of giving the players feedback on the fact that they were going out of budget. The role of the delivery manager should receive information on projects that have been initiated by other players. Also there should be an indication when players go out of budget. For example when the role of CFO is added, there is a person that has the responsibility to keep an eye on the budget. However we recognized that these functions should be added but were not in place for the pilot version of 'Hotel California'. However we did not realize that leaving out this function would have this much impact. This example shows that it is difficult to know how designed functions turn out in the actual game.

Another example of what can be difficult to design with a Serious Game design framework, and therefore requires game testing, is the conflict. In session 1 the players worked together in finding the best solution, although the players were given extra objectives that would lead them astray from working together. They choose to keep working together but in real life there will be more tension between parties and how resources will be allocated between them. During session 1 we tried to increase the conflict by letting the CEO increase the pressure on players to achieve their personal targets. This, however, had not really impact on the conflict in the game. There was some more tension in session 2 but still not enough. Many of the domain experts stated that there was too little conflict between players and that this could be increased by giving players more tasks. Tasks that would require their time and money that then could not be invested in new projects. Although we explained in point 17 of our Educational Game checklist that conflict was fully implemented we should still investigate how to increase the conflict in the game. The conflict in the game is very important as conflict is also

something players will endure in a real organization and the one of the purposes of the game is to cope with this conflict.

Another observation that is important to report on is the fact that players would sometimes get stuck and did not know what to do. This indicated that the information players were given was insufficient or that player's procedures were not holistic. When players get stuck this will surely have influence on the game's efficiency. The procedures for players were designed but not yet tested before the evaluation. Although the checklist suggests that players should have clear and understandable procedures they are really difficult to design as it is not known how players perceive what is handed to them. This indicates that games will always require testing and that models and checklists are, a part from being very helpful, not sufficient for creating efficient serious games.

Another observation that was made was that one person took charge of managing the communication between all roles. However this was not the person that should have been in control of asking information from other parties. In this case she played the Chief Commercial Officer (CCO) and she retrieved information directly from the IT operations manager without consulting the CIO. This observation shows that player's character reflect in the game as they play. Whether they always want to take the lead or are passive in communicating with others, it could be useful to see this reflection of people's behaviors as they will also show this behavior in their daily work. The CIO in this case did not take the lead of his department members and therefore his role was not important anymore. The game gives a representation of the players' character as they play as themselves in a different scene that stands apart from their daily work. This makes it possible to comment on players' behaviour without criticizing how they function in their daily work.

The playable options and projects were perceived as nice and fun. But according to both groups the projects could be more realistic. Both in how they are presented (more information, better explanation) and in how much resources the projects would costs and how much their return on investments would be. Although the projects and other decisions are all realistic and fitting within the Hotel organization domain, they could use some more elaboration to get a more holistic feeling.

The most interesting observations we made during the play test evaluation sessions were:

- Placing players in different rooms was an example of a physical part of the game that influenced the effectiveness of the game in a positive manner. We discuss mixing digital and physical elements in our proposed model and our game has shown us a good example where making the game more effective has happened.
- Players made 'mistakes' that resulted in not playing optimal. This indicates that the game is not too easy as the intention is to have points of improvement that can be addressed in the rest of the game. These improvements were shown in our game, after some discussion and feedback in round 1, when in round two all the players improved their play.
- Some critical functions missed in our game that made the game not complex enough. Due to time limitations some roles and functions needed to be cut in the pilot versions. We saw that players were able to go over budget that would be the responsibility of a role that was not present in the current version. These kinds of problems require testing in order to make them visible.
- The game gives a representation of the players' character as they play as themselves in a different scene that stands apart from their daily work. This makes it possible to comment on players' behaviour without criticizing their work.

- The projects and decisions were fun but were not realistic enough. More in-depth information on the projects and decisions could create more engagement for the players and therefore the game could also possibly be more effective.

More results will be analysed in the following sections. In Section 8.2 we will discuss the results of the Target group evaluation as we discuss the pre-/post-test that was conducted and their feedback on the game. In Section 8.3 we will analyse the results of the semi-structured interviews with the domain experts.

8.2 Target Group Evaluation Results

In this section we will present the results of the target group evaluation. Participants in the target group have affiliation with IT and account as people that can learn something from the game. The participants were asked to make a test that they had to make prior and after playing the game. Table 11, depicts the answers of the players in the pre- and post-test. The green colour indicates that the person has given the right answer, red means that the answer was wrong.

Table 11, Pre-/post-test answers

Player number	Question	Pre-test	Post-test
1		Answer	Answer
	1	A	A
	2	BAC	BAC
	3	C	C
	4	B	B
	5	C	C
	6	B	A
2		Answer	Answer
	1	A	A
	2	ABC	BAC
	3	C	A
	4	A	B
	5	B	C
	6	A	B
3		Answer	Answer
	1	A	A
	2	BAC	BAC
	3	A	A
	4	C	C
	5	B	C
	6	D	D
4		Answer	Answer
	1	B	B
	2	BAC	BAC
	3	A	A
	4	B	B
	5	A	C
	6	D	D
	Total correct	13	19

The results of the test indicate that the players made the post-test remarkably better than the pre-test. Where in total the participants gave the right answer to only 13 of 24 questions in the pre-test they increased the number of right answers to a total of 19 for the post-test. This indicates that they gained some insights on the subject that our game teaches. Because the tests were held directly prior to the game and directly afterwards there is no possibility that the knowledge was received somewhere else. To even further explore the impact of our game in terms of effectiveness we asked the participants of the target group some additional questions that could give us an indication of the games' effectiveness. Table 12 depicts the results of a self-reflection that the participants filled in after the game was played. Each 'x' represents an answer by the participants.

Table 12, Self-reflection after game by target group participants

With the numbers being: 1= strongly disagree, 2= disagree, 3= neutral, 4= agree, 5= strongly agree.

Statement about the game		1	2	3	4	5		Weighted average
1. The game gave me insight in how to create more financial value using IT and the governance of IT	Strongly disagree				xxxx		Strongly agree	4
2. I am more conscious about decisions on IT investments after playing the game.	Strongly disagree				xxx	x	Strongly agree	4.25
3. The game shows the value of IT for the business and how they are intertwined.	Strongly disagree			x	xxx		Strongly agree	3.75
4. What is taught in the game can be useful for players (even me) in their daily life.	Strongly disagree			xx	xx		Strongly agree	3.5
5. Thanks to the game I realize that the market has an influence on their organization.	Strongly disagree		xx	xx			Strongly agree	2.5
6. I have come to the realization that a formal structure in decision making and communication will help them in their daily work thanks to the game.	Strongly disagree			x	xx	x	Strongly agree	4
7. The game gave me the insight, that working together, as Business and IT, creates more value for the organization as a whole.	Strongly disagree					xxxx	Strongly agree	5
8. The game taught me something new about IT – business alignment/ IT governance.	Strongly disagree				xxx	x	Strongly agree	4.25

The statements, which could be rated from 1 (Strongly disagree) to 5 (strongly agree), give us an indication on how effective the game was on the specific elements that we had set as intended learning outcomes. The statements are based on the components of It governance, discussed in 6.2.2. This was done to evaluate the effectiveness of the game according the objectives. The weighted average that is depicted in the table shows how good the game scores on the specific statement according to the target group. These scores indicate that some intended learning outcomes are not really perceived by the participants when playing the game. Others however score pretty good which indicate that participants have indeed gotten some new insights on some of the components of IT governance. Players indicate that the game is not extremely useful (just above neutral) for them in their daily life's which could be due to the fact that, however they belong to the possible target group of people that could learn from the game, their daily affairs do not concern IT Governance. The weighted average was not added to one total score as it would not make sense to make assumptions about the effectiveness of the game in total. The game can be effective in various ways on different learning outcomes and a total score over all the statements would not give the total effectiveness of the game. The different intended learning outcomes will therefore be discussed and a general statement about the game's effectiveness will be formulated.

The highest scoring intended learning outcome is statement 7 with a solid 5. So according to the target audience the game is effective in teaching the players that the game gave them the insight, that working together, as Business and IT, creates more value for the organization as a whole. Statement 1, 2, 6 and 8 also score a 4 or higher which means that participants do agree with these statements. Players indicate that they have gained more conciseness about creating financial value with IT investments, decision making in IT investments and that a formal structure in decision making is important. The aspect of IT governance where the game is least effective according to the participants in this group is showing that the market has an influence on their organizations (statement 5). The game *should* and *could* do more with interference of the market surrounding the organization in the game. The score of 2.5 depicts that players did not learn something from the game on market influences on their fictional organization.

As not only the pedagogical elements are important for the effectiveness of the game but also the entertainment elements, the participants were also asked what they liked about the game and what not. Both some closed and open questions were asked, where the closed questions could be answered on a scale from 1 (strongly disagree) to 7 (strongly agree). A scale from 1 to 7 was used here because we believed this would allow the players to express their opinion more accurately (the statements about the intended learning outcomes have a scale from 1 to 5 as this is not an opinion). Table 13 depicts all the results on the general questions given by the target group during the evaluation of the game. For the open questions we will give a combination of the most common given answers.

Table 13, Results of general questions for target group about the game

Statement about the game	1	2	3	4	5	6	7	Weighted average	
1. It was easy to use	Strongly disagree				x	xxx		Strongly agree 5.75	
2. I liked the game	Strongly disagree					xxx	x	Strongly agree 6.25	
3. The game is fun to do	Strongly disagree					xxx	x	Strongly agree 6.25	
4. I would recommend it to a friend/organization	Strongly disagree				xx	xx		Strongly agree 5.5	
5. Would you advice the game to be played in organizations in order to get them more familiar with IT governance and Business IT alignment.	Strongly disagree				x	x	xx	Strongly agree 6.25	
6. What are the 3 aspects you liked best about the game?	<ul style="list-style-type: none"> - The need for collaboration, playing the game together as a team. - The simple explanation of the content in an atmosphere that is relaxing as a teaching environment. - the case and the setting of the game were nice 								
7. What are the 3 aspects you didn't like about the game?	<ul style="list-style-type: none"> - The game took too long - There were too many rules - the game needs more virtual feedback 								
8. What was your strategy for winning?	- Collaboration								
9. Was there too much, too little or just enough conflict in the game?	- Too little conflict in the game								
10. Which elements to make the game more fun can be improved?	<ul style="list-style-type: none"> - Time restrictions per round - Show more financial information in the game 								
11. Is there anything you would change about the interface?	- The interface is nice, there could be a background that has more to do with hotels.								
12. What was missing from the game?	<ul style="list-style-type: none"> - A feedback page with detailed feedback on the game and how it is progressing. - Time limits in every round. 								

The game was considered as fun to do and fairly easy to use according to the target group. On average the game scores almost a 6 out of 7 on the ease of use and fun to do. The game scored a little less on being recommended to others. This received a 5.5 out of 7. This could be due to the case that the game was only in its pilot phase and can be improved on many points before it is really finished. Strange is that participants indicate that they would advise that the game is being played in organizations to raise the awareness of Business – IT alignment. The fact that this gets rated higher could be because they believe the game has potential to be used in real organizations to discuss IT governance. When asked what they liked best about the game, all of them replied that the collaboration and ‘doing it as a team’ was the best part of the game. Also the setting that was created and the simple way of teaching new insights were praised. On the other hand, the game took too long in the opinion of the players and

there were too many rules. Both these points were already fixed for the evaluation with the domain experts, where the rounds had a fixed time and some rules were deleted or included in the introduction of the game. Like mentioned before in the observations there is too little conflict between players. Which is unsatisfying because the game needs to show players that there is a lot of conflict between roles. The last remark given is that the game should give more feedback to players on how they progress. Like mentioned in Table 13 this could be through giving more financial information. But also by giving players more updates on what projects have been initiated (like discussed earlier) and what the states is of their budgets and other resources.

It seems that the Hotel California game can be considered to be effective on many of the tested aspects, according to the target group players. The pre-test/post-test indicates that the game is a promising teaching tool on the intended learning outcomes and the questionnaires indicate the same as well. Mostly on the parts that are about communicating, working together and prioritizing decisions. However this game was only a pilot version and there can be made many improvements for the next version. The following section will discuss the findings of the domain experts and their opinions on how effective the game is and on what aspects. Later we will also compare the scores from both groups in order to see if the results are similar.

8.3 Domain Experts

This section discusses all the results retrieved from the domain expert evaluation. We will discuss the feedback of the experts on each question one by one. Based on the analysis of the interviews each question will receive a score based on how positive the domain experts are on the specific statement. This score will be somewhere between 1 and 5 and corresponds with the scores that were given by the target group. If the experts claimed that the aspects was not effective in the game the score will be a 1, for neutral a 3 and when they said it would be effective an 5. These scores will be used in the next section for comparison.

1. Does the game gives you insights in how to create more financial value using IT and the governance of IT?

This question raised different answers by the experts. Where expert 1 stated that ‘Not directly. I think that the game is to IT oriented and needs more introduction at the beginning. For example tell the participants something more about the traditional Governance in a Hotel organization structure, or from a different kind of organization’. The other two interviewees are a little bit more positive as they think that the game gives insight in the possible trade-offs between business investments and IT resources. This aspect will be scored with a **3.5** because not all experts had the same opinion.

2. Do you think players will be more conscious about decisions on IT investments after playing the game?

“Yes, I’m positive about this point, the game is very promising.” And “Yes. They have to make decisions that require them to think about the consequences” were given as answers by the domain experts. There indicated that they say a lot of potential in the game of giving players insights on how to deal with decision making in IT investment situations. Therefore this aspect of the game will be scored with a **5**.

