UNIVERSITY OF SKÖVDE

LICENTIATE DISSERTATION

# GAMES IN FORMAL EDUCATIONAL SETTINGS

## Obstacles for the development and use of learning games

BJÖRN BERG MARKLUND

*Informatics*

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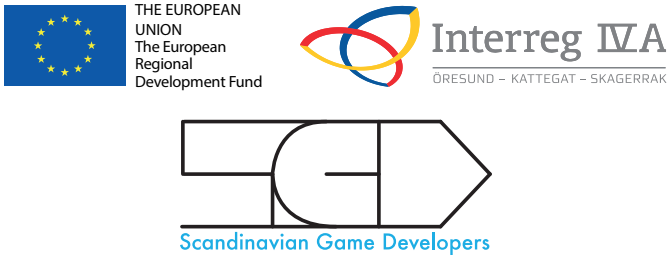


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# ABSTRACT

From the perspective of educators, games are viewed as a medium in which the younger generation both thrive and excel. Students navigate game environments with ease and regularly solve problems, engage in advanced collaborative efforts, and communicate complex concepts and strategies to one another during their private gaming sessions at home. Games invite the player to form an understanding of intricate systems and mechanics based on participation and experimentation rather than mere observation, and on these merits games are often prophesized as a medium that will significantly change the face of education as we know it. However, while teacher interest in using games is increasing, wide-spread and successful examples of games being implemented in formal educational contexts (e.g. schools and university courses) remain rare.

This thesis aims to examine why this is the case and identifies some of the more prevalent obstacles educators and developers both face when embarking on learning game projects as users and creators. In order to examine the situation from both of these perspectives, the research takes a mixed-method approach that entails extensive literature studies coupled with several studies with both educators and developers. Interviews were conducted in order to investigate attitudes and experiences, and more direct researcher participation and case studies were used to examine the processes of implementing and developing learning games as they were carried out. The studied cases and literature have revealed obstacles that indicate that "traditional" entertainment game development is incommensurable with learning game development, and that the use of games in formal educational settings introduces heavy demands on the recipient organization's infrastructure, culture, and working processes.

The conclusions of this research is that learning games embody a unique mixture of utility and game experience, and the formal context which they are to be used in significantly influence the process of developing and using them. Learning games can't be understood if they're solely seen as a teaching utility or solely as a game experience and to make them viable both educators and developers need to change their internal processes, their own perceptions of games and teaching, as well as the way they collaborate and communicate with each other. There are also several obstacles that are outside individual institutions and developers' control, for example the practicalities of the economic constraints that both developers and educators work under that put the sustainability of pursuing learning games for formal education as a business into question. However, the continuous incremental improvements on the infrastructure of educational institutions (e.g. availability of technology and teachers' familiarity with technology) can likely alleviate many of the obstacles currently inhibiting the impact learning games can potentially have in formal education.

II

# SAMMANFATTNING

Från många utbildares perspektiv ses spel som ett medium där den yngre generationen ges utrymme att växa, stimuleras och utmanas på deras egna villkor. På sin fritid navigerar elever vant i olika spelvärldar och löser avancerade problem, samarbetar med sina medspelare och kommunicerar komplexa strategier och idéer. I ett spel bjuds eleverna in till att bilda sig en förståelse för olika system genom medverkan och utforskning istället för iakttagande. Dessa kvalitéer hos spel har lett till att de ofta framställs som framtidens läromedel och att de kommer revolutionera sättet vi ser på lärande. Men trots att entusiasmen för att använda spel i undervisning har ökat, så finns det fortfarande relativt få lyckade exempel på inkludering av spel som läromedel i formella utbildningsmiljöer.

I denna avhandling undersöks utveckling och användning av lärospel, samt dess egenskaper som verktyg för lärande. För att kunna undersöka situationen från båda dessa perspektiv har forskningen inkluderat långtgående litteraturstudier samt fallstudier med både utvecklare och utbildare. Intervjuer har genomförts för att undersöka attityder och erfarenheter. Studier med mer direkt medverkan har genomförts för att undersöka processen att utveckla och använda lärospel. Resultaten från fallstudierna och litteraturstudierna har uppdagat vissa hinder och utmaningar som indikerar att lärospelsutveckling inte kan anses vara synonymt med utveckling av underhållningsspel samt att användandet av spel i formella utbildningskontexter ställer stora krav på en skolas infrastruktur, kultur, och arbetsprocesser.

Slutsaterna av denna forskning är att lärospel är en speciell blandning av verktyg och upplevelse samt att egenskaperna av de formella kontexter där de ska sättas i bruk har en påtaglig påverkan på hur de bör utvecklas och användas. Lärospel kan inte förstås om de enbart ses som läromedel eller som spel, för att göra dem användbara måste både utbildare och utvecklare förändra sina egna arbetsprocesser, sina föreställningar kring spel och utbildning, samt sättet de samverkar och kommuncerar med varandra på. Det finns även flera hinder som befinner sig bortom enskilda utvecklare och utbildares kontroll, exempelvis skolors tillgängliga resurser och de nationella kursplaner de arbetar efter. Men begränsningarna krymper även successivt då skolors tekniska infrastruktur byggs upp och lärares vana vid att använda teknik och spel ökar samtidigt som verktygen för spelutveckling blir effektivare. Dessa typer av framsteg kan ha stor inverkan på möjligheterna för mer utbredd användning av lärospel i formell utbildning.

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My close friends, my mom and dad, and my family for keeping me attached to reality during this whole, very peculiar, process.

And finally, a special shout-out to Victor, who has been more important during this than he will ever know.

# PUBLICATIONS

During this project, several papers and reports have been produced and published with varying relevance to the core aims of this thesis.

## PUBLICATIONS WITH HIGH RELEVANCE

1. Berg Marklund, B., Backlund, P., & Johannesson, M. (2013). *Children's Collaboration in Emergent Game Environments*. Proceedings of the 8th International Conference on the Foundations of Digital Games, Chania, Greece, p. 306-313.
2. Berg Marklund, B. Backlund, P., Engström, H., Dahlin, C-J., & Wilhelmsson, U. (2013), A Game-Based Approach to Support Social Presence in Project-Based Distance Learning. *International Journal of Game-Based Learning*. Accepted for publication.
3. Berg Marklund, B. (2013). *On the development of Learning Games*. Presented at the Foundations of Digital Games doctoral consortium, Chania, Greece, p. 474-476.

## PUBLICATIONS WITH LOWER RELEVANCE

1. Berg Marklund, B. (2012). *Game Development, Education & Incubation: A report from the Scandinavian Game Developers project*. Report published within the Scandinavian Game Developers project.
2. Berg Marklund, B. (2011). *Spelutbildarindex 2011*. Report published within the Knowledge Foundation funded project Expertkompetens för Innovation.

# CONTENTS

1. INTRODUCTION ..... 1
1.1 Research aims and objectives ..... 3
1.2 Thesis overview and structure ..... 4
1.3 Research contributions ..... 5

2. RESEARCH APPROACH ..... 7
2.1 Delimitation ..... 8
2.2 Research process ..... 8
2.2.1 Literature study approach ..... 10
2.2.2 Case study approach ..... 11

3. OVERVIEW OF LITERATURE STUDIES ..... 13
3.1 A brief history of entertainment games and edutainment ..... 13
3.1.1 The 60s and 70s – the advent of commercial digital games ..... 14
3.1.2 the 80s – edutainment and a renewed industry ..... 14
3.1.3 The 90s – games as their own creative craft ..... 15
3.1.4 Summary ..... 16
3.2 Entertainment Games and game studies ..... 16
3.2.1 The many definitions of games ..... 17
3.2.2 Perspectives on Game design and player experience ..... 21
3.2.3 Sociality, communities, and identity in and around games ..... 25
3.2.4 Violence and gender issues in games ..... 27
3.2.5 The craft of creating entertainment games ..... 29
3.2.6 Summary ..... 32
3.3 Serious Games and Learning Games ..... 33
3.3.1 Learning games as a field of research ..... 36
3.3.2 The educational potential and shortcomings of learning games ..... 39
3.3.3 Assessments and learning outcomes in games ..... 43
3.3.4 The design of learning games ..... 44
3.3.5 The development and use of learning games ..... 49
3.3.6 A brief discussion of gamification ..... 50
3.3.7 Summary ..... 51
3.4 Adjecent fields of research ..... 52
3.4.1 Instructional systems design ..... 53
3.4.2 Information systems and the sociotechnical perspective ..... 55
3.4.3 Technology Acceptance ..... 57
3.4.4 Summary ..... 59

4. CASE STUDIES ON LEARNING GAME DEVELOPMENT AND USE ..... 61
4.1 Case study methodology ..... 61
4.2 Interview protocols and documentation ..... 65
4.3 Case study outcomes ..... 68
4.3.1 Educators ..... 68
4.3.2 Developers ..... 73
4.4 Summary ..... 77

5. ANALYSIS AND CONCLUSIONS ..... 81
5.1 Creating a unified picture of learning games ..... 81
5.2 Learning games – a merger of utility and game experience ..... 82
5.3 Formal Education and Learning Games ..... 84
5.3.1 The classroom as an audience ..... 84
5.3.2 The school infrastructure ..... 86
5.3.3 Communication between developers and educators ..... 87
5.3.4 Technology acceptance and taking risks in formal education ..... 88
5.3.5 Return on investment ..... 89
5.4 Summary ..... 92

6. CLOSING REMARKS ..... 95
6.1 Future work ..... 97

7. REFERENCES ..... 103

# CHAPTER 1
# INTRODUCTION

> The presence of technology in learning environments is increasingly common: an e-mail address on a course syllabus; electronic mail as a supplement to office hours; class sessions held in computer labs; desktop computer in faculty offices; ... and course assignments that send students to World Wide Web (WWW) sites in search of information resources. (Green, 1996, p. 24)

The quote above is from Kenneth C. Green's paper *The Coming Ubiquity of Information Technology*. At the time this thesis is written Green's statement is only 17 years old, but it seems strangely antiquated given the way information technology currently saturates culture and society. In less than 17 years, "electronic mail" has gone from novelty to commonplace to the extent that the "electronic" prefix is used about as often as one feels the need to spell out the WWW-initialism in its entirety. With this rapid progress new ways of using technology for educational purposes are gaining traction, and among the many emerging trends games are stepping into the limelight. Games are often lauded for their unique capacity to model the structures of complex systems, distil them down to their essence and present them to the player for him or her to experience and manipulate first-hand (Gee, 2003; Prensky, 2001). They invite the player to form an understanding of intricate subject matters based on participation and experimentation rather than mere observation, and thus they are argued to have great potential as learning environments (Squire, 2011).