3. Does the game show you the value of IT for the business and how they are intertwined?

Also here the domain experts are not entirely in agreement if the game is effective on this point. However two of the interviewed domain experts are really positive where the other one indicates

that it does not directly show how the IT department is intertwined with the business. According to him the game could be more business oriented instead of IT oriented to explain this point better to players who play it from a business perspective. The other interviewees have a different opinion as they think that it show how IT and business are intertwined by the fact that hardware IT investments are part of the same portfolio choices (together with commercial choices) in the game. The score for this aspect of the game will be a 4.

4. Do you think that what is taught in the game can be useful for players (maybe you) in their daily life?

Expert 1 thought that it would be helpful after more functions and roles were added. He stated: "Looking at the communication part of the Game I would say absolutely. I would suggest to add the function of the CFO and be clearer about the roles and responsibilities at the beginning of the game". Expert 2 said that the game would be helpful in portfolio planning on investments and communication together. However Expert three stated that this is depended on the level of understanding of the players and therefore not useful for all players. This is also an indication that the game should have multiple difficulty levels that are, at this point, not implemented in the game. With two rather positive replies and one more neutral this aspects receives a 3.5.

5. Does the game shows people that changes in the market have an influence on their organization?

Just like the target, group also the domain experts where not positive about how the game gives players insights on the influence of the market. If the game wants to be effective this points should include more events from outside and also the consequences of not acting on what happens around the organization. Expert one stated that he could see the added value of the game but that this was not yet the case for the pilot version. This aspect scores a 2.

6. Do you think that players will come to the realization that a formal structure in decision making and communication will help them in their daily work thanks to the game?

Expert 2 stated: "Yes. As we saw in our game. After playing a little it became obvious that the game could not be played by one person only and communicating with each other helped. The first round our results were not that good, but the second round was better because we knew from each other what we needed and more importantly what the organization as a whole needed." Expert 3 however stated that this game did not especially did this because it was a pilot version and there was not yet a formal structure realized. With 2 positive and 1 less positive experts this aspects of the game receives a 3.75 for its effectiveness.

7. Does the game give players the insight, that working together, as Business and IT, creates more value for the organization as a whole?

All three experts declared in the interview that this sure is the point. Expert 1 stated: "Yes I think that this is one of the strong points of this Game. Looking over walls, communicate more, try more to collaborate will help. The game can facilitate this". Expert 2 said: "Yes, although the examples need to be detailed for a better fit". This indicates that our game is effective in showing players to communicate more between key players. Although the examples that are used could be more detailed, as mentioned before, to improve it even more. Given this, the game scores a 4.5 on improving communication and working together.

8. Does the game taught you something new about IT – business alignment/ IT governance?

This aspect is a bit different for the domain experts as they are unlikely to learn anything new from the game (they are domain experts for a reason). Not surprisingly they all the game did not learn them anything new and therefore this aspect will score a 1. However this will not be taken into account in the comparison of scores with the target group.

The domain expert evaluation results also indicate that some of the intended learning outcomes in the game are perceived to be effectively taught. Also domain experts talk positively about communication and working together. In Section 8.4 we will compare the scores of both evaluations and formulate a definite outcome of the game’s effectiveness. Other data retrieved from the domain expert evaluation is depicted in Table 14.

Table 14, Results of general questions for domain experts about the game

Statement about the game		1	2	3	4	5	6	7		Weighted average
1. It was easy to use	Strongly disagree		xx			x			Strongly agree	3
2. I liked the game	Strongly disagree					xx	x		Strongly agree	5.5
3. The game is fun to do	Strongly disagree					x	xx		Strongly agree	5.5
4. I would recommend it to a friend/organization	Strongly disagree		x			x	x		Strongly agree	4.5
5. Would you advice the game to be played in organizations in order to get them more familiar with IT governance and Business IT alignment.	Strongly disagree				x	x		x	Strongly agree	5.5
6. What are the 3 aspects you liked best about the game?	<ul style="list-style-type: none"> - What brings most benefits at a certain moment - Rooms setup and players in multiple rooms (is the same in real live) - The different roles and responsibilities in the Game 									
7. What are the 3 aspects you didn't like about the game?	<ul style="list-style-type: none"> - For some roles there not much to do, in every game round should be action for every role - needs further development for a real game - Too unclear at the beginning, need more guidance in the first steps of the game 									
8. What was your strategy for winning?	<ul style="list-style-type: none"> - First discuss, weigh, then decide and take position and seek for more communication with the key players in the game 									
9. Was there too much, too little or just enough conflict in the game?	<ul style="list-style-type: none"> - Too little conflict in the game the real world is more complex 									
10. Which elements to make the game more fun can be improved?	<ul style="list-style-type: none"> - implement notifications / newsflashes during the game. 									
11. Is there anything you would change about the interface?	<ul style="list-style-type: none"> - Needs to be further developed. Will be important in perception of end user. The end version would have to run smoother. 									
12. What was missing from the game?	<ul style="list-style-type: none"> - The CFO function - More explanation in the beginning - More interaction between the different players - More insight in the impact of decisions - Dashboard like interface with the pros and Cons of decisions 									

Surprisingly, two domain experts indicated that the game was not easy to use. They stated that this was because they knew other games that were easier to use for players. Towards the ease of use the game can be improved by using a better digital version of the game. Although the game could be easier to use they do state that they liked the game. The domain experts were really positive about the player setup in the game where different roles were placed in different rooms. Also they indicated that the game was well thought over which is also a compliment towards the literature on serious games. The biggest aspect the domain experts did not like was the fact that some roles had too little action. This aspect that corresponds with too little conflict in the game, is already mentioned multiple times in this Chapter. There was extensive feedback on things that could be improved. First of all the complexity, add more roles like a CFO. Better explanation in the beginning of the game and more feedback on the impact of decisions.

8.4 Comparison Between two Evaluations

In the previous sections we have presented all the observations that were made during the evaluation of the game in a session with target group members and domain experts. The various aspects have received a score, by the players or through analysis of the results, between 1 and 5 which will indicate the game's effectiveness as a teaching tool on the respective intended learning outcome. Table 15 depicts the comparison between the two groups and the grand weighted total by adding the two and dividing. The grand weighted total is the end result that gives us an indication of the games' effectiveness on the different aspects of the game. Any score above 3 indicates that the game is somewhat effective (or at least left something behind which can be seen as promising).

Without discussing all the points in the table again we will shortly discuss the best scoring aspect and the least scoring one. The game scores best on giving players insights on value adding by working together as Business and IT. This goal of the game receives a grand weighted total of 4.75 which means that the game addresses this point very rigorously. One of the main purposes of the game was to motivate players to communicate and start working together in order to add the most value to the organization as a whole. The least scoring point is that the game is not effective in giving players the insight that the market has influence on the IT decisions that the company makes. Players have not experienced that there is an environment around the organization that they are a part of a market that can influence them. This can and should be added in the next version of the game to not only increase this aspect but also the conflict between players and the game.

Table 15, Comparison of scores on the game's effectiveness

Statement about the game	Weighted average from target group	Weighted average from domain expert interview analysis	Grand Weighted Total (out of 5)
1. The game gave me insight in how to create more financial value using IT and the governance of IT	4	3.5	3.75
2. The game makes players more conscious about decisions on IT investments after playing the game.	4.25	5	4.5
3. The game shows the value of IT for the business and how they are intertwined.	3.75	4	4
4. What is taught in the game can be useful for players (even me) in their daily life.	3.5	3.5	3.5
5. Thanks to the game players realize that the market has an influence on their organization.	2.5	2	2.25
6. Players come to the realization that a formal structure in decision making and communication will help them in their daily work thanks to the game.	4	3.75	4
7. The game gives players the insight, that working together, as Business and IT, creates more value for the organization as a whole.	5	4.5	4.75
8. The game teaches players something new about IT – business alignment/ IT governance.	4.25	(1)	4.25

Table 16 depicts the comparison between the results of the evaluation on the game on other elements than learning. These scores are added and the grand weighted total is the score that was given by the participants in total. Scores higher than 4 indicate (as 4 is neutral) that players tend to be positive about that point which indicates a more effective game.

Table 16, Comparison of the scores for general remarks on the game

Statement about the game	Weighted average from target group	Weighted average from domain expert interview analysis	Grand Weighted Total (out of 7)
1. It was easy to use	5.75	3	4.5
2. I liked the game	6.25	5.5	6
3. The game is fun to do	6.25	5.5	6
4. I would recommend it to a friend/organization	5.5	4.5	5
5. Would you advise the game to be played in organizations in order to get them more familiar with IT governance and Business IT alignment.	6.25	5.5	6

Remarkable is that the scores given by the domain experts are lower than those given by the target group. Especially the variability for the ease of use is very high. One explanation could be that domain experts are more critical towards the game. Another explanation could be that they know more other business simulation game and can therefore better compare games which makes them more critical towards Hotel California. However still the grand weighted total is still above 4 which means that the outcomes are still above neutral. The scores indicate that the players all, at least liked the game and had fun playing it. Also the end score indicates that participants believe that it is useful to play the game with organizations to get them more familiar with IT governance and Business – IT alignment.

8.5 Meta-gaming, Mixed Reality and Customizability

Next to pedagogical elements, formal and dramatic elements we added, through literature research, meta-gaming, mixed reality and customizability to our design framework as promising elements of the game development process. We did not evaluate these elements but we have gained insights throughout the development of our game that we want to discuss shortly.

8.5.1 Meta-gaming

In our game we used meta-gaming aspects in the form of discussions and feedback sessions after played rounds. These meta-game moments pull the players away from the game but have the intention to enhance the effectiveness of the game. The feedback sessions are considered to be important and are believed to be extremely useful to increase the games effectiveness. In these periods players discussed with each other and created new insights that could be used in the following round. The players are pulled out of the game and are forced to look at what they are doing and how they do it. This gives them the opportunity to critically rethink their strategy and behaviour. During the game evaluations we saw that the moments of feedback and discussion were very useful for improving their behaviour and boosted the players' motivation towards playing. For the game that was designed and developed in this research using meta-gaming like this is increasing the game's effectiveness because players need to rethink their tactics and pushes them into the right behaviour. However it is hard to state that the game would be less effective is it did not have meta-gaming aspects. But we can state that it did our game more good than harm. Another form of meta-gaming in Hotel California is the fact that players of the target group made pre- and post-tests that can be seen as moments of learning. These are however not intended to be part of the real version of the game.

8.5.2 Mixed Reality

In Hotel California physical and digital gaming aspects meet each other to make the game more realistic and because of that more effective. Many aspects are supported by the digital part of the game but the interaction between players is mostly digital. Like mentioned before in Section 8.1 we believe that combining digital and physical aspects is very useful in this game and it helps the game to be more realistic. Because it is set out to enhance the communication between roles in an organization, the game requires players to do just that. An expert stated during the evaluation that: “it is good to separate players because, I as a CCO, operated isolated and made decisions that I wanted to have without involving the influenced IT department. In real organizations we also see that departments that decisions isolated”. This not only indicates that separating players is good to make the game more realistic but also that this physical aspect is common in reality and therefore an important issue to address in the game. Communication is an important aspect of our game, which is one of the intended learning outcomes, and Hotel California scores good on the communication aspect. We believe that this could not be done in this way when the game was only digital. Although, also here applies that, we do not have an indication that the game in total would be less effective than it is now. Perhaps then, other functions would have been implemented. In the Educational Game Checklist the requirement of applying mixed reality is an optional requirement and therefore it is not a necessary to include it in every game. In Hotel California the game this aspects got positive reactions and made the game have more feel and reality for the players.

8.5.2 Customization

We were set out to design a customizable game that could not only be easily adaptable but also be adjusted to the way people play. Figure 17 depicts the levels of customizability that we wanted to explore and design into the game. However due to the time scope and lack of programming experience not all was included into the pilot version of Hotel California. Figure 33 depicts the pilot version as it was developed for this thesis. The grey objects did not make it into the game but are still on the list of requirements for the definite version of the game. With the help of experienced developers it will be possible to make the game adaptive but also to include different difficulty modes. For adaptivity this is simply recognizing situations and letting the game adjust the activities that are presented to the players. This can be an automated process that can be monitoring the play during the game. Also the difficulty setting of the game is something that was not included in the pilot version. The resulting game cannot be played on hard or easy as there is just one difficulty mode. This will be added in the final version of the game.

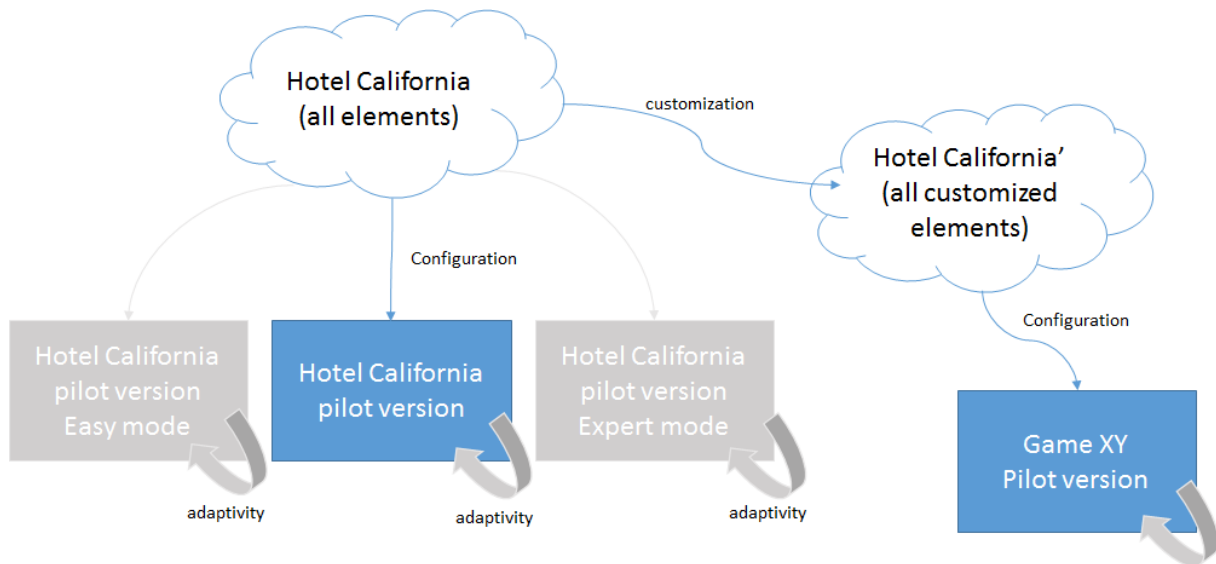


Figure 33, Customizability realized in the pilot version of Hotel California

What the Hotel California does have in the area of customizability is customization. For Hotel California we used a database (MySQL) to store all the projects and actions that could be played. The game requests the data from the database and displays the correct data to the player that needs to see the data. All this information can be easily customized by adding, deleting or adjusting the options. This enables the designers to add more information. Create new options or delete irrelevant options. This makes the game easily adjustable and new insights on IT governance could be implemented into the game without creating an entirely new game. During this research we created the game on both paper and computer. The paper version took less time to develop but it was error sensitive and not flexible. Each comment on the game required to recreate the game entirely. The pc version took longer to develop but was much easier to adjust mistakes, errors and comments. All in all this was not the desired result as it comes to customizability but more customization will be added in the coming versions of Hotel California.