In a game, the player is invited to take on the mantle of a medieval ruler, a business tycoon, a soldier in the midst of a conflict or any other actor that can be imagined (although there's a bit of a skew towards the white male, preferably with amnesia, that possess some unique quality that will save the world). If it's a well-crafted game, the player typically spends hours upon hours engrossed in it, with the sole purpose of mastering whatever challenges it contains. The game itself is designed to become progressively more challenging to keep the player interested, and introduces new concepts, items or manoeuvres that the player eagerly experiments with in order to be able to confidently wield them and to continue traversing the game. If the game is set in medieval times of war, the player might get control over different types of armies throughout the game, and will experiment with what type of units and tactics suit certain strategic situations; when is the longbow superior to the crossbow; when is it time to let lose the cavaliers; when is it time to huddle up behind a wall of shields and lances? If it's a multiplayer game, the players can interact with each other, discussing tactics and experiment with tactics that utilize each other's capabilities and resources. These types of situations, where the player is fully engaged and immersed in

the game world, are what educators aspire to achieve with their educational processes. There's an intense sense of intrinsic motivation to learn and master new concepts, a way to construct an understanding of complex events and processes through experimentation, as well as discussions and collaborative problem solving with others that help the player vocalize and reflect on what they know. And on these merits the value that games can potentially bring to an educational setting is immense (Lieberman, 2006; Squire, 2011), and there's an increasing interest for including more game-based learning in school curricula based on the argument that students are starved for an educational format that makes use of their affinity for new technologies (Gee & Hayes, 2012; Linehan, Kirman, Lawson, & Chan, 2011; Prensky, 2001; Srinivasan, Butler-Purry, & Pedersen, 2008).

However, whenever one attempts to lift a game with content that can be used for educational purposes into a formal educational setting, problems start piling up rather quickly (Egenfeldt-Nielsen, 2008). Not only are there inherent conceptual issues with the assumption that increased skill or knowledge regarding the contents of a game has any bearing on the world outside of the game even when the game content is closely tied to a specific subject matter (Linderoth, 2009; Rick & Weber, 2009; Shaffer, 2012). There's also the simple, often glossed over, fact that many components need to be in place for even the most rudimentary play session to be made possible in a school environment, and to even get to the point where the conceptual issues of learning games and their effects become pressing (Egenfeldt-Nielsen, 2008). Hardware availability, the teacher's grasp of the game, the students' gaming abilities, and the strict schedule limiting the length of the play sessions are but a few of the practical considerations you face when attempting to insert games in formal educational contexts (Egenfeldt-Nielsen, 2008; Macklin & Sharp, 2012; Squire, 2005; Westera, Nadolski, Hummel, & Wopereis, 2008).

It is important to realize that in the study of *learning games*, as with other neighbouring genres in the wider field of *serious games*, the produced artefact plays one part within a larger process, and understanding the context of use is in many cases as important as understanding the artefact itself (Alklind Taylor & Backlund, 2011; Nilsson, 2008).

In this thesis, *learning games* refer specifically to digital games used for educational purposes, for example teaching math, reading, history, geography, etc. As defined by Sawyer and Smith (2008), learning games "[use] gameplay to enhance motivation to learn, engage education, or to enhance effectiveness of content transfer or other specific learning outcome."

*Serious games* refer to any digital games with a purpose beyond providing engagement (e.g. health benefits, social change, military training, advertising, etc.). Thus, learning games are a specific genre within the broader area of serious games.

A game being *digital* refers to the game being played on a computer, video game console, or mobile device.

Learning games go through a great deal of challenging phases before they even reach the educational environment and the target recipient of the learning content, and once inside the environment the use of the developed game is no less difficult. So, while there has been plenty of interest and effort put into the learning games in recent years, introducing games into formal educational settings remains a rather elusive proposition due to the challenges that arise when these two worlds merge together.

Schools seem to be rushing towards the realm of information technology and digital games, and they are often seen as panaceas to many of the issues the educational system faces (Ausserhofer, 1999; Habgood & Ainsworth, 2011). Ipads are purchased, laptops are

distributed to students, and learning game development projects are embarked upon without much deliberation to whether or how these items can be properly utilized to assist students' learning and teachers' working situation (Klopfer, Osterweil, & Salen, 2009). Likewise, research within learning games and serious games has primarily been focused on isolating and describing the game artefacts and their virtues, and less effort is directed towards understanding how games fit into the contexts they are intended for (de Freitas & Oliver, 2006; Squire, 2003). The research presented in this thesis delves into these issues, and explain what their implications are for the design, development, and use of learning games in formal educational settings.

In this thesis, a *formal* educational context refers to structured teaching where students work on a specific structured learning activity, in a teaching environment such as a classroom or computer lab.

## 1.1 RESEARCH AIMS AND OBJECTIVES

In this thesis, I argue that the challenges involved in making and using learning games can't be sufficiently understood and navigated if we don't understand how they affect and are affected by the context they are put into. If we are to develop and use games in education, we need to make concessions in the way we look at game development as well as education and learning and explore the tension that arises when these two practices collide and how it can be relieved. To this end, learning games will be examined from three different perspectives that I argue are needed to encapsulate their nature – the games perspective, the information system perspective, and the pedagogical perspective. These different areas each provide a different lens that can help us get a better look at all aspects of learning games – the expressiveness of the medium itself, if and how it can fit and provide utility in educational institutions, and the challenges and benefits of using it for educational purposes. By merging research and practical expertise from these different fields, a new foundation that includes a wider array of parameters a learning game needs to adhere to can start to take shape and will in the end be beneficial for developers that want to understand the ins and outs of what it takes to create useful and impactful learning games. The primary contribution of the research is an expanded perspective of what challenges learning game developers face as compared to entertainment game developers - a perspective that focuses heavily on the quality of utility learning games need to work towards rather than their quality as games that manage to balance gameplay and learning content well. In short, the central research aim of this thesis is to:

**Propose a new model for understanding learning games that includes the challenges of fulfilling utilitarian needs as well as providing an engaging game experience.**

This aim has been pursued with a four-part process where I've initially focused on solidifying the foundation of my problem statement through literature research in the field of learning games. The literary research was then expanded to encompass the neighbouring fields I've identified as beneficial to our understanding of learning games. In addition to that, I've also studied cases where learning games are put to use and developed in an attempt to examine the validity or fallacies of my early arguments through representative cases. Finally, the results of the two literature approaches, as well as the more practical research cases, have been used to produce the model stated in the research aims. In summary, the four research objectives (O) in this thesis are:

**O1**: A literature study aimed at identifying common and current issues with the design, development, and use of learning games. The literature survey provides a foundation of

theories and methods previously established within the field, as well as a description of the current problems learning games face.

> *Design* refers to the process of deciding on a game's themes, gameplay challenges, and mechanics, whereas *development* refers to the process of actually creating the game software.
>
> The *use* of learning games refers to their implementation and usage in educational processes and environments.

**O2**: Conduct a literature survey to identify theories and practices in the design and development of entertainment games and information systems that can be useful when establishing solutions to the problems found from O1. This objective thus mainly aims to collect valuable and relevant conclusions and results from learning games' neighbouring fields, and when appropriate they will be elaborated upon in order to accommodate for the peculiarities of learning game development.

> *Entertainment game* is used throughout this thesis to describe all digital games developed and marketed as primarily autotelic activities (i.e. games that are appealing because of the engagement they provide the player).

**O3**: Use issues, theories and models identified in the literature studies as guidelines when studying cases of developers as well as educators that work with learning games. By studying both developers' and educators' perspectives on learning games the outcomes of this research will have a broader impact on our current understanding of learning games.

**O4**: Draw from the literature studies and case studies to establish a model to describe learning games and specify prevalent factors influencing their development and use. The purpose of the proposed model is to not only capture the challenges learning game developers face when balancing engaging gameplay with learning content – an issue that has been described thoroughly in previous research – but to point at the challenges one is faced with when attempting to create learning games that are usable in an educational context.

## 1.2 THESIS OVERVIEW AND STRUCTURE

This thesis provides an overview of the research and practice within fields that I argue offer models and theories essential for understanding how to create learning games for formal educational settings. To this aim, the background chapter of the thesis serves the purpose of capturing the traits from each field that are necessary to both discuss the reasoning behind my methodology as well as the final conclusions drawn from an analysis of the literature studies and case studies conducted during this research. The overview of the literature studies provide an overview and explanation of learning games as a field of research and practice and its position within the bigger field of serious games – but it also provides similar, although briefer, overviews of neighbouring fields that contribute to my final analysis of learning games development as a craft not primarily beholden to either game development or educational practice. The methodology chapter explains how the case studies involving developers and educators were conducted, and how that particular methodology was predicated by the theoretical foundation of the thesis. The analysis and conclusion chapter tie together the theoretical foundation and the results from examined cases from previous chapters into a unified general model for learning games, and

concludes the thesis with an identification of particular areas of the model that developers and users of learning games need to have an increased awareness of in order to produce better learning games together. The thesis structure is visualized in *Figure 1.1*.

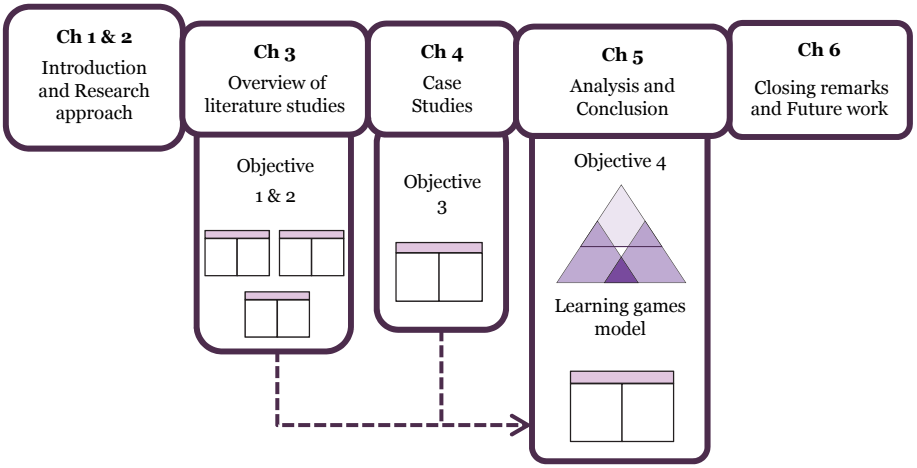


**Figure 1.1:** Thesis structure, the thesis chapters are coupled with the research objectives they cover.

The thesis is structured to first introduce the research approach and the concepts and theories important for understanding the motivations for using learning games and how they are developed. A brief overview of the case study methodologies and gathered empirics will go through the statements made by the subjects in the studies, and their implications for learning games' place in formal education are subsequently described in the analysis and conclusion chapter.

In service of readability, and to clarify the connection between the literature studies and case studies to the analysis and conclusion presented in the end of the thesis, the sub-sections to chapter 3 and chapter 4 will conclude with a short summary that describes their relevance to the stated research aim. The summaries condense the contents of the different sections and chapters into tables, where the conclusions relevant to the aims of the thesis are described along with their sources.

## 1.3 RESEARCH CONTRIBUTIONS

The thesis introduces new perspectives to the discussion of learning games, and in order to do this the different disciplines that contain these perspectives are described. For instance, the development and research of entertainment games is described at length in the overview of literature studies chapter since they heavily influence learning games, and understanding the former gives crucial insights into the latter. The connections between learning games and the other examined fields of research might be less obvious, but the connections are there. For example, information systems research has served an important role in building a vernacular for describing the utility and implementation of learning games in organizations and provides a utilitarian perspective that is seldom discussed in game studies. By introducing other disciplines the final contribution of this research, the learning game model, has a more nuanced grounding that touches upon more aspects of learning games than their quality and properties as game artefacts.

The motivation for steering the research in this direction rose from observations gathered both from studies of previous research in the area of serious games and my own interactions with educators that were in the early stages of appropriating games for educational use. When discussing learning games with educators, the intended audience for a significant portion of learning games, the ambitions and concerns they would frequently discuss were seldom mirrored in learning games literature. The primary discrepancy between researchers and practitioners was what "phase" of a learning game's lifespan they tended to discuss. Research often discuss learning games similarly to how entertainment games are discussed – for example focusing on design choices (Harteveld, Guimarães, Mayer, & Bidarra, 2010), certain mechanics' effects on player experience (Squire, Barnett, Grant, & Higginbotham, 2004), how games instil immersion and engagement (Habgood & Ainsworth, 2011; Malone, 1980b), and so forth. The educators I discussed learning games with, however, had a more practical approach and focus on the processes that can make a learning game useful in a formal educational setting. For example, their discussions would gravitate towards questions of how the teacher would construct lesson plans using the learning game, how much the game and necessary devises would cost, how the game adhered to curriculum criteria, and how student performances could be evaluated. This is not to say that research is being conducted on an irrelevant plane – understanding the nature of the artefact is of great importance – but a merger between the reflections on the practicalities of the educational environment and the ones on the characteristics of games reveal challenges and opportunities that can be overlooked if only one perspective is considered.

In essence, the main knowledge contribution of this thesis stem from the investigation of this merger and its implications for learning games as game experiences and educational tools, and consists of:

- *A retrospective and state-of-the-art description of entertainment games, serious games, and learning games*. By summarizing influential practices, paradigms, and debates within these fields the scientific context that dictate our understanding of learning games as an interdisciplinary discipline is described in detail. This contribution focuses on getting the reader conversant in the peculiarities of the craft, research, and cultural importance of games and learning games.
- *A categorization of previous research in learning games and serious games studies*. Through a summary of literature in the field, previous research foci and commonly used methodologies are described, which provides a subsequent identification of current knowledge gaps.
- *A categorization of different approaches to learning game design*. By compiling conclusions in the studied literature, four different approaches to learning game design has been identified and divided into four "camps". Descriptions of each camp's foundations and their characteristics are provided.
- *A model describing the necessity of a widened perspective of learning games as utilities as well as experiences*. The utilitarian aspects of learning games are often overlooked in research in favour of examining game experience and potential learning effects. The case studies with educators and developers reveal that high utility is crucial for an educational tool to have an impact in formal education, thus the proposed model provides a more inclusive lens through which learning games can be examined.
- *A description and analysis of the prominent real-world conditions affecting learning game design, development, and use*. The literature studies and the conducted case studies revealed several important conditions in both educators' and developers' working environments and processes that dictate the success and viability of learning game endeavours. The final analysis and summary of this thesis provides a listing of the more prominent challenges that often hinder the success of learning games.

# CHAPTER 2
# RESEARCH APPROACH

The approach taken during this research is based on an argument that the process of managing successful learning game projects, either as a developer or user, relies on a combination of elements that are not sufficiently described just in learning game literature. In this thesis, I make the argument that user acceptance, requirements analysis, organizational conditions, stakeholder roles, game design, instructional design, and many more parameters significantly influence the success of learning games. In order to make sense of learning games, I thus gradually introduced elements from these areas during my research. In the initial stages of this project, I was aware of the strong links between learning game research and game studies and educational psychology and was aiming to use these fields as my primary point of reference to describe the design of "good" learning games. But, as I started discussing learning games with educators, developers, students, and other researchers it gradually became harder to explain the peculiarities of learning games with those delimitations. This led me to focus more on development processes and the use of learning games, and to expand the scope of my literary studies to include information systems, instructional systems design and development, and technology acceptance. If I were to condense this process into one convoluted sentence, my approach went from trying to solve design problems by linking educational outcomes to specific game designs to instead focus on understanding the challenges involved in the development and use of learning games. After this transition, the thesis started focusing more on accurately summarizing and describing the nuances of these more practical problems rather than attempting to provide a solution by describing design processes.

In pursuit of this goal, I have used a flexible, mixed-method approach of studying learning games as objects in development, as objects to be utilized, and as theoretical concepts. To study each of these aspects, I've turned to what I consider being their central actors: developers and educators. Developers have been studied to examine the development processes of learning games, and teachers were studied to examine the process of implementing and using games in educational environments. Studying actors from both areas also made it possible to examine different opinions regarding the viability of learning games as teaching tools and development and business ventures. The studies including these actors have differed when it comes to research methodology, but they have all been conducted with the same topic in mind: what does it take to make a learning game work and have an impact? In this chapter, the research approach will be discussed in more detail, as will the delimitations of the research question to clarify some potential ambiguities in my terminology.

## 2.1 DELIMITATION

There's a fair amount of confusion when it comes to the term serious games so it's important to clarify what I mean when I use it, and what aspect of serious games it is that I'm actually discussing and researching. "Serious games" is for all intents and purposes an umbrella term spanning a wide range of games with a purpose beyond just providing an engaging experience. Games developed by a car company to market one of their new vehicles, physical exercise equipment specifically designed to work together with gameplay challenges, or games that aim to portray the situation for citizens of third-world countries are all examples of serious games. This makes using the term somewhat unruly as it covers such a wide range of products and this has led to new sub-categories emerging in the field; for instance, the three aforementioned examples can be categorized as an *advergame*, a *game for health*, and a *game for change* respectively. So, while serious games as a term does describe what the basic overarching discipline that the research presented here lie within, the term is too broad to be useful when discussing the presented ideas and conclusions in this thesis. In fact, claiming that the new definitions and models I'll be proposing is applicable to the entirety of the field of serious games would be down-right misleading. So in order to limit the scope of my research and to clarify who the final beneficiaries may be, the term learning games will be used instead of serious games. The reason for this is mainly that serious games is such an all-encompassing term that catering to every facet included under its umbrella is impossible without blunting the usefulness of the results and conclusions by using terminology that's bland enough to be applicable to anything from rehabilitation games and military simulations, to marketing- and political games. Serious games may still be useful as a term when distinguishing the field of research from neighbouring disciplines on an initial level. But in order to keep the discussion more focused, and hopefully less ambiguous, I'll be referring to my own research as aimed at learning games specifically. This means that my research is to be considered peripheral, if not totally inapplicable, to a large set of members of the serious games family and instead solely focused on games with defined learning purposes. Or if we are to use the definition from Sawyer and Smith's serious games taxonomy, games that "[use] gameplay to enhance motivation to learn, engage education, or to enhance effectiveness of content transfer or other specific learning outcome." (Sawyer & Smith, 2008)

## 2.2 RESEARCH PROCESS

In order to get a realistic view of the contemporary situation for developers within the field interviews were held with learning game developers regarding their working processes and craft alongside participatory studies where active learning game development projects were observed. But, as this research also aims to understand how learning games are actually used and how they serve as a utility, a big part of the research on their perspectives consisted of working together with and interviewing school teachers and principals to gather their perspective on the process.

To describe how the methodology has evolved, we can turn to a couple of specific examples of serious games research: Harteveld et al. (2010), Nilsson and Jakobsson (2011), and Egenfeldt-Nielsen (2008). By looking at these examples we can make a more in-depth examination of a few of the most commonly used methodologies in the research of learning games and serious game design: questionnaires, interviews, participation and workshops, and observations. In many cases, for instance when evaluating how a learning game affects social aspects, user engagement, and teaching processes, a combination of these methods are usually used to triangulate a certain phenomenon (Alklind Taylor & Backlund, 2011; Egenfeldt-Nielsen, 2008; Garzotto, 2007; Harteveld et al., 2010). Interviews and questionnaires are frequently employed in an effort to catch thought-processes

surrounding learning game activities or as a means of debriefing and contextualizing data collected during play-session experiments. For instance, interviews can capture the opinions of clients (e.g. teachers, students, or legislators) regarding what they think of learning games and the qualities they expect to see from them (Tan, Neill, & Johnston-Wilder, 2012), whether they felt a learning game executed on their expectations (Egenfeldt-Nielsen, 2008), or how a group of players or teachers perceived their performance in a play-session (Alklind Taylor & Backlund, 2011; Nilsson & Jakobsson, 2011). In the specific examples of Nilsson and Jakobsson, and Egenfeldt-Nielsen, interviews are used as a supplement to observation and quantitative assessments of learning outcomes from using learning games. Egenfeldt-Nielsen (2006) performed a study where a game was implemented into a classroom context to teach a specific subject, and observed how the teachers' and students' experienced this process. From his observations, he could identify how the game fell short or were cumbersome to use in the educational context, and contextualized these observations with student and teacher interviews. This is a common and sensible approach, seeing as interviews don't provide particularly reliable datasets as a stand-alone research method, but they can be helpful in providing context for data gather with the more direct approach of observation (Robson, 2002). The observation-interview coupling is a sensible one because each method ameliorates shortcomings of the other. As described by Robson (2002), observations are "…commonly used in an exploratory phase, typically in an unstructured form, to seek to find out what is going on in a situation as a precursor to subsequent testing out of the insights obtained."