8.6 The Effectiveness of Hotel California

All the intended learning outcomes that were formulated can be, according to the grand weighted total score, be improved. The previous sections have discussed many improvements that can be applied to the game. This is, knowing that our game is a pilot version, not a bad thing. But still many of the things that we wanted to teach with the game (give players insights) have shown to be to some level effective. To conclude this section, Table 17 depicts the grand weighted total that includes all the evaluations. The last column discusses the effectiveness of the aspects in the game.

Table 17, Effectiveness of Hotel California as a Serious Game

Statement about the game	Grand Weighted Total (out of 5)	Statement about effectiveness
1. The game gave me insight in how to create more financial value using IT and the governance of IT	3.75	Small indication that the game effective in giving insights of creating financial value with the use of IT governance
2. The game makes players more conscious about decisions on IT investments after playing the game.	4.5	There is an indication that the game is effective as it comes to giving insights on IT decision making
3. The game shows the value of IT for the business and how they are intertwined.	4	The game indicates being effective in showing how Business and IT are intertwined
4. What is taught in the game can be useful for players (even me) in their daily life.	3.5	The game in this state was not always applicable for players in their daily lives.
5. Thanks to the game players realize that the market has an influence on their organization.	2.25	The game was totally not effective on showing the influence of the market on IT governance
6. Players come to the realization that a formal structure in decision making and communication will help them in their daily work thanks to the game.	4	Hotel California indicates to be somewhat effective as it comes to teaching that communication and formal structure will help in IT governance
7. The game gives players the insight, that working together, as Business and IT, creates more value for the organization as a whole.	4.75	The game tends to be effective in showing players that working together will be the best strategy for adding value as an organization
8. The game teaches players something new about IT – business alignment/ IT governance.	4.25	For the target group the game taught them new things about IT governance and that indicates that the game is, on this point, effective
General statements	(out of 7)	
1. It was easy to use	4.5	The game was not always easy to use for everybody. This point is a little above neutral and needs improvement to prevent the game will become less effective due to players not being able to play
2. I liked the game	6	Basically all the players liked the game. This will help get them more motivated to playing and learning
3. The game is fun to do	6	Same as the statement above.
4. I would recommend it to a friend/organization	5	Hotel California is not ready yet to be played by real players and many things should be added and improved, but the game has potential.
5. Would you advice the game to be played in organizations in order to get them more familiar with IT governance and Business IT alignment.	6	Especially experts stated that a game like this should be played in many organizations because there is a need to teach the content of this game to many organizations.

Effectivity can always be improved even in the best game. But in the case of Hotel California we saw promising results that indicate that the game is and can be effective as a teaching tool. This game was made following literature and other scientific sources by designers with no real experience in game making. Still the end result was a game that was fun, enjoyable and on many aspects effective.

9. Discussion and Conclusion

9.1 Conclusion

In this thesis research we relied on scientific literature on Serious Games and pedagogical teaching to create an effective serious game. To recap we will discuss the sub questions and main question of this research formulated in Chapter 3 and how they were satisfied.

1. *What design methods currently exist in the serious game domain that can be used for the design and development of educational business games?*

In our search towards designing a serious game based on scientific sources we have found many methods and guidelines that were taken into account in the development of Hotel California. These guidelines are scattered across the literature and many frameworks are very abstract or high level.

2. *How to balance the educational value and the entertainment property of a game?*

All that was learned was combined into a Design Framework for Educational Games. This framework describes the many elements that Educational Games should hold. Even more detailed, the Educational Game Design Checklist explains the game elements in more depth. This Checklist requires games to have both pedagogical aspects and aspects that improve the entertainment property. The Educational Game Design Framework and the Educational Game Design Checklist can be used to balance out the educational value and entertainment property because it gives both the required attention.

3. *How to design an educational business game in order to make it easily customizable?*

We have explored how to make our game easily customizable. We could, unfortunately, not include all the aspects of customizability that we wanted and therefore we can only state that we only partially answered this question. The pilot version of Hotel California cannot be played on different difficulties and also the difficulty cannot be adjusted while playing. The game is easily adjustable by the designers in order to add, delete and edit actions or information.

4. *How to evaluate the effectiveness of an educational business game?*

To assess the effectiveness of Hotel California the evaluation steps by Rogers *et al.* (2007) were used. In combination with discussions, interviews and questionnaires about the games' content and intended learning outcomes, the game has followed the proposed steps by Rogers *et al.* (2007). This resulted in an extensive assessment of the games' effectiveness. The evaluations that were conducted indicated that the game, made with guidelines from literature, was promising in being effective as a teaching tool.

The main research question of this research was:

"How to design and develop effective and customizable serious games for business training purposes?"

In the previous Chapter we discussed all the results from our evaluations and came to the conclusion that Hotel California the game was effective as a teaching tool on many of the intended learning outcomes. In our journey towards creating a game that was effective we followed the proposed Educational Game Design Framework and Educational Game Design Checklist. This resulted in the game 'Hotel California'. The game has been evaluated and found effective on many aspects that the game had to teach. Some aspects were less effective but the overall end result is positive.

In order to answer the main question we can state the Educational Game Design Framework and Educational Game Design Checklist can be used design a customizable serious games for business training purposes and that they can be used to produce effective Educational Games to some extent.

Although the game turned out to be effective as a teaching tool, developing a game will always be a creative and iterative process that takes a lot of time to create a good game. Following the proposed framework and checklist will not result in a game that can be used immediately. Shorten the time to design and create games is one of the motivations for starting this research and maybe using the proposed framework can do that. But creating games will always require testing the artefact with real players. Also following the Educational Game Design Checklist does not make designing games a straightforward process where requirements are explained and implemented into the game. Games are very complex and many the elements depend on each other which requires many iterations before it satisfies the designers, the client and the players.

9.2 Limitations

This research had some limitations that interfered with achieving better results. The first limitation was the time available to design, develop and evaluate the game. The time scope for this research was 8 months in which literature research was conducted, the game has been designed, and the pilot version of the game was developed and evaluated. With more time available the effectiveness of the game could have been tested more rigorously. The ability to not only test the short-term effectiveness but also the long-term impact of the game. Evaluating the long-term effectiveness is extremely important to assess the 'real' impact of the Educational Game. That this could not be done in the time frame with a pilot version of our game is a serious limitation to this research. Also with more time the game would have been better because more functions and roles would have been added that could have resulted in even better outcomes.

A limitation to this research is the fact that more experiments are needed to make better assumptions about the quality of games that can be designed with the proposed framework and checklist. Also for the target group evaluation people were used that have affiliation with IT. However we could not manage to attract participants that corresponded with the roles in the game. These people are very busy and were not willing to invest their time in a pilot version of a game that is still under development. To overcome this problem the evaluation was also done with domain experts that know the roles that are in the game.

9.3 Further Research

More research is needed on testing the Educational Game Design Framework and Educational Game Design Checklist on the creation of other Business games. These artefacts are now used on one game but more evidence is needed to make harder statements about the proposed framework and checklist. Next to the creation of other games, the long term effectiveness of game created using the Framework should be evaluated. If the games produces using the proposed framework does not result in effective game on the long term, the results of this thesis might be wrong.

Also, we stated before that the Educational Game Design Framework and Educational Game Design Checklist could also be useful for serious games of other types. The proposed framework does not have to limited for the creation of Educational Business Games. However more research is needed to explore this.

Additional research is needed for the checklist in order to get an indication to what it means when not all requirements are satisfied and what that does to the effectiveness of the serious game. Now the Educational Game Checklist list requirements gives an overview of all the important parts of serious

game design. Designers can argue if they applied the requirement 'Partially' 'Fully' or did 'Not' apply the requirement. This is very useful in designing and comparing game but it does not score games if they do not have all the requirements applied. If games could be measured with the checklist on their effectivity the Educational Game Checklist could be used as a scoring tool, to give scores to games and give an indication to why they are less effective as a teaching tool. This however requires more research on the individual requirements and how they influence the effectivity of the game.

Also the proposed checklist is obtained following literature. An Evaluation of the Educational Business Game Checklist could be useful to explore missing requirements that could or must be included in the checklist.

Because games are complex artefacts and humans are even more complex the creation of a multiplayer game is an intensive process. For better understanding of player interactions in multiplayer games it would be good to explore important interactions. Designers of a single player serious game will not have to elaborate on the interaction between players, but in a multiplayer game this is very important. For further research it will be good to include more on player interactions and what interactions between players are important.

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11. Appendix

Appendix 1. Play-test session questions

Play-test questions that can be used in play-test sessions created by Fullerton (2014)

IN-GAME OBSERVATIONS

[Your thoughts as you watch the testers play]

IN-GAME QUESTIONS

[Questions you ask the testers as they play]

1. Why did you make that choice?
2. Does that rule seem confusing?
3. What did you think that would do?
4. What is confusing you?

POSTGAME QUESTIONS

[Questions you ask the testers after they have played]

General questions

1. What was your first impression?
2. How did that impression change as you played?
3. Was there anything you found frustrating?
4. Did the game drag at any point?
5. Were there particular aspects that you found satisfying?
6. What was the most exciting moment in the game?
7. Did the game feel too long, too short, or just about right?

Formal elements

1. Describe the objective of the game.
2. Was the objective clear at all times?
3. What types of choices did you make during the game?
4. What was the most important decision you made?
5. What was your strategy for winning?
6. Did you find any loopholes in the system?
7. How would you describe the conflict?
8. In what way did you interact with other players?
9. Do you prefer to play alone or with human opponents?
10. What elements do you think could be improved?

Dramatic elements

1. Was the game's premise appealing to you?
2. Did the story enhance or detract from the game?
3. As you played, did the story evolve with the game?
4. Is this game appropriate for the target audience?
5. On a piece of paper, graph your emotional involvement over the course of the game.
6. Did you feel a sense of dramatic climax as the game progressed?
7. How would you make the story and game work better as a whole?

Procedures, rules, interface, and controls

1. Were the procedures and rules easy to understand?
2. How did the controls feel? Did they make sense?
3. Could you find the information you needed on the interface?
4. Was there anything about the interface you would change?
5. Did anything feel clunky, awkward, or confusing?
6. Are there any controls or interface features you would like to see added?

End of session

1. Overall, how would you describe this game's appeal?
2. Would you purchase this game?
3. What elements of the game attracted you?
4. What was missing from the game?
5. If you could change just one thing, what would it be?
6. Who do you think is the target audience for this game?
7. If you were to give this game as a gift, who would you give it to?

REVISION IDEAS

[Ideas you have for improving the game]

Appendix 2. Heuristics for gameplay

Heuristics for playability by Desurvire, Caplan & Toth (2004)

	Heuristic and Description
Game Play	1 Player's fatigue is minimized by varying activities and pacing during game play.
	2 Provide consistency between the game elements and the overarching setting and story to suspend disbelief.
	3 Provide clear goals, present overriding goal early as well as short-term goals throughout play.
	4 There is an interesting and absorbing tutorial that mimics game play.
	5 The game is enjoyable to replay.
	6 Game play should be balanced with multiple ways to win.
	7 Player is taught skills early that you expect the players to use later, or right before the new skill is needed.
	8 Players discover the story as part of game play.
	9 Even if the game cannot be modeless, it should be perceived as modeless.
	10 The game is fun for the Player first, the designer second and the computer third. That is, if the non-expert player's experience isn't put first, excellent game mechanics and graphics programming triumphs are meaningless.
	11 Player should not experience being penalized repetitively for the same failure.
	12 Player's should perceive a sense of control and impact onto the game world. The game world reacts to the player and remembers their passage through it. Changes the player makes in the game world are persistent and noticeable if they back-track to where they've been before.
	13 The first player action is painfully obvious and should result in immediate positive feedback.
	14 The game should give rewards that immerse the player more deeply in the game by increasing their capabilities (power-up), and expanding their ability to customize.
	15 Pace the game to apply pressure but not frustrate the player. Vary the difficulty level so that the player has greater challenge as they develop mastery. Easy to learn, hard to master.
	16 Challenges are positive game experiences, rather than a negative experience (results in their wanting to play more, rather than quitting).
Game Story	1 Player understands the story line as a single consistent vision.
	2 Player is interested in the story line. The story experience relates to their real life and grabs their interest.
	3 The Player spends time thinking about possible story outcomes.
	4 The Player feels as though the world is going on whether their character is there or not.
	5 The Player has a sense of control over their character and is able to use tactics and strategies.
	6 Player experiences fairness of outcomes.
	7 The game transports the player into a level of personal involvement emotionally (e.g., scare, threat, thrill, reward, punishment) and viscerally (e.g., sounds of environment).
	8 Player is interested in the characters because (1) they are like me; (2) they are interesting to me, (3) the characters develop as action occurs.
Mechanics	1 Game should react in a consistent, challenging, and exciting way to the player's actions (e.g., appropriate music with the action).
	2 Make effects of the Artificial Intelligence (AI) clearly visible to the player by ensuring they are consistent with the player's reasonable expectations of the AI actor.
	3 A player should always be able to identify their score/status and goal in the game.
	4 Mechanics/controller actions have consistently mapped and learnable responses.
	5 Shorten the learning curve by following the trends set by the gaming industry to meet user's expectations.
	6 Controls should be intuitive, and mapped in a natural way; they should be customizable and default to industry standard settings.
	7 Player should be given controls that are basic enough to learn quickly yet expandable for advanced options.
Usability	1 Provide immediate feedback for user actions.
	2 The Player can easily turn the game off and on, and be able to save games in different states.
	3 The Player experiences the user interface as consistent (in control, color, typography, and dialog design) but the game play is varied.
	4 The Player should experience the menu as a part of the game.
	5 Upon initially turning the game on the Player has enough information to get started to play.
	6 Players should be given context sensitive help while playing so that they do not get stuck or have to rely on a manual.
	7 Sounds from the game provide meaningful feedback or stir a particular emotion.
	8 Players do not need to use a manual to play game.
	9 The interface should be as non-intrusive to the Player as possible.
	10 Make the menu layers well-organized and minimalist to the extent the menu options are intuitive.
	11 Get the player involved quickly and easily with tutorials and/or progressive or adjustable difficulty levels.
	12 Art should be recognizable to player, and speak to its function.