The Nilsson and Jakobsson (2011) study utilized observations much in the same way, observing the use of games in educational situations to gather data regarding player behaviours and game performance. Interviews are then subsequently employed to make sense of the data gathered from observations and to minimalize the impact of researcher bias when it comes to interpreting them and clearing up certain ambiguousness regarding why the game was used in a certain way, if players found the game engaging, or how the collaborations inside the game worked for them. Harteveld et al. (2010) took a somewhat different approach, and worked together with their subjects to a greater extent. In their study, they developed a serious game together with subject matter experts and users and through iterative play-testing and workshops where they discussed design decisions with these research subjects they were able to discern the dilemmas that arise during a typical serious games development project.

During this thesis work, I've approached the problem area with a similar mixed-method approach – oscillating between being a passive observer, actively participating, and interviewing. The process was kept very flexible, and the data produced was primarily qualitative. It's also important to point out that the methodology has evolved significantly during the project, and wasn't always a mixture of observation, participation, and interviews. In the initial steps of the research, some scattered interviews and discussions on learning games were held both with developers and educators. Later as specific factors and patterns of interest started emerging, the methodology was honed to study those in more detail. A constant component of the research has been studying literature relevant to the subject, and as previously mentioned the scope of what literature I judged as relevant expanded rapidly in the early stages of the thesis work. The research process is visualized in *Figure 2.1*, and was inspired by the process used by Alklind Taylor in studies on the use of serious games in military training scenarios. Alklind Taylor employed an evolutionary methodology to accommodate for unanticipated empirical findings and new theoretical realizations during the research process (Alklind Taylor, 2011; Alklind Taylor & Backlund, 2011). Her research has taken an *abductive* approach (Alklind Taylor, 2011), a flexible and primarily qualitative process of carrying out case studies described by Dubois and Gadde (2002). The approach "makes use of a combination of empirical fieldwork, case analysis

and established theoretical models, where the researcher is constantly going back and forth between empirical observations and theory" (Alklind Taylor, 2011, p. 8).

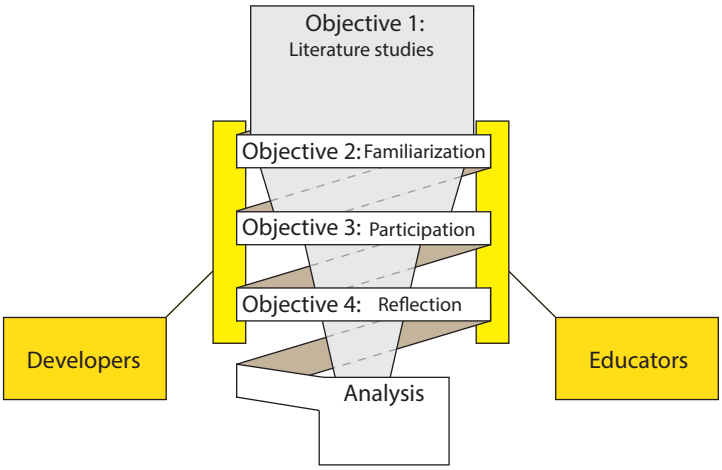


**Figure 2.1:** *The process taken to combine case studies with developers and educators with literature studies of previous research. As the research progressed, literature studies became more focused as a result of more involved case studies.*

The approach, described by Dubois and Gadde (2002) as *systematic combining*, has been useful on multiple occasions during the honing of my research process. In particular, their considerations of research with case studies as evolutionary processes that are iteratively refined and restructured rather than static and linear captures the essence of my research method. Their reasoning behind calling the method abductive rather than inductive, which it closely resembles, is the emphasis on continuous interplay between theory and empirical observation. Compared to an inductive process such as grounded theory where the researcher approaches an area without set preconditions (as far as that is possible) and generating a problem statement or theory out of it, systematic combination stresses the development and refinement of theory rather than theory generation.

### 2.2.1 LITERATURE STUDY APPROACH

The literature studies have been a perennially present component of the research process. Upon entering the research project, I had already done a considerable amount of studying in the areas of entertainment games, serious games, and on the Swedish games industry from my bachelor's, master's, and other research projects respectively. Having these earlier experiences meant that I did not start the project out cold, and primarily that I had some game design and development experiences that gave some directions to my early literary studies. I cannot claim that the literature studies were particularly systematic and as previously stated the entire research project has been prone to directional changes as a result of outcomes of the conducted case studies. But that didn't mean that the literature studies lacked strategy and structure. The literature studies were executed in two distinct phases – an initial exploratory phase to have a solid foundation to base initial case studies on, and a continuous adaptive phase where the literature was used in a more reactionary fashion to "make sense" of case study results.

Initial exploratory literature studies were primarily focused on understanding learning games, and specifically how they differed from what I was previously familiar with from my entertainment games and more general serious games studies. Here, literature that dealt with subject matters relevant to the research aims of this thesis were used as a starting

point, and through their reference lists, and by searching for literature using specific terms and problems articulated by the authors, the list of literature grew. The categories the literature studies contributed towards strengthening, and some examples of references used as the foundation for these categories are:

- Effects and challenges of using games to educate from a practical as well as cognitive and psychological perspectives: (Blumberg & Ismailer, 2009; Linderoth, 2012b; O'Neil, Wainess, & Baker, 2005; Squire, 2007; Tan et al., 2012)
- Design and development: (Egenfeldt-Nielsen, 2011; Harteveld et al., 2010)
- Literature reviews that described the state-of-the-art, as well as meta-analysis of learning games as a science: (Egenfeldt-Nielsen, 2006; Kirriemuir & McFarlane, 2004; McClarty et al., 2012)
- Introductory literature to the fields of information systems, technology acceptance, and instructional design: (Alter, 2008a; Avison & Fitzgerald, 2006; King & He, 2006; Petter, Delone, & McLean, 2012)

Results from the conducted case studies also directed my further literature studies towards information systems and sociotechnical research. As mentioned earlier, it became increasingly difficult to describe current practices of learning game development only through research from entertainment game and learning game studies. While the realization that information systems, instructional systems, and technology acceptance was useful for my research increased the breadth of my theoretical foundation, it significantly honed the direction of subsequent studies, and introduced new elements to investigate during further case studies.

### 2.2.2 CASE STUDY APPROACH

As the purpose of my research is to understand the practicalities of using and creating learning games, primarily relying on case studies was a natural choice. Case studies have a rich history in information system research in particular (Runeson & Höst, 2009), and is suitable for studying processes or phenomena in their natural contexts:

> A case study examines a phenomenon in its natural setting, employing multiple methods of data collections to gather information from one or a few entities (people, groups, or organizations). The boundaries of the phenomenon are not clearly evident at the outset of the research and no experimental control or manipulation is used. (Benbasat, Goldstein, & Mead, 1987, p. 370)

In other words, case studies are exploratory by design, use mixed-method to examine a phenomenon in its real setting from the perspective of one or more entities. The case studies in this research have both been numerous and varied and has included a total of eight developers, as well as two schools and several individual educators. No single case has stood as a constant fixture in the research process, and much effort has been spent on finding enough cases to be able to build an inclusive view of learning game development and use. Much like the literature studies, the case studies have gone from exploratory to becoming more focused in their design. As mentioned earlier, my research oscillated between case studies and literature studies in accordance with the process of systematic combination (as shown in *Figure 2.1*). The design of the early cases studies was thus influenced by an initial, somewhat vague, problem statement gleaned from the first months of literature studies, but also served the purpose of guiding further literature studies, and to hone the problem statement of my research as a whole. Initial studies primarily consisted of interviews with educators and developers and were unstructured by design, with an eye towards probing for opinions on learning games at a conceptual level from these two different perspectives. The early unstructured interviews followed directions described by Robson (2002), where the interview is carried out with the general research interests as a framework, but without a rigid interview structure. Rather than following an

interview protocol these interviews followed what Lofland and Lofland (1995) refers to as guides, which is a list of subjects to bring up during the interview conversation – but not to be introduced sequentially or read verbatim. As the research progressed the research questions became more specific following results from the case and literature studies which made more structure progressively more necessary in later interviews, and the methodology also expanded to include participatory studies and observations. Briefly summarized, the research process has been far from static and predetermined, and has instead been kept flexible within the boundaries of the general research question and objectives. The strength of the flexible approach is that it has allowed pursuits of emerging patterns revealed through case studies and literature studies, and it has also been an absolute necessity given the situation educators and developers work under.

## SELECTION

A driving factor for the structure of the case studies and the selection of cases has been predicated by the practical limitations of what cases were available for study. The research project did not start out with a predetermined set of cases to study. Instead it started out with several sources of potential cases, project partners, and actors I've previously worked with in other projects. The reason for the lack of more stable predetermined cases is that neither developers nor educators can work with learning game projects on a whim. Educators are bound to strict schedules that detail their school years, and they need to adhere to requirements in the curriculum. With these constraints, they can't be expected to introduce new learning game solutions into the classroom under experimental circumstances at any given point in time. Developers are under scheduling constraints as well, since many of them rely on funding from development projects either from the government or from private clients. These factors made some the studies of the actual development and use of learning games difficult, and limited the amount of cases I could study as well as the duration of individual case studies. For cases where development and use of learning games were studied directly, selection relied on finding opportunities where a developer or school was launching a learning game effort of some kind. The part of the thesis work that relies more on opinions and attitudes towards learning games, however, remained relatively unfazed by these limiting factors since interviews with educators and developers on the subject did not adhere to those kinds of limitations.

Another factor influencing the selection of cases is the context this research was carried out in. The research presented in this thesis is conducted as a part of the *Scandinavian Game Developers* project, which is an EU Interreg IVa funded initiative to support game developers in Sweden, Denmark, and Norway. Part of this support is to provide guidelines for how to develop and use learning game development projects, and my research contributes to this aim. The project has provided me with additional channels through which I've been able to find developer and educator cases to study.

# CHAPTER 3
# OVERVIEW OF LITERATURE STUDIES

A substantial part of this research consists of identifying theories and models that can provide a solid foundation for an expanded understanding of learning games' properties. It's important to note that the domain of learning games is deeply interdisciplinary as it is an amalgamation of research found in the fields of entertainment games, pedagogy and education, and sociotechnical systems which all in turn are interdisciplinary in and of themselves. For instance, the field of game studies combines Human-Computer Interaction, cognitive psychology, software development, sociology, and many more to create theories and models that can describe what games are, the way they work and the way players experience and make meaning of gaming activities. This makes it difficult to specify the research scope when one endeavours to conduct a somewhat broad analysis of learning games, and to identify the challenges that make them difficult to develop and put to use in educational contexts. Primarily, it can prove difficult to point to where potential solutions to identified problems lie, a particular issue can be partly described through the lens of information systems as well as by looking at it from a game designer's perspective – or a combination of both. With these difficulties in mind, this chapter constitutes one of the knowledge contributions of this thesis: an overview of the history of learning games and the aspects of the broader games medium necessary for understanding them. Also, in the interest of supporting a new model that views learning games from several other perspectives, it also covers aspects of information systems, instructional system design, technology acceptance, and technology enhanced learning.

## 3.1 A BRIEF HISTORY OF ENTERTAINMENT GAMES AND EDUTAINMENT

When talking about the heritage of games and the broad area of serious games, it's important to acknowledge that games have been used to caricature reality or abstract concepts for "serious" purposes for almost as long as they have existed as a facet of human culture. A popular and recognizable example of this, although far from the oldest, is *Chess*. The instructional history of Chess is believed to reach back to its inaugural roots in India during the 7th century (Kende & Seres, 2006; Shenk, 2007). Chess, while its purpose in society has changed many times throughout its lifespan, is believed to have begun as a way to practice strategic decision-making in the military and evolve logical thinking (Shenk, 2007). By representing challenges faced by strategists, Chess aimed to distil very real concepts of warfare and make them presentable in a manageable framework to provide players with a platform to experiment and train in a typical serious game-esque manner. So

while the basic principle of using games for "serious" purposes isn't new, the manifestation of the principle through digital games is in comparison quite novel (Djaouti, Alvarez, Jessel, & Rampnoux, 2011). This retrospective will give a brief introduction of the history of digital games, both ones made for education and entertainment.

### 3.1.1 THE 60S AND 70S – THE ADVENT OF COMMERCIAL DIGITAL GAMES

The advent of digital simulation brought the potential of games, both serious and not, to a new level. Suddenly, the ability to not only provide abstract representations of subject matters and real-world occurrences on boards and cards, but to simulate them with a high level of verisimilitude, seemed to be just around the corner. Digital games started out as a small off-shoot of software engineering and were often made to test and display the capabilities of the technology of the time. *Tennis for Two* (Higinbotham, 1958) and *Spacewar* (Russel, 1961) are often attributed as the games that heralded the medium as we know it today, but it would take a decade before games were able to transcend the halls of engineering institutions and make their way to the public (Kent, 2001). The Magnavox Odyssey, the first commercially available game system for home use, was released in 1972 and marked the start of games as a potential retail market venture. In the same year, Atari engineer Al Alcorn created *Pong* (1972), at the time a coin-operated arcade machine. It's interesting to note that the advent of educational digital games didn't linger behind entertainment games, as *The Oregon Trail* (Rawitsch, Heinemann, & Dillenberger, 1971), one of the most iconic games regardless of educational/entertainment labelling, saw its first release in 1971 when it was developed and put to use in a small school district in Minnesota (Kickmeier-Rust, Mattheiss, Steiner, & Albert, 2011). Thus, the 70s marked saw the inauguration of the entertainment game home console- and arcade market, as well as digital learning games as a concept. From the moment that the Magnavox took its first teetering steps onto the marketplace, interest in games as a craft and commercial enterprise evolved and grew very rapidly, and games quickly went from being a fringe novelty product to a significant global industry mainly consisting of arcade halls, computer games and home consoles.

### 3.1.2 THE 80S – EDUTAINMENT AND A RENEWED INDUSTRY

In the beginning of the 80s, one of the first publications devoted to the potential and craft of digital games for education and training surfaced: Malone's dissertation *What makes things fun to learn? A study of intrinsically motivating computer games* (1980a). In his work at the time, Malone delved into how video games had potential to be a valuable tool in traditional teaching environments (Malone, 1980a, 1980b, 1981). Academic discourse regarding digital games had been scarce before this point with only a handful of books and scientific publications (Washburn, 2003), so this was an important step in establishing digital game-based learning as a field of research. The early 80s was also of etymological importance as the moniker edutainment was first associated with games in -84 as the game *Seven Cities of Gold* (1984) was released by Electronics Arts with the buzzword prominently featured in its PR campaign (Cheung, Li, & Zapart, 2006). This decade also marks an important coming of age for video games as a medium. After the market for home video games crashed during the period of 82-85, and the subsequent Nintendo Entertainment System-lead renaissance (Kent, 2001; Squire, 2007), games started taking on whole new types of expressions. Developers became increasingly inspired by works of film, literature, new animation techniques and advancements in cognitive sciences and moved away from the pure high-score focused games that dominated the market before the crash. With home consoles being the primary market for games, the need for behaviouristic arcade-designs which were largely built out of necessity due to their coin-dependent

income lessened and made room for games that told stories and contained challenges not solely focused on finding ways of killing the player (i.e. extracting more coins out of them). As these influences from other media made their way into games, games themselves started moving away from being a pure computer science/software development based field. A couple of significant examples of this change are *The Legend of Zelda* (1986) by Nintendo for the Nintendo Entertainment System, and *Prince of Persia* (1989) created by Jordan Mechner for the Apple II computer. The former was a significant step forward for the medium due to its grand open-world design and letting the player experience an epic story of a hero's journey (Kent, 2001), and the latter due to its adventure film-inspired storytelling and its vivid animations and graphics depicting human movement with high fidelity (Fox, 2006; Mechner, 2011).

### 3.1.3 THE 90S – GAMES AS THEIR OWN CREATIVE CRAFT

The emancipation of entertainment games continued and accelerated in the 90s as the craft of game development continued to distinguish itself from its computer science roots. The field started being a uniquely interdisciplinary craft rather than mainly being subservient to software development and computer science. As the possibilities of what could be expressed with game technology kept expanding and influences from cognitive sciences (e.g. Human-Computer Interaction, experience, and embodied cognition) and the arts (narrative, dramaturgy, visual language, and color composition) played an increasingly large role in the creation of games. With this convergence of disciplines, the number of academic publications in the area of game development and game studies also increased and 1994 in particular is an important peak in research interest as 70 scholarly works in the field of game studies were published, a significant increase from the 34 publications in 1984 (Washburn, 2003). To compare the two decades, according to Washburn (2003) the amount of papers on games published in the 80s were roughly 43 papers per year with an increase towards the end of the decade, the 90s had a 62 papers per year average.

More importantly for the field of serious games perhaps, is that this decade marks the decline of serious games' predecessor edutainment. While the market for edutainment had been growing steadily up until the mid-90s, the market situation started changing to later collapse entirely at the turn of the millennia (Ito, 2009; Shuler, 2012). There are several descriptions of the decline of edutainment (Ito, 2009; Klopfer et al. 2009; Shuler, 2012) that attribute it to a combination of factors:

- Decreased computer time in labs due to the internet making computers potent research tools and decreasing the time they were available for gameplay (Shuler, 2012)
- Edutainment games offered many promises, but rarely amounted to more than drill-and-practice games made only to blunt the monotony of repetitive exercises (Ito, 2009; Klopfer et al. 2009; Egenfeldt-Nielsen 2011)
- Edutainment suffered greatly from downward pricing-pressure and consolidation of available shelf-space in stores caused by a shift to mass-market retailing for CD-rom based software (Ito, 2009; Klopfer et al. 2009; Shuler, 2012)
- Edutainment games fell way behind their entertainment game counterparts in terms of quality (Ito, 2009; Klopfer et al., 2009)

After a few turbulent years in the late 90s, the market for edutainment receded and the term has since fallen into disuse (Ito, 2009). Since then, game companies have been wary about officially associating their titles with educational concepts, even though the game may very well have valuable informative and educational content (Shuler, 2012). Ito (2009) provides a good summarization of the life of game-based edutainment being an example of:

> [A] new technology that was accompanied by a set of heightened expectations, followed by a precipitous fall from grace after failing to deliver on an unrealistic billing. (Ito, 2009, p. 10)

Entering the new millennium, entertainment games were growing rapidly as an industry, and games with "serious" purposes were dwindling in popularity (Djaouti et al., 2011; Kirriemuir & McFarlane, 2004). Since then, a lot has happened within both areas and with this brief retrospective as a frame of reference the rest of the background chapter will describe how current practices and research within both entertainment games and serious games have changed since the early 00's.

### 3.1.4 SUMMARY

Table 3.1 provides a brief summarization of this chapter. The reference column contains codes used later in the Analysis and Conclusion chapter to refer back to relevant conclusions.

**Table 3.1:** Summarization of chapter conclusions with examples of sources providing the information.

| Chapter conclusions | Source(s) | Reference |
|---|---|---|
| Edutainment, the predecessor of today's serious games and learning games, declined in popularity due to lacking quality as compared to their entertainment game counterparts, an over reliance on repetitive drill-and-practice designs, and due to practical concerns caused by changing conditions in the educational environment. | Shuler (2012)<br>Ito (2009)<br>Klopfer et al. (2009)<br>Egenfeldt-Nielsen (2011) | 3.1.A |
| The shape of games has been continuously changing throughout the past decades, both as a result of technological progress or new influences. The attitudes towards learning games and their designs are highly influenced by the state of entertainment games – understanding the latter is important to understanding the former. | Malone (1980, 1980b)<br>Washburn (2003)<br>Ito (2009)<br>Klopfer et al. (2009)<br>Kirriemuir and McFarlane (2004)<br>Djaouti et al. (2011) | 3.1.B |

## 3.2 ENTERTAINMENT GAMES AND GAME STUDIES

Presenting a more detailed overview of current research and development practices in the area of entertainment games before delving into the description of serious games in this thesis wasn't an arbitrary choice. The evolution of entertainment games predicate the way we create and understand digital games as a medium and serious games are often seen as a sub-category or addendum to concepts that have already been extensively used in entertainment games. With that in mind, providing an overview of entertainment games can thus provide some context to help the later description and discussion of serious games flow more smoothly.

So what, then, has become of games as a medium and industry since the turn of the millennia? As may have been apparent in the retrospective, digital games have not only been on a trajectory of increased monetary significance, they have also been expanding into many different corners of culture and society (Alpert, 2007; Bogost, 2011a; Buckley & Anderson, 2006). From being a fringe activity mainly contained in arcade halls and living rooms in the 70s (Kent, 2001), games started to crop up in educational institutions and military facilities, and they've been giving rise to e-sport events that attract tens of thousands of spectators and conventions that host thousands of developers and enthusiasts (Jonsson, 2012; Ratan & Ritterfeld, 2009). As time progressed, the places you encountered digital games grew more varied, but one could argue that it was still an activity and community that you needed to exert significant effort in order to become a part of rather than just a casual observer. That situation has changed severely during the last decade.