Appendix 3. Self-report
USE questionnaire based on Lund (2001)

USEFULNESS		1	2	3	4	5	6	7	NA
1. It helps me be more effective. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
2. It helps me be more productive. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
3. It is useful. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
4. It gives me more control over the activities in my life. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
5. It makes the things I want to accomplish easier to get done. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
6. It saves me time when I use it. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
7. It meets my needs. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
8. It does everything I would expect it to do. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
EASE OF USE		1	2	3	4	5	6	7	NA
9. It is easy to use. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
10. It is simple to use. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
11. It is user friendly. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
12. It requires the fewest steps possible to accomplish what I want to do with it. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
13. It is flexible. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
14. Using it is effortless. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
15. I can use it without written instructions. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
16. I don't notice any inconsistencies as I use it. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
17. Both occasional and regular users would like it. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
18. I can recover from mistakes quickly and easily. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
19. I can use it successfully every time. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
EASE OF LEARNING		1	2	3	4	5	6	7	NA
20. I learned to use it quickly. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
21. I easily remember how to use it. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
22. It is easy to learn to use it. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
23. I quickly became skillful with it. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
SATISFACTION		1	2	3	4	5	6	7	NA
24. I am satisfied with it. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
25. I would recommend it to a friend. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
26. It is fun to use. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
27. It works the way I want it to work. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
28. It is wonderful. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
29. I feel I need to have it. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
30. It is pleasant to use. <input type="checkbox"/>	strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	strongly agree <input type="radio"/>
		1	2	3	4	5	6	7	NA

Appendix 4. Questions used during evaluation

1.1 Pre-test open questions about IT Governance for domain experts

1. What do you think are the most problematic issues today in the domain between IT and the Business?

- 1.
- 2.
- 3.

2. What is the solution to these problems according to you?

3. Do you feel that you are familiar with the IT and business domain and the interaction between them (IT governance). Please explain?

1.2 Post-test questions for semi-structured interview about IT governance for the Domain experts

1. Does the game gives you insight in how to create more financial value using IT and the governance of IT?

2. Do you think players will be more conscious about decisions on IT investments after playing the game?

3. Does the game show you the value of IT for the business and how they are intertwined?

4. Do you think that what is taught in the game can be useful for players (maybe you) in their daily life?

5. Does the game show people that changes in the market have an influence on their organization?

6. You think that the game will make people realize that the market has an influence on their organization.

7. Do you think that players will come to the realization that a formal structure in decision making and communication will help them in their daily work thanks to the game?

8. Does the game give players the insight, that working together, as Business and IT, creates more value for the organization as a whole?

9. Does the game taught you something new about IT – business alignment/ IT governance?

1.3 Pre-test multiple-choice questions about IT Governance for target audience:

1. How would you decide on which new innovative IT projects to initiate?

A: follow strategy

B: follow the market and do what seems best

C: React on emerging issues

2. What would be the perfect way to prioritize the IT projects that you want to initiate? (set the order, like: ABC)

A: what has the most impact on income

B: What reduces the most issues

C: The one who pays gets first pick.

3. How would you say a planning should be made around IT projects

A: Plan as much as you can upfront

B: Do not plan things upfront as everything can change

C: Only plan for the upcoming period as there are many stakeholders

4. What is the most important aspect of IT Governance?

A: Planning the projects

B: Communication among stakeholders

C: Minimizing Risks

5. IT governance is something done by?

A: the CIO

B: the CEO

C: the CXO's

6. Decisions on IT are made and influenced by:

A: The CIO

B: The IT employees

C: Other Departments and the IT employees

D: All of the above

1.4 Post-test multiple-choice questions about IT Governance for target audience:

1. How would you decide on which new innovative IT projects to initiate?

A: follow strategy

B: follow the market and do what seems best

C: React on emerging issues

2. What would be the perfect way to prioritize the IT projects that you want to initiate? (set the order, like: ABC)

A: what has the most impact on income

B: What reduces the most issues

C: The one who pays gets first pick.

3. How would you say a planning should be made around IT projects

A: Plan as much as you can upfront

B: Do not plan things upfront as everything can change

C: Only plan for the upcoming period as there are many stakeholders

4. What is the most important aspect of IT Governance?

- A: Planning the projects
- B: Communication among stakeholders
- C: Minimizing Risks

5. IT governance is something done by?

- A: the CIO
- B: the CEO
- C: the CXO's

6. Decisions on IT are made and influenced by:

- A: The CIO
- B: The IT employees
- C: Other Departments and the IT employees
- D: All of the above

1.5 General questions about the game.

with the numbers being: 1= strongly disagree
 2= disagree
 3= neutral
 4= agree
 5= strongly agree

		1.	2.	3.	4.	5.	
1. The game gives insight in how to create more financial value using IT and the governance of IT	Strongly disagree						Strongly agree
2. Players will be more conscious about decisions on IT investments after playing the game.	Strongly disagree						Strongly agree
3. The game shows the value of IT for the business and how they are intertwined.	Strongly disagree						Strongly agree
4. What is taught in the game can be useful for players (maybe you) in their daily life.	Strongly disagree						Strongly agree
5. The game shows people that changes in the market have an influence on their organization.	Strongly disagree						Strongly agree
6. Players will come to the realization that a formal structure in decision making	Strongly disagree						Strongly agree

and communication will help them in their daily work thanks to the game.								
7. The game will give players the insight, that working together, as Business and IT, creates more value for the organization as a whole.	Strongly disagree							Strongly agree
8. The game taught me something new about IT – business alignment/ IT governance.	Strongly disagree							Strongly agree

Post-test questions about the game experience and engagement based on Lund (2004)

1. It was easy to use	Strongly disagree								Strongly agree
2. I liked the game	Strongly disagree								Strongly agree
3. I would recommend it to a friend/organization	Strongly disagree								Strongly agree
4. The game is fun to do	Strongly disagree								Strongly agree
5. Would you advice the game to be played for organizations in order to get them more familiar with IT governance and Business IT alignment.	Strongly disagree								Strongly agree

Open questions about the game experience and engagement based on Fullerton (2014)

1. what are the 3 aspects you liked best about the game?
2. what are the 3 aspects you didn't like about the game?
3. What was your strategy for winning?
4. Was there too much, too little or just enough conflict in the game?
5. Which elements to make the game more fun can be improved?
6. Is there anything you would change about the interface?
7. What was missing from the game?
8. If you could change one thing, what would you change?

Appendix 5. Game balancing

		by IT self (b)															
action 4. marketing campaign on internet.	CCO	Website application where clients can win a vacation	<input type="checkbox"/> action 4 alt 1	FALSE	€ 2.000.000	-5	5	€ 200.000	1%	0%	1%						
		actively manage facebook page and twitter.	<input type="checkbox"/> action 4 alt 2	FALSE	€ 1.000.000	-5	5	€ 100.000	1%	0%	2%						
5. IT capacity upgrade 1	IT operations manager	expand IT backbone capacity from 200 to 300 with low risk	<input checked="" type="checkbox"/> action 5 alt 1	TRUE	€ 2.000.000	-5	0	€ 200.000	0%	2%	0%	0%					
		expand IT backbone capacity from 200 to 300 quick & dirty method	<input type="checkbox"/> action 5 alt 2	FALSE	€ 1.000.000	-5	0	€ 200.000	0%	2%	0%	3%					
		expand IT backbone capacity from 200 to 350 in same time	<input type="checkbox"/> action 5 alt 3	FALSE	€ 2.000.000	-10	0	€ 300.000	0%	3%	0%	1%					
					€ 9.000.000,00	-25	40	€ 1.200.000	104%	98%	104%	0%	10,0				
					Budgeted for round 1	FTE's to spend	140 cap at start, 200 max	2 mil at start	1.226 million	1154 million	5 out of 10 at start	3% risk at start	points are 0 at beginning				
					10.000.000	30	120	2.000.000	1.226.000.000	1.154.000.000	5,0	3%	0				
					Total: budget left	€ 1.000.000	5	160	€ 3.200.000	€ 1.275.040.000	€ 1.130.920.000	5,20	3%	10,00			
					-€ 2.200.000												

Figure 34, Game balacing using Excel (1)

27.2 PMS integration build	IT operations manager	PMS intergration build	<input type="checkbox"/> action 27,2 alt	FALSE	€ 2.000.000			€ 300.000									
28. Back up, servers in order to protect loyalty card holders data it might be a good	CIO	Store valuable data on site data in server storage.	<input type="checkbox"/> action 28 alt 1	FALSE	€ 4.000.000	-5	5	€ 500.000				1%	2,5				
		store data on a cloud server to spread risks.	<input type="checkbox"/> action 28 alt 2	FALSE	€ 4.000.000	0	5	€ 300.000				0%	3,5	1 points to round 5 move to cloud project			
Action 32. start making a distinction between rooms to attract new	CCO	rebuild the App allow booking and check in for all the rooms on the mobile phone.	<input checked="" type="checkbox"/> action 32 alt 1	TRUE	€ 2.000.000	5	15	€ 300.000	2%		2%		2,5				
		rebuild the Website to allow webcustomers to check in and book the different rooms.	<input type="checkbox"/> action 32 alt 2	FALSE	€ 3.000.000	5	15	€ 400.000	3%		3%		2,5				
					€ 15.000.000,00	-20	0	TRUE	108%	100%	106%	0%	12,5				
					Budgeted for round 1	FTE's to spend	140 cap at start, 200 max	2 mil at start	1.226 million	1154 million	5 out of 10 at start	3% risk at start	points are 0 at beginning				
					20.000.000	30	160	3200000	1.275.040.000	1.130.920.000	5,2	3%	10,00				
					Total: budget left	€ 5.000.000	10	160	€ 3.200.001	€ 1.377.043.200	€ 1.130.920.000	€ 5,51	3%	23			
					€ 1.799.999												

Figure 35, Game balacing using Excel (2)

Appendix 6. List of requirements.

Table 18, depicts an extensive list with requirements for the game.

Table 18, List of requirements for the serious game

FUNCTIONAL REQUIREMENTS	
	<p>The game has to be designed in a way that there are reflection moments in which the participant, possibly with help of a game leader, are able to reflect on their performance and behaviour during the game.</p> <ul style="list-style-type: none"> - performance reports which reflect the business performance - After every round? - Some consequences can become clear several rounds after the decision, like in real life
	<p>Players have to be able to define and implement improvements.</p> <ul style="list-style-type: none"> -
	<p>The game hands out 'events' to players that come from the outer world that forces decisions up onto the players.</p> <ul style="list-style-type: none"> - Events by supplier - Events by customers' needs - Events from IT/Business
	<p>Every round will take 30 min.</p> <ul style="list-style-type: none"> - Or else?
	<p>Every round is followed by a break in which 1 year are skilled to see how decisions work out</p> <ul style="list-style-type: none"> -
	<p>Players see how their decisions work out on a dashboard</p> <ul style="list-style-type: none"> - Only available to players after players have found out that this might be good info to know?
	<p>Once changes have been made they cannot be undone, only cancelled</p> <ul style="list-style-type: none"> -
	<p>The game has different play options to make the game focus more on a specific goal</p> <ul style="list-style-type: none"> - Focus on value - Focus on costs - Focus on communication - Focus on collaboration
QUALITY REQUIREMENTS	
	<p>The game focusses on the competences people need for good IT Governance</p>
	<p>The game is playable on multiple locations</p> <ul style="list-style-type: none"> - At home - At the company
	<p>The game is played online</p> <ul style="list-style-type: none"> - Online for data sharing
	<p>The game should be playable by 6 – 10 players. It should not be depending on the number of available participants if a game goes on.</p> <ul style="list-style-type: none"> - Minimal number of players =5? - Computer can fill in the rest of the roles.
	<p>The game is supported by computer</p> <ul style="list-style-type: none"> - Contains digital aspects (game attributen) - Physical interaction between players

	The game's feedback is available after the game is played	<ul style="list-style-type: none"> - For the players to prolong the learning experience - Outcomes of all played games should be collected for improvement and further development purposes
	Intended learning outcomes have to be measurable	<ul style="list-style-type: none"> - Yes
		-
	The game shall contain multiple rounds	<ul style="list-style-type: none"> - 5 rounds
	The game will take several hours in time	<ul style="list-style-type: none"> - 3 hours - 6 hours
	The game will have a tutorial round	<ul style="list-style-type: none"> - For the players - For the game leader
	The game will document the results of the play	-
	The game will focus on issues of IT Governance between the Business, IT and Supplier	<ul style="list-style-type: none"> - IT Governance domain
	The game will measure different outcomes	<ul style="list-style-type: none"> - Customer satisfaction - Market share - Costs - Employee satisfaction - Continuity
	The game will have different roles	<ul style="list-style-type: none"> - Roles that play an important part in IT Governance
	Business Value will play a crucial role in the game as a theme and this is also where the game will put focus	<ul style="list-style-type: none"> - Waarde is een belangrijk aspect voor AMG
	innovate, change & operate will play a crucial role in the game as a theme and this is also where the game will put focus	<ul style="list-style-type: none"> - Important for AMG
	The game must be playable with multiple business teams	<ul style="list-style-type: none"> - Competition
	The game will be played with people from both the Business and IT	<ul style="list-style-type: none"> - Both parties will have to play together in the game
	Business IT will be a theme in the game	-
	The game will propose events that arises conflicting interests between players	<ul style="list-style-type: none"> - Players will have to choose between their own budget and value for the company - Choices between own bonuses or what is good for the company

		- - between 'sexy' technical solutions and pragmatic solutions.
	Operate will not be played by physical persons, but will be used to show the outcome from the decisions made in the other two layers	- Operate has to perform based on the decisions people made in innovate and change.
		-
		-
CONSTRAINTS	Internet will be needed to play the game	- To process data
	The first game will not be multi language	- Only english
	The Model behind the roles in the game will be based on the AMG roles model.	- Not based on ITIL, BSL, or whatever kind of IT framework
		-
		-
		-
		-

Appendix 7. Target Group test results and questionnaires.