Technological devices (e.g. smartphones and tablets) that can support games, and where games are also made easily accessible, are nowadays quite ubiquitous. Whereas you'd previously have had to make a conscientious choice to seek out games – either seeking out certain locations where you could play, purchasing devices that had gaming capabilities (high-end PCs, or game consoles), and going to retailers to purchase the games themselves - they are now far closer to peoples' everyday habits. This has opened up digital games as a pass-time to a far wider audience than what one would even consider feasible before, and it has also birthed the division of "casual" gaming audiences and "hard-core" gaming audiences. The former refers to the kind of gamers that primarily take part in games through the ubiquitous methods mentioned (for instance people who play games on their phone or on Facebook in a spare moment), whereas the latter refers to the type of gamer that still are willing to invest both effort and money in order to engage with the medium in a more deliberate manner (e.g. still buying high-end PCs or gaming consoles, spending time getting proficient in certain game titles, keeping up on gaming culture, etc.).

This diversification of demographics for games is reflected in industry practice, games research, and gaming culture as well. As previously described, the 90s was an important decade for entertainment games as they started coming into their own as an art form, academic interest increased, and the revenue followed suit. Reports on the actual size of the games industry, both when it comes to turnover, income and workforce varies somewhat between references. Certain forecasters in the mid 00's claimed that the industry doubled its sales on a four-year basis (Alpert, 2007). 2004 marks an important year for the games industry as that was the year video game sales surpassed the movie industry's box-office receipt sales, and it was also the year individual game titles would outperform the biggest grossing films in sales. Specifically, *Halo 2* (2004) for the Xbox outperformed *Shrek 2* with 125$m to 108$m in sales (Alpert, 2007). The video games industry have also enjoyed continued growth during the past decade, for instance the Entertainment Software Association (2010) reported that game sales increased from 7,0$bn to 10,5$bn between 2005-2009 in the US, and the Association of Swedish Game Developers (2012) reported that the Swedish games industry had a turnover growth from 71,3m SEK to 257m SEK between 2006-2011.

With the previously mentioned ubiquity of game-ready systems and the rise of social games and party games, marketing campaigns aimed at parents and grandparents and what one wouldn't consider being the core demographic for entertainment games has become relatively commonplace. In a presentation given in 2011, Ian Bogost described the assimilation of entertainment games into the broader society and culture during the 00s quite well by dubbing the process as the "domestication of video games" (Bogost, 2011). This description captures the process in an interesting way as it can both be considered quite inflammatory and reassuring – just as the process itself is to some individuals. It is inflammatory for some hard-core gamers, the vanguard that passionately defend the purity of games as an art form and part of their identity, and it's reassuring in the sense that the assimilation has had a certain demystifying and "de-vilifying" effect on games and has given them a platform to grow in directions previously unreachable (Bogost, 2011a, 2011b).

### 3.2.1 THE MANY DEFINITIONS OF GAMES

Delving into the specifics of what is usually classified as a game is a somewhat complex process, as the definition of games have been constantly modified and tweaked by many scholars throughout the years. In particular, as the limit of what games could and would do was pushed during the 90s and 00s when a myriad of attempts to come up with new definitions for what one was allowed to call a "game" cropped up (Table 3.2 provides some examples). New definitions would either focus on trying to expand the term in order to be more inclusive to games that had completely new types of mechanics and means of

expression, whereas some other were more focused on keeping the "game" definition intact and coming up with completely new terms to describe innovations within the field (e.g. interactive media, or electronic toys). Spending some time getting acquainted with these different definitions will play an important role in the continuation of this thesis, as the concept of serious games is one of the terms that can prove particularly confusing and sometimes contrary to how games are traditionally defined. To contextualize this debate a description of the works that defined games to begin is important both to show where game studies originated and why the early definitions became problematic as games as a conceptual construct grew larger and more complex.

As mentioned earlier, games have been a part of human culture for a long time, but they've also played a large role in shaping culture and society as well. Björk (2013) provides a historical overview of how games played a significant role in the works of the great mathematicians and computer scientists that provided the world with the foundations for modern computer and programming architecture. Björk (2013) traces the use of proto-scientific pursuits using distinct game vernacular back to the early 17th century and the works of Pascal and Leibniz. Pascal laid the foundations both for our understanding of probability while examining and revising the rules of hazzard games, and also of game theory through the theological argument Pascal's wager, and Leibniz compared the core game mechanics of Chess and *Ludo Latrunculorum* (a game played in ancient Rome and Greece that shares many similarities with Chess) in order to prove that the two games had separate origins and that neither was modelled upon the other. The tradition of using games and theoretical game concepts as devices to make scientific progress was carried onward through the 19th and 20th century in the works of Babbage, Lovelace, Turing, and many other computer scientists of great importance (Björk, 2013).

But the studies of games' properties and importance as cultural artefacts in and of themselves started a bit more recently, and are often attributed specifically to the work of Dutch historian Johan Huizinga and the ideas he presented in his book *Homo Ludens* (Huizinga, 1938). In Homo Ludens, Huizinga (1938) looked at instances of structured gaming activity in the games we encounter in everyday life, and made conclusions both regarding the function games perform in society and culture as well as the properties of games and what constitutes a game as opposed to work or other activities we don't associate with games and play and even separates it from gambling. When it came to their purpose, Huizinga (1938) states that games aren't an outcome of culture or of mankind's need for playful expressions and outlets, but rather a precursor to culture itself. Huizinga (1938) also established five characteristics in order to define what a game, or rather the playing of a game, is:

1. Play is a voluntary/free activity.
2. Play is not 'ordinary' or beholden to 'real' life.
3. Play is distinctly separate from the 'ordinary' both in terms of locality and duration.
4. Play is an activity that demands and instils absolute order.
5. Play is disconnected from material interest and no profit can be gained from it.

Huizinga's work was later expanded upon by French sociologist and philosopher Roger Caillois, who provided an extensive categorization of the types of games people indulge in. Caillois (1958) made a distinction between games played as competition, games of chance, role-playing and re-enactment games, and games that manipulate and alter human cognition and perception. The categories primarily serve as a useful tool for discussing the prevalence and purpose of different types of games in different cultures, and Caillois (1958) made the observation that the games popularized in a culture revealed volumes about what core values that culture held (e.g. games that challenge strategic thinking was valued in some cultures, and games that tested reflexes and motor skills was valued higher in others). But to return to the point of what it is that defines a game, Caillois (1958) also established a

series of core criteria that spanned all these game categories to define what separates games and play from other activities:

1. Playing is not obligatory, if it were, it would at once lose its attractive and joyous quality as diversion.
2. Confined within limits of space and time.
3. The outcome is uncertain, the course cannot be determined beforehand.
4. Unproductive, it does not create goods, wealth or new elements of any kind.
5. Governed by self-imposed rules and legislations.
6. Make-believe and accompanied by an awareness of being separated from reality.

There are many commonalities between Huizinga's and Caillois's criteria; both games and play to be separate from ordinary life; they are activities that create a distinct universe with its own rules and constraints; they are ephemeral constructs that don't have bearing on the real world once the game activity is over; and they are voluntary activities. Although their discourse predated digital games and innovations in technology has changed the appearance of games dramatically since their works, the criteria established by Huizinga and Callois have remained a constant in games studies. It's also important to note that the definitions they provided are made by dissecting what the act of playing a game is like, and what transformations take place when an individual enters a play scenario. But as the act of playing a game is wholly dependent of the characteristics of a game and the unique universe a game creates through its rules and space, the definitions of play are commonly used as synonymous with the definitions of a game.

As time progressed and the study of games started finding its voice, there eventually came a need to distinguish games from playfulness – in essence separating the structured world of games from the more haphazard and ephemeral nature of playful activities, such as children's or animal's play, where the goal and structure is seldom apparent either to participants or observers. This distinction isn't merely a question of semantics as the function of play and games are significantly different from one another both in how they affect their participants psychologically, but also in how they fit into culture and society. Shortly put, making a clear distinction between these two terms was important in order for the studies of both to progress by clearing up some ambiguities of what it is one actually studied when talking about games or play (Nieborg & Hermes, 2008). So in order to make the distinction, game scholars usually add an extra line about the definition of a game as having some sort of quantifiable outcome that resonates with and feels significant to the participants of the activity. In effect, scholars aimed to add a specific purpose to the activity that all involved participants strive towards achieving, sometimes in direct competition with each other and sometimes during cooperation. More current definitions of games give some indication of how games have been incrementally redefined through the years by scholars and developers in the field:

**Table 3.2:** Definitions of the concept "game", some authors specify that they define digital games (or video games), otherwise the definitions are meant to be applicable to both digital and non-digital games.

| Source | Definition |
|---|---|
| Järvinen, Heliö, and Mäyrä (2002, p. 13-14) | A sequence of actions within formal and predefined rules and goals, [... with] definitions of winning or losing, or at least of gain and loss. |
| Salen and Zimmerman (2004, p. 80) | A system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome. |
| Juul (2005) | A game is a rule-based formal system with a variable and quantifiable outcome, where different outcomes are assigned different values, the player exerts effort in order to influence the outcome, the player feels attached to the outcome, and the consequences of the activity are optional and negotiable. |
| Aarseth (2007, p. 130) | Games are facilitators that structure player behavior, and whose main purpose is enjoyment. |
| Tavinor (2008) | [A video game] is an artifact in a visual digital medium, is intended as an object of entertainment, and is intended to provide such entertainment through one or both of the following modes of engagement: rule and objective gameplay or interactive fiction. |
| McGonigal (2011, p. 21) | What defines a game are the goal, the rules, the feedback system, and voluntary participation. |

One commonality of many of these definitions is that they place the presence of rules and the structure they provide in high regards and as one of the primary (if not the primary) requirements for something being called a game at all. With this focus on structure and quantifiable outcomes, there's an implication that the visual themes and stories in games are irrelevant to the classification. Here, we've stumbled upon one of the more pervasive debates in the recent history of game studies (Frasca, 2003; Murray, 2005) – a debate of whether stories are to be seen as a crucial part of games alongside its rules, or as irrelevant superimposed trappings on top of the rules (i.e. not relevant to the definition)? The two sides of the argument are commonly corralled into either the *narratology* or the *ludology* paradigm (Murray, 2005), although the strict definitions of either term are debatable themselves (Frasca, 2003; Pearce, 2005). The former paradigm places emphasis on the importance of fiction and narrative as crucial components in games' properties as a medium, and the latter focusing on the rules and structures that make up a game (Frasca, 2003). It's hard to present both sides of this argument in detail and in a straight-forward fashion, but it's still valuable to briefly give it some thought as it is one of the many signifiers that the field of games research isn't an easily defined discipline, and that it isn't a field with a linear progression.

The narratology/ludology debate hasn't concluded (and will not conclude) in one faction getting to stake the definite claims to what constitutes a game or not. The strict polarization of the debate is in fact a bit of a fallacy in and of itself (Murray, 2005; Pearce, 2005) as it's seldom a question of whether games should be considered being black or white, but what shade of grey they are. In any case, the debate has resulted in continuous re-examinations and new definitions of games as mixtures of both fiction and rules, for example Tavinor's (2008) definition in Table 3.2. Juul (2005) has a similarly inclusive approach in the introduction of his book where his definition in Table 3.2 is quoted from as well, stating that:

> ...video games are two rather different things at the same time: video games are real in that they are made of real rules that players actually interact with; that winning or losing a game is a real event. Conversely, when winning a game by slaying a dragon, the dragon is not a real dragon, but a fictional one. To play a video game is therefore to interact with real rules while imagining a fictional world and a video game is a set of rules as well a fictional world. (Juul, 2005, p. 2)

As the purpose of this thesis isn't to clarify definitions, an inclusive approach similar to the ones provided by Juul (2005) and Tavinor (2008) is used when discussing learning games. In this thesis, games are considered as instances where the participant(s) enter a construct – either contained in analogue or digital artefacts, or being purely abstract – governed by an agreed upon set of laws that both dictate the agency of its inhabitants and make the success of their efforts measurable and comparable. Games are also systems that can involve fiction that the participants partake in, and that modify, contextualize, and even direct the game activity in a non-trivial way.

The field of game studies is the academic discipline of trying to understand how these types of systems work, how they are made, their history, how they fit into society, and how players both affect and are affected by different types of games. It's also important to keep in mind that although digital games are frequently the object of study in contemporary game studies, the field of game studies as a whole isn't limited to digital games. There are games without goals, open-ended games, games on a variety of platforms, games that incorporate reality in them, and many other that constantly problematize our definitions of what constitutes a game, and thus the definition is becoming increasingly fragmented. But, for the purposes of this thesis, the definitions provided here are good to keep in mind when progressing into our discussion about serious games and learning games.

### 3.2.2 PERSPECTIVES ON GAME DESIGN AND PLAYER EXPERIENCE

One of the major branches of game studies is the research discipline concerning the anatomy of games. The objects of scrutiny in this area of games research are the components that make up a game, and how their individual properties affect it and how they influence the player's experience of it. Here, it becomes apparent how the earlier described definitions of what constitutes a game has played an important role, as they direct the focus for these types of research endeavours. So, research in game design focus on understanding how specific elements and mechanics of games – their rules and goals, as well as their narrative and fiction - can be arranged and how they affect the play experience. This is an area of research that has become increasingly popular (Squire, 2007), perhaps as the ontological discussions mentioned earlier is receding somewhat and giving room for more musings on the practical structure of games. A few examples of works in this area are *Patterns in Game Design* by Björk and Holopainen (2005), *Flow in Games* by Chen (2007), and the *Mechanics-Dynamics-Aesthetics* (MDA) framework by Hunicke, LeBlanc, and Zubek (2004). These works delve into what effects certain compositions of game elements have on a player's experiences while playing a game, but they take very different approaches that make them good representations of how game studies build upon theories from other fields of research. Why games are engaging, how they can be honed to elicit certain reactions, as well as other aspects of their anatomy is explained in detail in these types of game research publications. For this reason, this discussion is particularly important in the context of this thesis since it provides underpinning to the discussion of how we understand learning games as experiences.

#### THE MDA FRAMEWORK

The MDA framework proposed by Hunicke et al. (2004) introduces an interesting way to look at game design, but also introduces the idea of thinking of games and game experiences as collaborations between the game's designer and its player. The MDA framework divides the elements that make up a game experience, or game encounter, into three components that span the details of the mechanics that make up the game, as well as

the more ephemeral nature of the player's experiences and influences on the game. Shortly summarized, the MDA framework separates a game into:

- **Mechanics** in this context refers to the "cogs and cranks" that make up the machinery of the game and specify how the player is able to interact with it. This could be anything from the rolling of dice, the shuffling of a deck of cards, the randomization of equipment properties, the availability of weaponry, or the geometry of the game world.
- **Dynamics** is the way the mechanics of the game manifest when the game is being played. The "clash" between the players and the mechanics creates dynamics depending on what they both bring to the game encounter. For instance a game dynamic can be allowing the player to manipulate the game world and customize their game character – in this instance the aesthetic of expression can be evoked, and depends on mechanics that allow for high degrees of malleability of both the game world itself and the player's character properties and appearance.
- **Aesthetics** is the response that is evoked in the player when he/she is interacting with the game. A few examples of game aesthetics are dramatic tension, a sense of team spirit, or challenge – these can be experienced by the player if the mechanics of the game create the appropriate dynamics.

This comprehensive framework is useful both for analysing and creating games. For instance, through play-testing of a game the designer or researcher can see what types of aesthetics the game conjures among the participants, and by using the MDA framework get an idea of what mechanics are taking the game in the right direction and which ones muddle up the design or instil dynamics that weren't intended. *Figure 3.1* shows the model accompanying the MDA framework, and the quote from the paper introducing it can serve as a good summarization of the different types of lenses the framework provides:

> From the designer's perspective, the mechanics give rise to dynamic system behavior [sic], which in turn leads to particular aesthetic experiences. From the player's perspective, aesthetics set the tone, which is born out in observable dynamics and eventually, operable mechanics. (Hunicke, LeBlanc, & Zubek, 2004, p. 2)

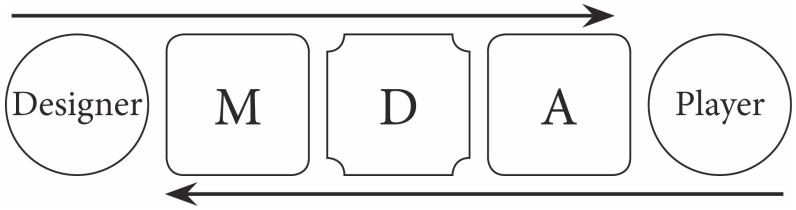


**Figure 3.1:** The Mechanics-Dynamics-Aesthetics framework as visualized by its authors (Hunicke, Leblanc, & Zubeck, 2004)

## PATTERNS IN GAME DESIGN

Building on the theory of pattern languages, which has its origins in architecture in the late 70s (Alexander, 1979), Björk and Holopainen (2005) describe how the interconnection between very specific game mechanics dictate the challenges presented and moods evoked by a game system. This makes design patterns useful as a tool both when designing a game, or as guidelines to evaluate a game – as the authors themselves describe it:

> ... game design patterns are semi-formalized interdependent descriptions of commonly reoccurring parts of the design of a game that concern gameplay. These concepts allow one to describe how the specific configuration of and interrelation between game components affect gameplay. (Björk & Holopainen, 2006, p. 411)

The general purpose of patterns is to formalize something that is inherently both chaotic and subjective, and subsequently establish a vocabulary to be able to discuss it (Alexander,

1979). To refer back to architecture, a pattern could either be determined with a relatively broad scope or it could be very narrowly described. For instance, a bigger pattern could consist of the elements that make up an entire city street, a building, or a courtyard – or it could be limited to describe a hallway or the area around a living-room window. The patterns in any of these cases would both consist of a description of the relationship between individual components in these scenes or settings and the properties of the components in and of themselves, and determining how these parameters mesh together and the effect they have on the observer. Do the storefronts and their windows, the textiles of their awnings, the climbing vines wrapping in between their brick-work, and their furnishings work together in a way that instils a feeling of beauty and gels with the atmosphere of the city? Once the positive and negative patterns are identified, they can start to be codified and used to construct a vernacular that can be useful for other architects – in short as templates that describe what components, colours, dimensions, and layouts work well in certain situations, depending on the aesthetics you're aiming for. This principle, described by architect Alexander (1979), was a way to make something very organic and subjective into a more systematic form of problem-solving. Patterns is a way to understand why certain things instil a sense of harmony whereas some do the opposite, and what steps one could take to avoid or ameliorate bad architectural designs. Björk and Holopainen's (2005, 2006) patterns work very much in the same way, and creates a unifying language to describe design elements in games as well as how they affect the final harmony of the game experience. How does the increasing speed of the falling "tetrominoes" in *Tetris* (Pajitnov, 1984) impact the experience of the game, or how does the finite amount of resources in a *StarCraft* (1998) game affect the pace of the game and influence the way multiplayer matches ramp up in intensity? Just as Alexander (1979) provided general patterns for how window sills and building materials made up the visage of a building, the design patterns for game design described how resources abundance and limitations, trading capabilities, competitiveness and collaboration, elements and methods of randomization, and other game mechanics made up games. By naming different design patterns, describing the consequences they have on the play experience and what they encourage and discourage players to do, what other patterns they can be combined with, and some examples of where the patterns are being used in games already, the design patterns are also structured into a vocabulary that makes the discussion of game mechanics easier among developers and researchers.

## FLOW IN GAMES AND THE THEORY OF FUN

Another example of how the design of games has been examined is the way psychology has been used to understanding game design and player experience. In particular, the popular psychology theory of *flow* was appropriated to explain a specific facet of the relationship between a game and its player. In 2007, Chen used the theory of flow or the "theory of optimal experience", which was originally established by psychologist Csikszentmihalyi (1990), to describe how player experience was in large part depending on the relationship between a game's challenge and its player's level of skill (Chen, 2007). According to Csikszentmihalyi (1990), flow theory can be used to explain why certain types of activities absorb its participants very intensely, whereas others quickly leave the participant bored or stressed out. Through rigorous studies conducted on thousands of participants spanning many countries and cultures, Csikszentmihalyi (1990) found that the phenomenon of becoming absorbed by an activity, even to the point of losing track of time and your surroundings, could be narrowed down as dependent on a set of criteria that activity and performer needed to adhere to.

- One must be involved in an activity with a clear set of goals and progress. This adds direction and structure to the task.
- The task at hand must have clear and immediate feedback. This helps the person negotiate any changing demands and allows him or her to adjust his or her performance to maintain the flow state.
- One must have a good balance between the perceived challenges of the task at hand and his or her own perceived skills. One must have confidence that he or she is capable to do the task at hand.

Chen (2007) compared Csikszentmihalyi's criteria to the dynamics one would find in a well put together game, that is to say a game that had an ability to engage its player to a high degree, and saw that Csikszentmihalyis criteria was a solid template to explain the building blocks of a good game. Just like rock climbing, ballroom dancing, or the playing of an instrument, or any other activity that has the ability to instil a sense of flow, an engaging game needed to adequately challenge its player while not being imposingly difficult, make the player feel in control and as if he/she has agency in the game world, and provide feedback that indicates either successful or unsuccessful outcomes of certain actions to allow the player to progress (Chen, 2007; Cowley, Charles, Black, & Hickey, 2008). If the right psychological triggers could be pushed, a sense of being fully absorbed by the experience of play would be possible, and this realization has had a big impact on game design both as an object of study and as a craft (Cowley et al., 2008; Sweetser & Wyeth, 2005). Among the stated criteria, the balance between player skill and game challenge is probably the most commonly referred to when flow is discussed (see *Figure 3.2*).