Participant 1

1.4 Post-test multiple-choice questions about IT Governance for target audience:

1. How would you decide on which new innovative IT projects to initiate?

A: follow strategy

B: follow the market and do what seems best

C: React on emerging issues

2. What would be the perfect way to prioritize the IT projects that you want to initiate? (set the order, like: ABC)

A: what has the most impact on income

B: What reduces the most issues

C: The one who pays gets first pick. **BAC**

3. How would you say a planning should be made around IT projects

A: Plan as much as you can upfront

B: Do not plan things upfront as everything can change

C: Only plan for the upcoming period as there are many stakeholders

4. What is the most important aspect of IT Governance?

A: Planning the projects

B: Communication among stakeholders

C: Minimizing Risks

5. IT governance is something done by?

A: the CIO

B: the CEO

C: the CXO's

6. Decisions on IT are made and influenced by:

A: The CIO

B: The IT employees

C: Other Departments and the IT employees

D: All of the above

1.5 General questions about the game.

With the numbers being: 1= strongly disagree
 2= disagree
 3= neutral
 4= agree
 5= strongly agree

		1.	2.	3.	4.	5.	
1. The game gives insight in how to create more financial value using IT and the governance of IT	Strongly disagree	x					Strongly agree
2. Players will be more conscious about decisions on IT investments after playing the game.	Strongly disagree					x	Strongly agree
3. The game shows the value of IT for the business and how they are intertwined.	Strongly disagree		x				Strongly agree
4. What is taught in the game can be useful for players (maybe you) in their daily life.	Strongly disagree				x		Strongly agree
5. The game shows people that changes in the market have an influence on their organization.	Strongly disagree			x			Strongly agree
6. Thanks to the game people will realize that the market has an influence on their organization.	Strongly disagree		x				Strongly agree
7. Players will come to the realization that a formal structure in decision making and communication will help them in their daily work thanks to the game.	Strongly disagree			x			Strongly agree
8. The game will give players the insight, that working together, as Business and IT, creates more value for the organization as a whole.	Strongly disagree					x	Strongly agree
9. The game taught me something new about IT –	Strongly disagree				x		Strongly agree

business alignment/ IT governance.								
------------------------------------	--	--	--	--	--	--	--	--

Post-test questions about the game experience and engagement based on Lund (2004)

1. It was easy to use	Strongly disagree						x		Strongly agree
2. I liked the game	Strongly disagree							x	Strongly agree
3. I would recommend it to a friend/organization	Strongly disagree					x			Strongly agree
4. The game is fun to do	Strongly disagree							x	Strongly agree
5. Would you advice the game to be played for organizations in order to get them more familiar with IT governance and Business IT alignment.	Strongly disagree						x		Strongly agree

Open questions about the game experience and engagement based on Fullerton (2014)

1. what are the 3 aspects you liked best about the game?

1. The need for collaboration
2. You were able to see what the direct impact of a certain choice is
3. The case-setting

2. what are the 3 aspects you didn't like about the game?

1. De pauwveren op de achtergrond, zeker toen hij een paar keer lang moest laden, dan zag ik alleen die achtergrond, die is dan veel te druk.
2. Het duurde een beetje lang
3. Ik heb geen derde ;)

3. What was your strategy for winning?

Overleggen met anderen, ik was niet echt gefocust om zelf te winnen

4. Was there too much, too little or just enough conflict in the game?

De samenwerking verliep goed.

5. Which elements to make the game more fun can be improved?

-

6. Is there anything you would change about the interface?

Ik zou de achtergrond veranderen, maar dit is alleen maar irritant als de pagina niet goed laadt, als deze gewoon laadt, is er niks dat ik zou veranderen.

7. What was missing from the game?

Een tijdslimiet om de beslissingen te maken of een ronde te voltooien.

8. If you could change one thing, what would you change?

Participant 2

1.4 Post-test multiple-choice questions about IT Governance for target audience:

1. How would you decide on which new innovative IT projects to initiate?

A: follow strategy

B: follow the market and do what seems best

C: React on emerging issues

2. What would be the perfect way to prioritize the IT projects that you want to initiate? (set the order, like: ABC)

A: what has the most impact on income **(2)**

B: What reduces the most issues **(1)**

C: The one who pays gets first pick. **(3)**

3. How would you say a planning should be made around IT projects

A: Plan as much as you can upfront

B: Do not plan things upfront as everything can change

C: Only plan for the upcoming period as there are many stakeholders

4. What is the most important aspect of IT Governance?

A: Planning the projects

B: Communication among stakeholders

C: Minimizing Risks

5. IT governance is something done by?

A: the CIO

B: the CEO

C: the CXO's

6. Decisions on IT are made and influenced by:

A: The CIO

B: The IT employees

C: Other Departments and the IT employees

D: All of the above

1.5 General questions about the game.

with the numbers being:

- 1= strongly disagree
- 2= disagree
- 3= neutral
- 4= agree
- 5= strongly agree

		1.	2.	3.	4.	5.	
1. The game gives insight in how to create more financial value using IT and the governance of IT	Strongly disagree				✓		Strongly agree
2. Players will be more conscious about decisions on IT investments after playing the game.	Strongly disagree				✓		Strongly agree
3. The game shows the value of IT for the business and how they are intertwined.	Strongly disagree				✓		Strongly agree
4. What is taught in the game can be useful for players (maybe you) in their daily life.	Strongly disagree			✓			Strongly agree
5. The game shows people that changes in the market have an influence on their organization.	Strongly disagree					✓	Strongly agree
6. Thanks to the game people will realize that the market has an influence on their organization.	Strongly disagree					✓	Strongly agree
7. Players will come to the realization that a formal structure in decision making and communication will help them in their daily work thanks to the game.	Strongly disagree					✓	Strongly agree
8. The game will give players the insight, that working together, as Business and IT, creates more value for the organization as a whole.	Strongly disagree					✓	Strongly agree
9. The game taught me something new about IT – business alignment/ IT governance.	Strongly disagree				✓		Strongly agree

Post-test questions about the game experience and engagement based on Lund (2004)

1. It was easy to use	Strongly disagree						✓		Strongly agree
2. I liked the game	Strongly disagree						✓		Strongly agree

3. I would recommend it to a friend/organization	Strongly disagree							✓		Strongly agree
4. The game is fun to do	Strongly disagree							✓		Strongly agree
5. Would you advice the game to be played for organizations in order to get them more familiar with IT governance and Business IT alignment.	Strongly disagree								✓	Strongly agree

Open questions about the game experience and engagement based on Fullerton (2014)

1. what are the 3 aspects you liked best about the game?

- it gives insights in a real situation;
- people learn how important teamwork is;
- it's a game, so in a relaxed atmosphere one can teach something about a (sometimes hard to learn or understand) subject.

2. what are the 3 aspects you didn't like about the game?

- it took some time to play the game (duration time of the game);
- there were a lot of rules to consider in the game.

3. What was your strategy for winning?

My strategy was getting to know what the targets of the other CXO's were and focussing on my targets.

4. Was there too much, too little or just enough conflict in the game?

There was too little conflicts, but I am not sure if that is important. You want people to work together, right?

5. Which elements to make the game more fun can be improved?

Time restrictions per round, Monopoly money, and maybe something like an evaluation round at the end. In that case, people can talk and learn about what went wrong and or what went well.

6. Is there anything you would change about the interface?

The background pictures. This could be more towards the theme of the game. With serious pictures, people will maybe act more serious.

7. What was missing from the game?

No idea.

8. If you could change one thing, what would you change?

/

Participant 3

1.4 Post-test multiple-choice questions about IT Governance for target audience:

1. How would you decide on which new innovative IT projects to initiate?

A: follow strategy

B: follow the market and do what seems best

C: React on emerging issues

2. What would be the perfect way to prioritize the IT projects that you want to initiate? (set the order, like: ABC)

A: what has the most impact on income

B: What reduces the most issues

C: The one who pays gets first pick.

3. How would you say a planning should be made around IT projects

A: Plan as much as you can upfront

B: Do not plan things upfront as everything can change

C: Only plan for the upcoming period as there are many stakeholders

4. What is the most important aspect of IT Governance?

A: Planning the projects

B: Communication among stakeholders

C: Minimizing Risks

5. IT governance is something done by?

A: the CIO

B: the CEO

C: the CXO's

6. Decisions on IT are made and influenced by:

A: The CIO

B: The IT employees

C: Other Departments and the IT employees

D: All of the above

1.5 General questions about the game.

with the numbers being:

- 1= strongly disagree
- 2= disagree
- 3= neutral
- 4= agree
- 5= strongly agree

		1.	2.	3.	4.	5.	
1. The game gives insight in how to create more financial value using IT and the governance of IT	Strongly disagree				x		Strongly agree
2. Players will be more conscious about decisions on IT investments after playing the game.	Strongly disagree				x		Strongly agree
3. The game shows the value of IT for the business and how they are intertwined.	Strongly disagree				x		Strongly agree
4. What is taught in the game can be useful for players (maybe you) in their daily life.	Strongly disagree				x		Strongly agree
5. The game shows people that changes in the market have an influence on their organization.	Strongly disagree			x			Strongly agree
6. Thanks to the game people will realize that the market has an influence on their organization.	Strongly disagree			x			Strongly agree
7. Players will come to the realization that a formal structure in decision making and communication will help them in their daily work thanks to the game.	Strongly disagree					x	Strongly agree
8. The game will give players the insight, that working together, as Business and IT, creates more value for the organization as a whole.	Strongly disagree					x	Strongly agree
9. The game taught me something new about IT – business alignment/ IT governance.	Strongly disagree			x			Strongly agree

Post-test questions about the game experience and engagement based on Lund (2004)

1. It was easy to use	Strongly disagree						x		Strongly agree
2. I liked the game	Strongly disagree						x		Strongly agree

3. I would recommend it to a friend/organization	Strongly disagree							x		Strongly agree
4. The game is fun to do	Strongly disagree							x		Strongly agree
5. Would you advice the game to be played for organizations in order to get them more familiar with IT governance and Business IT alignment.	Strongly disagree								x	Strongly agree

Open questions about the game experience and engagement based on Fullerton (2014)

1. what are the 3 aspects you liked best about the game?

Collaboration, awareness and simple explanation

2. what are the 3 aspects you didn't like about the game?

Lack of feedback in virtual game

3. What was your strategy for winning?

Collaborating

4. Was there too much, too little or just enough conflict in the game?

Just enough

5. Which elements to make the game more fun can be improved?

Show more financial information in the virtual game.

6. Is there anything you would change about the interface?

Add in a detailed feedback screen.

7. What was missing from the game?

Add in a detailed feedback (result) screen.

8. If you could change one thing, what would you change?

See above

Appendix 8. Domain expert interview transcripts and questionnaires.

Name: Expert 1

(will be anonymous)

1.1 Post-test questions for semi-structured interview about IT governance for the Domain experts

1. Does the game gives you insights in how to create more financial value using IT and the governance of IT?

Not directly. I think that the game is to IT oriented and needs more introduction at the beginning. For example tell the participants something more about the traditional Governance in a Hotel organization structure, or from a different kind of organization.

2. Do you think players will be more conscious about decisions on IT investments after playing the game?

Yes, I'm positive about this point, the game is very promising.

3. Does the game show you the value of IT for the business and how they are intertwined?

In line with question 1 my answer at this moment is not directly

4. Do you think that what is taught in the game can be useful for players (maybe you) in their daily life?

Looking at the communication part of the Game I would say absolutely. I would suggest to add the function of the CFO and be more clear about the roles and responsibilities at the beginning of the game.

5. Does the game show people that changes in the market have an influence on their organization?

Not in this version but if there are more events from outside Yes! Of course managing a hotel is something completely different then a production company but I see the added value.

6. You think that the game will make people realize that the market has an influence on their organization.

Yes, see answer above

7. Do you think that players will come to the realization that a formal structure in decision making and communication will help them in their daily work thanks to the game?

Yes but I think that using the informal communication lines will still exist and still will be very powerful, don't underestimate that fact.

8. Does the game give players the insight, that working together, as Business and IT, creates more value for the organization as a whole?

Yes I think that this is one of the strong points of this Game. Looking over walls, communicate more, try more to collaborate will help. The game can facilitate this.

9. Does the game taught you something new about IT – business alignment/ IT governance?

No

10. Does the game invite you to work together with colleagues?

Perhaps depends on the type of organization, types of responsibilities etc.

1.2 Post-test questions about the game experience and engagement based on Lund (2004)

1. It was easy to use	Strongly disagree					x			Strongly agree
2. I liked the game	Strongly disagree						x		Strongly agree
3. I would recommend it to a friend/organization	Strongly disagree						x		Strongly agree
4. The game is fun to do	Strongly disagree						x		Strongly agree
5. Would you advice the game to be played for organizations in order to get them more familiar with IT governance and Business IT alignment.	Strongly disagree							x	Strongly agree

Open questions about the game experience and engagement based on Fullerton (2014)

1. what are the 3 aspects you liked best about the game?

The IT based solution of the Game was very good

Materials and rooms setup (is the same in real live)

The different roles and responsibilities in the Game

2. What are the 3 aspects you didn't like about the game?

To unclear at the beginning, need more guidance in the first steps of the game

Some IT functions didn't work properly

For the Delivery Manager was not much to do, in every game round should be action for every role

3. What was your strategy for achieving the optimal solution?

Seek for more communication with the key players in the game

4. Was there too much, too little or just enough conflict in the game?

Too little

5. Which elements to make the game more fun can be improved?

More managed interaction between roles, forced meetings and decision moments with impact

6. Is there anything you would change about the interface?

The ideal situation is that all function work properly because otherwise it cost too much time and it gives a unpleasant feeling

7. What was missing from the game?

The CFO function

More explanation in the beginning

More interaction between the different players

More insight in the impact of decisions

Dashboard like interface with the pro's and Con's of decisions

8. If you could change one thing, what would you change?

Nothing specific, this is a very promising game with a great potential.

Other remarks:

Name: Expert 2

(will be anonymous)

1.1 Post-test questions for semi-structured interview about IT governance for the Domain experts

1. Does the game gives you insights in how to create more financial value using IT and the governance of IT?

Yes, first is gives insight in the possible trade-offs between business investments and it investments. The down drill in the excel we got afterwards gives insight in the effects.

2. Do you think players will be more conscious about decisions on IT investments after playing the game?

Yes, the fact that hardware It investments are part of the same portfolio choices (together with commercial choices)

3. Does the game show you the value of IT for the business and how they are intertwined?

Yes, see above.

4. Do you think that what is taught in the game can be useful for players (maybe you) in their daily life?

Depends on the objective. If the Objective is portfolio planning on investments, the answer is yes.

5. Does the game show people that changes in the market have an influence on their organization?

No quite. This is not really shown in the game, if however the game should have more context and extra features this could be one of them. The market changing could have an effect on the hotel company and they should therefore change their ways.

6. You think that the game will make people realize that the market has an influence on their organization.

Yes, the IT department discovers the importance of sales en operations objectives

7. Do you think that players will come to the realization that a formal structure in decision making and communication will help them in their daily work thanks to the game?

Yes. As we saw in our game. After playing a little it became obvious that the game could not be played by one person only and communicating with each other helped. The first round our results were not that good, but the second round was better because we knew from each other what we needed and more importantly what the organization as a whole needed.

8. Does the game give players the insight, that working together, as Business and IT, creates more value for the organization as a whole?

Yes, although the examples need to be detailed for a better fit.

9. Does the game taught you something new about IT – business alignment/ IT governance?

No, but take into account this is my profession.

10. Does the game invite you to work together with colleagues?

To some extend yes. More activities would help, but also if some roles would get feedback on what happened in the company they would be forced to work together.

1.2 Post-test questions about the game experience and engagement based on Lund (2004)

1. It was easy to use	Strongly disagree		x						Strongly agree
2. I liked the game	Strongly disagree					x			Strongly agree
3. I would recommend it to a friend/organization	Strongly disagree		x						Strongly agree
4. The game is fun to do	Strongly disagree					x			Strongly agree
5. Would you advice the game to be played for organizations in order to get them more familiar with IT governance and Business IT alignment.	Strongly disagree				x				Strongly agree

Open questions about the game experience and engagement based on Fullerton (2014)

1. what are the 3 aspects you liked best about the game?

The business-it allignement on business case choices

Sitting in multiple rooms , but nu to distant

2. what are the 3 aspects you didn't like about the game?

To much time required for the business case calculations

3. What was your strategy for achieving the optimal solution?

To much waiting time in between (give us something more to do)

4. Was there too much, too little or just enough conflict in the game?

Too little, the real world is more complex and that is what you would seek for such a game. We know that this is a pilot version but more complexity is needed. You need to find the balance between complex and not a real company.

5. Which elements to make the game more fun can be improved?

Notifications / newsflashes during the game.

6. Is there anything you would change about the interface?

7. What was missing from the game?

Focus on a fit with the buying customer: what will convince for instance an Operatrions Director to take part in the game or even better to be a sponsor of the game?

8. If you could change one thing, what would you change?

Other remarks:

1.1 Post-test questions for semi-structured interview about IT governance for the Domain experts

1. Does the game gives you insights in how to create more financial value using IT and the governance of IT?

Some, to the extend we could judge this.

2. Do you think players will be more conscious about decisions on IT investments after playing the game?

Yes. They have to make decisions that require them to think about the consequences

3. Does the game show you the value of IT for the business and how they are intertwined?

Yes, It shows that decisions made have influence on the IT department although the changes requested are not for IT.

4. Do you think that what is taught in the game can be useful for players (maybe you) in their daily life?

Depends on their knowledge level and competence skills. But it could be applicable to players that have less knowledge about IT governance.

5. Does the game show people that changes in the market have an influence on their organization?

No, not enough,

6. You think that the game will make people realize that the market has an influence on their organization.

No, for the reason of the previous question

7. Do you think that players will come to the realization that a formal structure in decision making and communication will help them in their daily work thanks to the game?

Not specifically to this game as in the pilot version we did not have the chance yet to create a structure for decision making.

8. Does the game give players the insight, that working together, as Business and IT, creates more value for the organization as a whole?

This certainly should be the case, and we saw that working together improved our results

9. Does the game taught you something new about IT – business alignment/ IT governance?

No, but that is not a real surprise

10. Does the game invite you to work together with colleagues?

Already was the case 😊. It did not invite us to working together as it was not handed to us but we found out that we had to work together.

1.2 Post-test questions about the game experience and engagement based on Lund (2004)

1. It was easy to use	Strongly disagree		x						Strongly agree
2. I liked the game	Strongly disagree					x			Strongly agree
3. I would recommend it to a friend/organization	Strongly disagree					x			Strongly agree
4. The game is fun to do	Strongly disagree						x		Strongly agree
5. Would you advice the game to be played for organizations in order to get them more familiar with IT governance and Business IT alignment.	Strongly disagree					x			Strongly agree

Open questions about the game experience and engagement based on Fullerton (2014)

1. what are the 3 aspects you liked best about the game?

Well thought over

Relation between money and long time/ short time decision making

Portfolio management – what brings most benefits at a certain moment

2. what are the 3 aspects you didn't like about the game?

Needs some further development

3. What was your strategy for achieving the optimal solution?

After first round:

First discuss, weigh, then decide and take position

4. Was there too much, too little or just enough conflict in the game?

Too little

5. Which elements to make the game more fun can be improved?

Sudden events

6. Is there anything you would change about the interface?

Needs to be further developed. Will be important in perception of end user!

7. What was missing from the game?

8. If you could change one thing, what would you change?

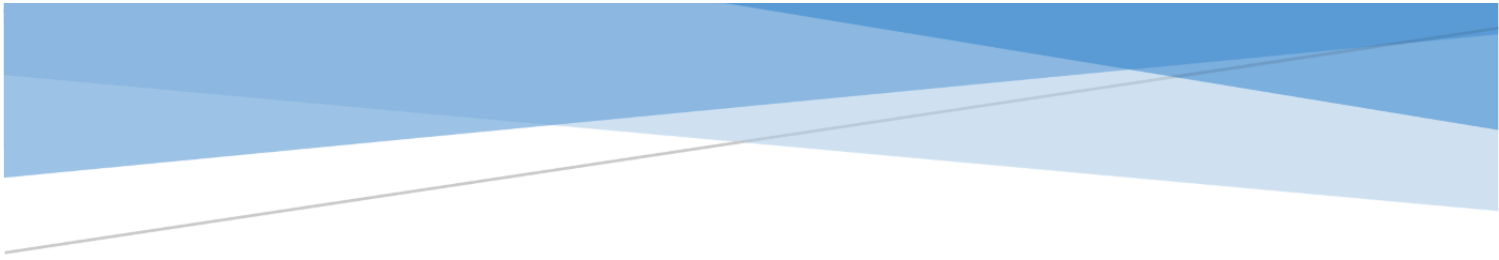
Other remarks:

Contact Barry Derksen of Bitti, www.bitti.nl

Part of the portfolio of Bitti is an IT alignment scan.

Game could be something to do after a scan; otherwise he could give valuable input.

(Alfred knows Barry I think)



DESIGN AND DEVELOPMENT OF EFFECTIVE AND CUSTOMIZABLE EDUCATIONAL BUSINESS GAMES

Master Thesis

Ton Masselink, 4059042

1. The background

This document is written for Anderson MacGyver as a pitch for a serious game. The serious game can be used to train employees of organizations and could therefore be called an Educational Business Game. This Educational Business Game will be situated around the business processes of a company and the IT department of that organization. The main idea behind the game is that the IT department has an important but not always clear role in creating value for the organization. The value that is created for the business can be optimised through certain behaviour of the players in the game. The game will be played with multiple players from both the business and the IT department of an organization.

2. Goal of the game

The goal of the game is to give insights to both IT and Business management into working together and creating value for the organization. This game will focus on the relation between business value and strategic decision making concerning the investments in IT. This domain is called IT governance. IT governance can be defined as:

“Specifying the decision rights and an accountability framework to encourage desirable behaviour in the creation and use of IT.”

This means that IT governance is about decision making processes and the people involved to ensure that the organisation's IT sustains and extends the organisation's strategies and objectives. People in an organization have to take decisions about the direction and usage of IT. According to Weill & Ross (2004) IT Governance encompasses five major management related decisions:

- IT principles: high level decisions about the strategic role of IT in the organization.
- IT architecture: an integrated set of technical choices to guide the organisation in satisfying business needs.
- IT infrastructure: shared IT services providing the foundation for the enterprise's IT capability.
- Business application needs: business requirements for purchased or internally developed IT applications
- Prioritization and investment: decisions about how much and where to invest in IT, including project approval and justification techniques.

This includes for example innovating, project portfolio management and lifecycle management. Different sub goals of IT governance are (Weill & Ross, 2004):

- Creating financial value with the right decisions
- See the impact of IT investments
- Getting insights on the value of IT for the business and inspire people to change
- Get insights on the influence of changes on the market
- Showing possible risks and how to minimize them
- Specifying a formal division of tasks and roles in decision making
- Align Business and IT

Different stakeholders in an organization have different opinions and interests. In making a decision, some look at the costs of IT systems, others only at innovations and the possibilities of new IT systems. There are some that want to stick with the current IT system and do not want change (although it's older). An optimal balance between these factors can create more value for the organization and this can only be achieved with good IT governance. This collision of multiple interests makes decision

making and creating real value for the company extremely hard. Collaboration between multiple parties, communication and prioritization can help here to achieve better IT governance.

Like stated before, communication, decision making and collaboration are activities that play an important role in the IT Governance. These overall activities will be taken into account in the design and development of game activities. The other direct goals of the game is for players to:

- Creating financial value with the right decisions
- See the impact of IT investments
- Getting insights on the value of IT for the business and inspire people to change
- Get insights on the influence of changes on the market
- Showing possible risks and how to minimize them
- Specifying a formal division of tasks and roles in decision making
- Align Business and IT

3. The game scenario

In high overview the game will look like the following:

- **Round 1**, introduction round. This round will have some changes that need to be carried out. However there will be not much challenge because this round is used to get the players to know the roles and dependencies.

- **Round 1.5**, after round 1, the players will get the basic concepts of the game, however an organization that is stable provides not much challenge. After round 1, the players will get a briefing in this in between round. The (fictional) CEO will inform the players about the new strategy that has been formed. This new strategy will contains that the Hotel Chain wants to become one of the best Hotel chains in the world. This can be achieved by winning the World Luxury Hotel Award. The World Luxury Hotel Award, also called the Oscar award of the hotel industry, is the most exclusive award that an Hotel can gain for its excellent service towards guests. The awards are based on the votes of guests. This can be done by investing more money and therefore also in IT related projects. The players will be informed that there are also 2 major events upcoming in year 4 and 5 (round 4 and 5). These events in year 4 and 5 need some planning because all that needs to be realized beforehand cannot be implemented all in the same year the events will be. They have to decide if they want to invest in the event of that year or in the events to come. There won't be enough money and time to do everything. Because of this, players will have to focus on meeting their own targets. But they will find out that doing it together and focussing on the main events, the company will have more benefit.

After the strategy is clear the players will be split up in two groups, the CXO's and the IT department. They will get some multiple-choice questions that will help them to decide where they want to focus on as a team. The CXO's will get other questions that the IT team. This will probably end up with two different ways of where the focus will be. At the end of round 1.5 the CXO's will have to decide how much of the budget (80 million for 4 years) they are spending on innovation, change and operate.

- **Round 2**, in round two the team knows that they have to plan for the events in year 4 and 5. However there is another event in this round. This means that there is a lot of innovation, change and also the operate is high. This will put a strain on the IT department. They will have to decide if they want to invest in now or long term.

- **Round 3**, AirBnB is growing massively and eating away market share from hotels. If Hotel California wants to stay successful they have to fight back. This will put even more pressure on the events in the

next two years. Depending on how well they implement counter solutions to keep their market share the loss of sales will be not so high.

- **Round 4**, in round 4 the players they will find out if they have enough actions implemented to get the Olympics and the UEFA EC to a successful end. They can again choose here in this round to invest in achieving max benefits in this round or partly invest in the hotel take over in year 5.

- **Round 5**, in the last round the players will have the last chance to make the Hotel Chain ready for the takeover of another major Hotel Chain. If they cannot achieve 100% success they will have to prioritize what will give the highest success.

3.1 The Hotel California Chain story, the ideal situation.

This section will depict the ideal situation that Hotel California Chain should follow if they want to achieve a 100% in the game. 100%, however, is not achievable because of the many constraints. The ideal walkthrough of the game will depict all the actions that are needed to get a 100 points in the game. The game will give, next to the actions for the ideal situation, also some other actions in every round that do not satisfy the main event. These side actions will not give the players points but might yield extra sales or might cut cost of operations.

Table 1, 2, 3, 4, and 5 show the required actions for each round. This means that if players implement these actions they will get full points that will add up to 100, which is the highest score. However, events, issues and other interesting actions will form barriers to achieve that goal. Also not enough resources are available to pursue all the main events in each round which means that a perfect score of 100 is not achievable. Players and teams will have to do their best to get a highest score possible.

The game will begin with some rules that the players can use to play the game.

Rules

1. The team can earn points for implementing actions that satisfy main events. Actions that do not satisfy the main event will not earn points but still can have a positive effect on the sales or the costs of the organization.
2. If players receives possible options in a round on which they have to make a decision and they do not pick anything, it will have a negative influence on the company (He who does not advance goes backwards). Only when no actions are decided up on by a player, does not count if there are more actions and the player choses only one.
3. Actions that are involved in the main event disappear after the year that main event is placed in (example, if in round 1, the organizations wants to have Wi-Fi for a computer expo, this option will not be longer available in round 2. Because the expo event has already happened).
4. The budget is the amount of money available. This means that players cannot lend money or invest more than available. Budget is needed to pay for new projects and current IT costs.
5. Each round the team will receive a new budget. Money that is left over from the previous round will be kept.
6. The game works with 'budget tables'. Options can cost more that the budget one player has. In a budget table players can fill in the amount of money they will spend on this specific option. If all the required money is in place the option can be bought and the budget table and the money can be handed it at the CIO.
7. The game knows different resources:
 - Money (Money for IT investments and money for IT operations)

- FTE's (FTE's needed for change projects and innovations and FTE's needed to keep IT operational.)
 - IT capacity units
8. Decisions made by players to invest in something have influence on the resources (rule 8) but also on the sales, cost of operations of the Hotel, the IT risk and the customer satisfaction.
 9. High customer satisfaction will result in extra sales. (Customer satisfaction 6.5+ will result in more sales.)
 10. One round represents the first quarter of the year. This is where decisions are made for the upcoming year. The time between rounds represent q2, 3 and 4. This is where the impact of decisions will take place. Projects chosen in q1 will have impact on that year. This means that an event can be 'in year four we want...' it can still be implemented in q1 of year four. It is not needed to have implemented it before round 4 starts.
 11. The game has:
 - Main events: large events that require more than 1 option to be implemented. These main events yield points for the players.
 - Possible actions: innovations, solutions or changes that can be implemented by the team to satisfy the main events, business goals or upcoming issues.
 - Side events: events or issues that require attention.

Hotel California

Hotel California Group is the third most important European hotel chain in the business travel sector worldwide, the fifth largest in Europe and one of the top 25 hotel chains in the world. With over 370 hotels in prime locations and almost 60,000 rooms, Hotel California Group is a European leader present in 27 countries. The Group also has strong presence in America. The Company is present in the world's most important cities including Amsterdam, Barcelona, Berlin, Bogota, Brussels, Buenos Aires, Frankfurt, London, Madrid, Mexico D.F., Milan, New York, Paris, Rome and Vienna. Hotel California is a Hotel chain that develops, owns and manages over 370 hotels in areas where both business and leisure travellers are present. Hotel California Chain operates with a model where 53% of the hotels are leased, 24% is managed and 23% is owned.

Table 1, Income, costs and profit

INCOME STATEMENT EXCLUDING ELEMENTS THAT DO NOT REPRESENT CASH OUTFLOWS OR INFLOWS	
	12 M 2013
	€ Million
Income from the hotel business	1,266.0
Income from the property business	14.9
Non-recurring activity	45.1
TOTAL INCOME	1,326.0
Cost of property sales	(0.3)
Staff costs	(460.7)
Direct management costs	(421.8)
Other non-recurring costs	(22.2)
Leases and property tax (excl. Revers. of prov. for onerous contracts and other)	(288.9)
Financial expenses	(59.0)
TOTAL COSTS	(1,252.8)
TOTAL OPERATING CASH FLOW	73.2

Table 2, Hotel California portfolio breakdown

	TOTAL		LEASED		OWNED		MANAGED		FRANCHISE	
	Hotels	Rooms	Hotels	Rooms	Hotels	Rooms	Hotels	Rooms	Hotels	Rooms
TOTAL	379	58,195	211	30,966	82	13,352	77	13,156	9	721
EUROPE										
Spain	161	19,474	86	10,032	16	2,428	51	6,386	8	628
Germany	59	10,438	54	9,438	5	1,000	-	-	-	-
Italy	49	7,970	31	5,185	15	2,280	3	505	-	-
The Netherlands	35	6,509	16	2,441	17	3,520	2	548	-	-
Belgium	10	1,550	2	434	8	1,116	-	-	-	-
Austria	6	1,183	6	1,183	-	-	-	-	-	-
Switzerland	4	522	3	400	1	122	-	-	-	-
France	3	556	2	397	-	-	1	159	-	-
Czech Republic	2	579	-	-	-	-	2	579	-	-
United Kingdom	2	321	1	121	-	-	1	200	-	-
Portugal	2	165	2	165	-	-	-	-	-	-
Romania	2	161	1	83	-	-	1	78	-	-
Hungary	1	160	1	160	-	-	-	-	-	-
Luxembourg	1	148	1	148	-	-	-	-	-	-
Slovakia	1	117	-	-	-	-	1	117	-	-
Poland	1	93	-	-	-	-	-	-	1	93
Andorra	1	60	-	-	-	-	1	60	-	-
TOTAL EUROPE	340	50,006	206	30,187	62	10,466	63	8,632	9	721
AMERICA										
Argentina	13	2,049	-	-	11	1,524	2	525	-	-
Mexico	12	1,984	4	581	4	681	4	722	-	-
Dominican Republic	4	2,011	-	-	-	-	4	2,011	-	-
Venezuela	3	1,194	-	-	-	-	3	1,194	-	-
United States	1	242	-	-	1	242	-	-	-	-
Colombia	1	137	-	-	1	137	-	-	-	-
Uruguay	1	136	-	-	1	136	-	-	-	-
Chile	1	122	-	-	1	122	-	-	-	-
Haiti	1	72	-	-	-	-	1	72	-	-
TOTAL AMERICA	37	7,947	4	581	19	2,842	14	4,524	0	0
AFRICA										
South Africa	2	242	1	198	1	44	-	-	-	-
TOTAL AFRICA	2	242	1	198	1	44	0	0	-	-

Round 1. Introduction

Hotel California Group (HC group) is not the biggest hotel chain in the world, but it is a global player and they have grown a lot in the last 10 years. Their hotels are in the biggest cities in the world in Europe, North America, South America, Asia and Africa. Now it's time for a new team to take over the wheel at HC group.

In creating a better Hotel chain the CEO was looking for a new look that would identify all their hotels as one. Restyling their brand image needed some changes in IT as well, as some of the hotels operated alone. Because a lot of new hotels had been added in the recent years, many of them operated in a different way.

Main event: the main event this round is the fact that the CEO wants to make the HC group hotels operate more uniform. This means that the CEO wants the COO, CCO and CIO to steer more on working in the same way. The requirements that he has for this event to succeed is:

- Hotels should operate in the same way to boost efficiency. Some hotels are operating on a different systems

- Hotels should be accessed by Customers and guests in one singular way.

There were some actions available to achieve this but still they had to decide what they would do. With a 10 million for IT budget they satisfied these requirements by (see required actions in Table 1):

1. Implementing the same IT platform to the Hotels that were running on a different platform, they did this to ensure stability and to save compatibility issues in the future.
2. Also these new hotels required a new hotel procurement system that would fit within the system of HC group. The HC group decided to update the new hotels only instead of buying a complete new system for all hotels. Although that would save some money on the long term, the benefits were not high enough for this risky investment.
3. The installation of the new systems had to be guided by the IT department. This required some money and time
4. Building a new website for all the hotels done by a third party. This included the new image with logo. But the most important aspect was that all the hotels under the name HC could now be booked in the same website.

Actions and their alternatives can be seen in Table 19.

Table 19, round 1 actions

Main event	Required actions	Alternative 1	Alternative 2	Alternative 3
Create a uniform Hotel Brand by rolling out same IT systems and a new website All four actions will grand a total of 10 points	1.IT platform the same for all hotels	Change the new hotels to the same platform	Keep supporting both operating systems	
	2. Procurement system for all hotels to streamline procurement.	New procurement system for all hotels	Supply only new hotels with procurement system that is already in place at other hotels.	
	2.5 Roll out new systems.	System rollout done by IT department.		
	3. build a new Hotel website	Website build by IT department	Third party website design but maintained by IT self	

Next to the required actions there are side actions that impact sales, cost of operation and IT costs. Also IT capacity needs to be upgraded once or twice, and there will be side events (issues) that will disrupt the game and extra actions will be needed to fix the side events or issues.

Round 1.5. New strategic plan

The CEO of HC group wants to go further than a new image of his hotels. He wants to aim much higher in the upcoming 4 years. The new strategy should make this possible.

This new strategy will contains that the Hotel Chain wants to become one of the best Hotel chains in the world. This can be achieved by winning the World Luxury Hotel Award. The World Luxury Hotel

Award, also called the Oscar award of the hotel industry, is the most exclusive award that a Hotel can get for its excellent service towards guests. The awards are based on the votes of guests. The Board of Directors unanimously approved the four-year Strategic Plan. Developed in line with the Company's new vision, it guarantees a sustainable and profitable future. After studying and analysing the Company's key strategic areas, four value creation levers were defined, focused on building the four-year Strategic Plan to transform the business model. In this sense, the Group has defined and grouped together the initiatives that will allow it to improve profits and margins, increase expansion and provide access to the "facilitators" of Hotel California Group's transformation through new strategies in sustainability, human resources and systems. More specifically, these four value drivers can be divided as follows:

1. Improve revenues: through a new customer value proposition based on new brand architecture and experience, as well as new price positioning and increased investment in marketing. In addition, a repositioning plan has been designed with enough economic investment to proceed with portfolio segmentation and product renovation, thus increasing the value proposition and maximum ADR potential of the hotels. Furthermore, owned assets that are not in line with Hotel California Group's new strategy have been sold; and additional assets have also been sold in order to finance this repositioning plan.

2. Increase margins: by reducing intermediary costs and indirect channel costs, as well as increasing direct online sales (website and mobile applications). In addition, sales and pricing (price-value) strategy and a market performance management strategy were designed. Furthermore, we have optimised support (commercial, administration...) and purchasing functions and have continued with the leases adjustment plan, including leases renegotiation. Also cutting cost in old IT systems that can be replaced by more advanced systems.

3. Growth: through an ambitious expansion plan into key markets and reinforcement of presence in Europe and Latin American with different products to compete within each segment (upper-up-scale, up-scale, mid-scale), supported by contracts and conditions of each country.

4. Transformation enablers: through a new Sustainability and Human Resources strategy, and strong, innovative IT plans that will allow us to change business culture and make Hotel California Group a global company.

New customer value proposition

Hotel California Group has identified customers' needs and defined the experience for each one of its brands. The following principles of experience were derived from this analysis and set the Group apart from its competitors:

- **Feel at ease:** we want our customers to feel at ease with us, we want to be accessible and for this, we would like to offer them alternatives and styles that adapt to their way of life, working and interacting.
- **Feel the place:** we want our customers to connect with the city, to become familiar with everything that will make their stay more enjoyable.
- **Feel special:** we want our customers to feel special, to surprise them with generosity and spontaneity, with details that help them enjoy this custom-tailored attention.

• **“Brilliant Basics”**: we work to ensure guests have a memorable experience when they visit our hotels, improving our relationship with them and striving to make them feel special while exceeding their expectations.

The Hotel California Group has divided all the initiatives in its plan into four key priority areas for the upcoming years: carrying out a clear segmentation of its hotels under a new brand umbrella; designing a new value proposition that enhances guest experience; driving brand recognition through communications; and optimizing management and organisation capabilities, particularly with regard to the Group’s technology systems.

Next to the strategic plan, the CEO explains that in year 4 (round 4) there will be two events that can boost our sales substantially. With the Olympic Games in New York and the UEFA European Championship in Germany and France many of our hotels can benefit from these events. They will get more reservations and make these events into a success if:

- They find a way to improve the service of their guests outside of the hotels. During the games there is a lot to do in the cities around our hotels. Showing our guests what is happening will increase their satisfaction and their stay that much more enjoyable.
- A lot of the guest will come driving their own cars. Always in cities, but especially during these events, our guests will have trouble parking their cars. In order to still allow people to come with their car in the city, and not book a hotel outside the city centres, we will need to find a solution.
- Before this event starts we will need a CRM system that can capture all the valuable information from guests. Also this creates the possibility to keep in touch with guests. Because we believe that many new guest will visit us during the games we can capture this moment to harvest a lot of valuable data.
- We want our guest to experience the Olympics all over the world and the UEFA EC in Europe. Therefore we want to install TV screens in all our hotels in order for our guests to follow the games. Also for guests that are with us because they have tickets to see the games can follow the sport events for which they don’t have tickets.

But that is not all, The CEO has an ambitious plan. He wants to take over the famous Hilton Hotels in year 5 (round 5). This is for now too farfetched because the two organizations operate differently. Mostly it is because HC group lacks some essential parts that would make the takeover more successful. So to make the takeover succeed, HC group has to catch up and invest in their own hotels backend. Reimaging and placing all the hotels under one umbrella that was done in year 1 was the first step into the future. What is needed to achieve a successful takeover:

- A loyalty program that allows guests to become member. The Hilton Hotels already have a loyalty program. For a successful takeover we want to be able to transfer all their data to our systems.
- A flexible and capable IT department that can handle changes rapidly.
- outsource some standard IT activities in order to be more scalable and save costs.
- A new Property Management System for all our hotels that is ready for the future. A new PMS system will make the fit with Hilton better and painless.

- We want to move our data to the cloud as much as possible to save IT costs on servers and hardware. This will also make our IT more flexible and scalable.

For both the events in year four and the takeover in year five counts that there is too much work to be done to start implementing it in the year that it will take place. Therefore some planning will be needed.

At the end of round 1.5 the CXO's had to decide how they wanted to divide the budget that they were given for IT related investments. The new budget of 20 million for each year (80 in total) was meant for innovations and change, but also for IT operate. And therefore they had to decide what part of the budget would go were as a guide for their spending.

Round 2. Overload

The CCO, COO and the CIO knew what was on the horizon and that it was ambitious. They had to start implementing some of the requirements for year 4 and 5 already now. But they had to decide which ones they could implement now considering time and budget. What solutions would have the most value so we should implement it early?

Main event: next to what needed to happen for year 4 and 5, there was another opportunity that should be acted up on. The business consultant found out that they could be the first hotel organization that could offer guests to book a room, together with the flight that would perfectly match their arrival and departure date. This allowed guest to book at the HC website to get a room and flight without booking at an intermediary. Also this could mean that the Hotel could get some money for all the flights that were booked through their website.

To make the room and flight booking process a success they had to satisfy the following requirements:

- Find a way to share the information of rooms and flight with airline companies.
- Build the application where customers can book a perfectly matched flight.

So what did the they do to achieve both the main event of this year and start working on the upcoming events:

1. they shared their booking and room information with 1 airline. They gave them their information in return which forms the basis for the solution
2. this data had to be stored and captured somewhere and therefore they had to acquire a new server.
3. The IT department had to build the application for their website that made it possible to book both room and flight.
4. also they initiated this year was the purchase of a new customized PMS integrated with all systems for all the hotels. This costly requirement can also save a lot of costs and therefore it was smart to implement it early on.
5. The new PMS system required from the IT department that they had to build the integrations with other systems.

All the required actions for the main event in round two can be found in Table 20 and for round 5 in Table 23.

Table 20, round 2 actions

Main event	Required actions	Alternative 1	Alternative 2	Alternative 3
Opportunity to book a room plus perfect fitted flight. All four actions will grand a total of 15 points	8. Share Hotel information with airlines	With 1 airline as a test. Requires a server	3 airlines. Requires a server to store data	
	8.5 Buy server for booking flight +room	Buy server on-site	Buy cloud server	
	9. Build application for website and app to book room + flight	Build the solution for one company (option 8)	Build the solution for more companies (option 8)	

Round 3. Governance

A new main event happened in round 3 that required some additional actions to be implemented.

Main event: Airbnb is starting to grow rapidly and we have to act quickly to keep our sales and not to lose too much market share. This can be done by:

- An hotel App that makes it easier to find hotels, easier to book rooms.
- increase the customer satisfaction in our hotels by adding more features that make our hotel more attractive for our customers.

What they choose to implement this round was.

1. A hotel App integrated with their booking systems which allowed customers to book rooms but also check in with their mobile phones.
2. Let IT build the integration
3. Install entertainment systems in all the hotel rooms to give more service and value for guests.
4. Enable free Wi-Fi in all the hotels for all guests. With this they could give their customers the service they wanted which Airbnb's not always could.
5. also they planned already to enable the trip advisor on their hotel app and website that was required for later in year 4

Table 21 depicts the required actions needed to not lose too much money to Airbnb.

Table 21, round 3 actions

Main event	Required actions	Alternative 1	Alternative 2	Alternative 3
Airbnb is on the rise. How can we fight this? Total points:20 Total turnover for 20 points: -20 mil All four actions will grand a total of 20 points	12.Hotel app	App with hotel check in integrated with booking system	Standalone app with info of hotels and locations	
	12.1.App integration	Build app integration		
	14Entertainment systems in hotel rooms	All rooms get entertainment systems	Luxury rooms get entertainment systems	
	15. Enable free WiFi every were in the hotels	Free WiFi		
	15.5 Buy WiFi routers	Buy strong routers	Buy medium quality routers	

Round 4. Improve communications and plan ahead

Main event: there will be two events that can boost our sales substantially. With the Olympic Games in New York and the UEFA European Championship in Germany and France many of our hotels can benefit from these events.

They already knew what was needed and so they:

1. They teamed up with a large parking garage company and enabled the hotel guests to book a parking space for a fixed price.
2. A new CRM system integrated with their PMS.
3. They hired big tv screens for all the hotels and IT was in charge of getting the tv rights.
4. Already for round 5 they moved some of their services to the cloud to save money.

Side event: Due to the need for new laptops, IT operations had to buy new laptops for all employees at the office. Need laptops were needed

5. so they also bought new laptops which ensured them to continue to work efficiently.

Table 22 depicts the actions required to achieve max points for this main event.

Table 22, round 4 actions

Main event	Required actions	Alternative 1	Alternative 2	Alternative 3
Olympic games in North America + UEFA European championship in Europe.	19. TripAdvisor on app and website	Integrate TripAdvisor with app and website to add extra customer service		
	20. parking garage link so guest can book a parking spot	Only show and mention parking garages so guest	Build an solution on app and web that allows customers to book	

All four actions will grand a total of 25 points		have to book themselves	a parking spot at a nearby parking garage	
	21. CRM system to keep in touch with clients	An off the shelf CRM solution ready to use. This means that you have to support two platforms	Customized CRM that can run on your platform which is also integrated with our Property management system (PMS)	
	22. Big tv screens for all the hotels to watch the Olympics and EC	Hire TV that need to be installed.		
	22.5 buy broadcasting rights	Buy the rights to show the olympics	Don't buy the rights and take the risk of being shut down.	

Round 5. Exploit governance.

This is the last year before the takeover. In this year all that not has been realized should become real to achieve the maximum number of points.

What they did:

1. Purchase a third party loyalty program that runs with their CRM.
2. Handed out scrum training to IT personnel in order to make them future ready and more flexible.
3. To ensure that their data was save in the cloud they decided to create an extra data storage back up.
4. Outsource their telecommunication to save money.

Side event: rumours are, that the CRM system purchased in year 4 does not work correctly. However the systems works correctly but people don't seem to know how to work with the system correctly and therefore the implementation is not completely successful. Therefore they decided to:

5. Hire an IT change consultant to play a game with employees that work with the new CRM system to learn them to cope with the change. This prevented the

Table 23, round 5 actions

Main event	Required actions	Alternative 1	Alternative 2	Alternative 3
Big take over or another luxury hotel. We can take over this hotel if our IT is in order.	24. loyalty program	IT builds and hosts loyalty program on own servers	Third party software but IT builds the integration with booking system and CRM	

All four actions will grand a total of 30 points	25. train IT personnel to perform better in projects	Let IT people follow a week scrum course	Invite someone for a scrum lecture.	
	26. outsource some functions	Web and mobile development, app hosting and app maintenance	All data warehouse services	
	27. New PMS system that will make takeover much easier.	PMS of the shelf, customized to company needs	PMS integrated with existing systems. This will result in better brand alignment.	
	27.1 PMS integration build	PMS integration build		
	28 Back up servers	On site	In cloud	
	32. distinction between rooms to attract new customers.	Rebuild app	Rebuild website	
	Move data to cloud	No option, this depends on choises made in other actions (to cloud yes or no)		

This chapter showed the walkthrough of the game in a perfect state and if all required actions could be delivered by the IT department. However during the game this will not be the case. The ideal walkthrough helps us as designers to focus on a strategy.

3.2 Game dynamics

- There are main events that they have to implement as good as possible. Is some actions are missing for the main event will result in rewarding the team with less points for that event than max achievable.
- Main events in year 4 and 5 are know from the start and the required actions should partly be implemented ahead because there are too much actions required to implement them all in 1 round.
- What option is implemented ahead also matters, of course with the available resources but also with the benefits. Some solutions have more or better benefits for the hotel and its belter to implement them sooner than others. Also some don't have real benefit to be implemented earlier in the game.
- Players CCO, COO and CIO will have additional targets that requires them to focus on player specific goals.
- the actions that are required for the main event of that round will disappear when that round is over, side actions will stay available.

- because players have events that they know are coming in the later years and events that are happening right now they will have to ask themselves if they want to focus on the long term goal or the short-term earnings.

4. Characters and goals

CCO

Personal background: The CCO is new to the hotel scene but has a lot of experience with sales and marketing. His/her priority is to get more guests to the hotels of the California group. In order to achieve more sales for the organization things will have to change in order to anticipate to the client's needs. He is in charge of all the marketing and sales related aspects of the organization and will therefore focus on attaining and retaining guests.

Targets:

- Increase sales by 10% (at least sales up to €1.348.600.000 or higher which corresponds with a total of 10% points) if this is achieved this player will receive a prize
- Achieve a customer satisfaction of 6.5 (currently 5/10) this will result in a profit bonus of €30 million

COO

Personal background: The new COO at Hotel California Group is in charge of the operations of the hotel and is an experienced worker in the hotel scene on the operations side. This means that he is in charge of the daily operations like personnel, interiors and procurement. This also means that he has the most costs in the organization and can therefore have a huge influence on the costs of operations. He, however, does not have much affiliation with IT but he realizes that hotels need to innovate. He is always looking at new ways of cutting costs of operation and he realizes that IT can help him with that.

Targets:

- Cut cost by 7%. (at least cost of operations €1.078.504.600 or lower higher which corresponds with a total of 7% points) if this is achieved this player will receive a prize
- Achieve a customer satisfaction of 6.0 (currently 5/10) this will result in a profit bonus of €30 million

CIO

Personal background: With a long history in IT, the CIO knows how IT departments work. The company that they work for is their client and most of the time they don't seem to understand what IT is and how it should and can be used. The business often claims that their IT is too expensive. This is why the CIO likes to take matters in his own hands in order and organizes the IT systems and the department what is the easiest way to maintain it. Keeping a sharp eye on the costs of IT but also tries to explain to the CEO and CFO that with rising demand for IT support the costs of IT also will rise. Although it is a tough position, the CIO from Hotel California Group really enjoys his job, focussing on what the company asks from him and on the other side keeping his own IT team satisfied and rolling.

Personnel description:

IT Operations Manager: if extra actions are required to execute a project they can be initiated through the IT Operations Manager.

IT Delivery Manager: Has the overview of all the things that need to happen for each year.

Targets:

- Achieve 10% cost reduction of the total investment budget (at least €3.000.000 at the end of the game) if this is achieved this player will receive a prize

IT Delivery Manager

Personal background: For the organization to move forward, new IT projects are always present. In order to structure them and make the planning on money, time and resources, the IT delivery manager takes his job very seriously. He is the all-seeing eye as it comes to the future planning and what can and cannot be done within a specific timeframe. All new projects and innovations that have to do something with IT will end on his desk where he has the last check whether or not the project that be implemented. The IT delivery manager has to put the IT department's FTEs to work on the new projects. If there are not enough FTEs available for the wanted projects that were requested by the organization he has the ability to hire extra manpower. The IT delivery manager can request info on how many FTEs there are needed for all kinds of projects.

Targets:

- Keep IT cost low

IT Operations Manager

Personal background: The IT operations manager manages the day to day IT services that are hosted by the IT department. He is in charge of keeping IT running and keeps track of the network capacity that is currently available at the organization. The capacity units that are needed to keep current services running. At this time Hotel California has a network capacity of 200 units of which they actively use 130. But new projects, services and innovations require capacity units and therefor the maximum capacity could be easily reached. This should be closely monitored and acted upon by the IT operations manager if necessary. Besides that the IT operations manager needs to have some of the available IT department's employees (FTEs) to keep daily IT services running. The IT operations manager can request info on how much a project will cost IT yearly once implemented and how many capacity units there are needed for all kinds of projects.

Targets:

- Keep IT cost low
- Keep track of the IT network capacity in order to prevent IT failures.

Round 1. Introduction

Hotel California Group (HC group) is not the biggest hotel chain in the world, but it is a global player and they have grown a lot in the last 10 years. Their hotels are in the biggest cities in the world in Europe, North America, South America, Asia and Africa. Now it's time for a new team to take over the wheel at HC group.

In creating a better Hotel chain the CEO was looking for a new look that would identify all their hotels as one. Restyling their brand image needed some changes in IT as well, as some of the hotels operated

alone. Because a lot of new hotels had been added in the recent years, many of them operated in a different way.

Main event: the main event this round is the fact that the CEO wants to make the HC group hotels operate more uniform. This means that the CEO wants the COO, CCO and CIO to steer more on working in the same way. The requirements that he has for this event to succeed is:

- Hotels should operate in the same way to boost efficiency. Some hotels are operating on a different systems
- Hotels should be accessed by Customers and guests in one singular way.