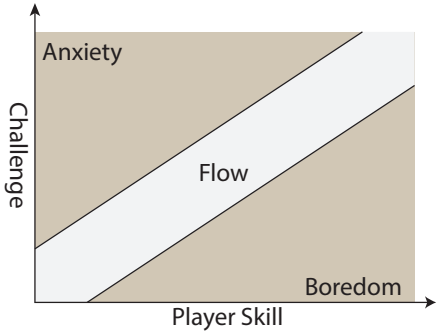


**Figure 3.2:** The relationship between challenge and player skill, a merger of the diagrams presented by Chen (2007) and Csikszentmihalyi (1990).

Since its inauguration, flow has both been used as a template to design good game experiences, not in the least by Chen himself in game titles developed by his studio, but also as a tool for evaluating games and why they do or do not engage their players (Sweetser & Wyeth, 2005). Another example that could be valuable to mention in relation to flow is the *theory of fun*, described by Koster (2005). Much like the theory of flow and optimal experience, the theory of fun attempts to describe why people are engaged by certain things and there are many similarities between the two theories since they both examine games with the player and human psychology as the primary lens. Koster (2005) describes fun as a sensation that arises out of comprehension and mastery and as a product of the human brain managing to decipher the patterns of a game challenge. Games that manage to remain fun for the player for a long duration of time are games that constantly reconfigure the patterns in the game in some way and push the player's ability to continuously develop their understanding and mastery of the game (Koster, 2005). Conversely, games that the player lose interest in quickly, are the ones that either present

incomplete or incomprehensible patterns or puzzles, or are too easily mastered and don't throw any new configurations the player's way (Koster, 2005).

These are but a few examples of how the study of game design, and by extension the study of players, is inspired and influenced by research in scientific fields that at a glance can seem far removed from the games medium. Patterns try to codify game components to create a language with which to describe them and their effects on the game experience better, flow in games take a psychological approach to understand how the proportions of challenge severity and player skill affect play experience, and the MDA framework looks at how game experiences and encounters are made up from collaborations between their designers and their players. The different approaches these different scholars and professionals have taken in order to understand the anatomy of games and player experience better is a good indicator both of how complex the interrelationship between games and their players are, and the breadth of knowledge that goes into designing games. These different perspectives will return later on in the thesis, but in the context of how they fit into the creation and understanding of learning games.

### 3.2.3 SOCIALITY, COMMUNITIES, AND IDENTITY IN AND AROUND GAMES

Beyond studies focusing on the interplay between game mechanics and player experience and psychology, there are also studies focusing on examining games from a broader perspective. As games become more connected and communal experiences the boundary between what is relevant or not when studying a game becomes blurred, and a perspective that is too formalized and focused on the mechanics can miss out on important experiences games provide. Thus studies of the "ecosystems" created around games nowadays constitute a big part of game studies.

Games are very potent role-playing and identity building tools. Single-player games often encourage the player to take on the role and persona of the main character – the attributes and personality of which could either be static and determined by the game's designers and writers, or could be a tabula rasa that the player is free to imprint with what they want. Other games, such as *The Sims* (2000) or many real-time strategy games don't provide any avatar for the player to inhabit in the world, but allow the player to play through or create their own narratives and stories with the props and characters provided to them. Beyond this, multiplayer online games not only provide the opportunity for experiencing a story through a characters eyes, but also to create stories, communities, and worlds within and around the game together with other players. This characteristic of interaction is something that sets games apart from other types of media. Film, TV, books, and music are all art forms where the consumer is absorbing the material as it is presented by their creators, games invite the consumer to control and be part of the experience and experiment with the plasticity of identity that modern technology affords us (Raessens, 2005).

When games are studied as mediators of culture and socialization the more mechanical definitions of games are insufficient as they often omit the intricate layers of interpretation and social constructs added to the game by the players (Eklund, 2012; Gee & Hayes, 2012; Raessens, 2005; Stenros, Paavilainen, & Mäyrä, 2009). One way to describe why this is the case is to take a look at a few games and describe the components that influence, and sometimes have centre stage in the play experience, without being strictly formalized by the games' rules.

Massively multiplayer online games provide good examples of the importance of being inclusive to the social sphere surrounding games when examining game experiences and their effects on their players. In the massively multiplayer online science-fiction game *Eve Online* (2003) the players have an immense amount of control over the game world

(Carter, 2013a). Players set up organizations among each other, form large diplomatic networks, control star-systems, and influence the game's economy. Beyond that, they also carry out advanced political machinations to infiltrate and swindle organizations that are run by other players (Carter, 2013a, 2013b). In games like Eve Online, the game mechanics guide the players' gaming activities and behaviours by stating what actions are possible and impossible within the game, but a significant part of the game experience consists of the social interplay that is largely independent of these formal boundaries (Carter, Gibbs, & Harrop, 2012). As decisions and alliances made in game-separate venues will significantly impact what happens in the game-world and how the players approach the game, the boundary of Eve Online as a game experience becomes rather fuzzy (Carter et al., 2012). This type of mutual influence between games and their communities are found in many multiplayer online games, and a devoted community can steer a game in directions unforeseen by developers (Carter et al., 2012; Taylor, 2004). In *Second Life* (2003), for example, Malaby (2012) observed that the community steered the game in a different direction than what seemed intended with the original game's design "the rise of social and cultural capital within Second Life has happened in many respects despite Second Life's architecture." (Malaby, 2012, p. 229)

Another example is the popular real-time strategy game *StarCraft II: Wings of Liberty* (SC2) (2010), but its community is of a somewhat different nature than the ones in the described massively multiplayer online games. Around SC2, an extensive e-sports community has sprung up which includes; big broadcasted tournaments with hundreds of thousands of dollars prize rewards; a myriad of online communities dedicated to discussing the game, its strategies, and the results of e-sport leagues; as well as YouTube channels dedicated to providing commentary to SC2 matches. It is perhaps debatable whether the community is a superimposed layer on top of the game or if it has any real impact on the game itself. But, as in Eve Online, the community surrounding the formal game structure with its tournament seasons, commentaries, and discussions influence the way the game is played, and even how the creators of the game update features and balance game mechanics. In all these examples, where is the boundary around the game? Are the rules of the games the main directors of the experience of playing the game?

The schemes and planning done by players in EVE Online and the spectacle of tournaments and intricacies of the meta-game around SC2 are all central aspects of why many players find these games intriguing and change the way they play and experience the game. But, if we look at the play experience and its dynamics through the game definitions usually employed (and described in Table 3.2) this isn't accounted for. These problems and questions have been delved into by sociology-, culture- and media-scholars which often take a different approach to understanding games than game scholars are wont to do, and expand the definitions in directions that make it possible to understand games as something beyond the software artefact and play encounter (Eklund, 2012; Peterson, 2011; Raessens, 2005). A couple of examples that summarize these aspects are Raessen (2005) in his summary of the cultural approach to understanding games, and Eklund (2012) in her dissertation on socialization in games:

> Computer games have to be defined based on specific combinations of technical, social, cultural and economic characteristics and not on exclusive, essential ones. (Raessens, 2005, p. 373)

> (social) gaming is created in the relations between gamers engaging in games with the more formalist approach that games are rule based structures. Games create a foundation for interaction that can further develop into the creation/maintenance of relationships and identity. (Eklund, 2012, p. i)

The social and cultural universes that are created around games are yet another face of the medium, and one that is important to understand when discussing learning games as well (Gee & Hayes, 2012). A game can create environments around them that encourage experimentation, communication, and analysis far beyond what the game's design provides in and of itself (Gee & Hayes, 2012; Halverson, 2012). Understanding how these ecosystems arise, function, and how they can be directed and encouraged can introduce new possibilities for the concept of learning games, and highlights the importance of not considering them as isolated experiences.

### 3.2.4 VIOLENCE AND GENDER ISSUES IN GAMES

The debate on the psychological effects of violence in digital games has been around almost as long as the digital games medium itself (Squire, 2002). The game often attributed with igniting the discussion of whether games should be allowed to depict violence, and whether games are harmful to their players by reinforcing antisocial and violent behaviour is *Death Race* released for arcades in 1976 (Fox, 2006; Kent, 2001; Koster, 2005). The game was inspired by the film *Death Race 2000* released the year prior, and was essentially a game where the main challenge was to use a steering wheel on the arcade cabinet to drive over as many gremlins as possible before the time limit ran out (Fox, 2006). Being a game from 1976, the graphic resolution of the game was very low which made the gremlins depicted in the game were indistinguishable from human beings, in essence making the game look like it was about vehicular manslaughter. The controversy surrounding the game reached as far as national coverage on *CBS 60 Minutes* in the US, and it became the first significant bout with controversy of that nature for the video games industry (Kent, 2001). The representation of violence in games has been a perennial topic of discussion in media outlets since that point.

There's of course also plenty of research tackling the issue whether games make people violent or otherwise cause antisocial behaviour (Lee & Peng, 2006; Squire, 2002; Weber, Ritterfeld, & Kostygina, 2006). There are several concerns regarding the social and psychological effects of playing games that aren't tied to violence and aggression as well, for instance whether playing video games can become an addiction, and if representations of gender and sexuality representations warp perceptions and attitudes of their players (Weber et al., 2006).

Violence has been the focus of much of the published research on the negative effects of games. Aggression in this type of research often refers to mental processes, and that playing violent games can lead to more aggressive thought processes and attitudes rather than to direct acts of violence (Anderson & Dill, 2000; Dalquist & Christofferson, 2011). There's plenty of research that points to correlations between playing violent games and displaying violent tendencies (Anderson & Dill, 2000; Goldstein, 2005). But, the empirical evidence presented in much of the research is often critiqued as dubious and insufficient due to methodological issues and additional research is often called upon (Dill & Dill, 1998; Griffiths, 1999). In a report presented in 2011, studies on game violence performed between 2000 and 2011 were inventoried and out of the 105 studies found by the authors only five of had measured their subjects' attitudes and aggressiveness both before and after playing a violent game (Dalquist & Christofferson, 2011). Another common issue with many of the examined studies on the correlation between violent games and aggression was that they're often conducted in laboratory settings, and that there are few longitudinal studies where the long-term effects of violent gameplay is examined (Dalquist & Christofferson, 2011). Overall the results from the examined studies were also quite varied, and not enough to draw a definite conclusion, but the collected material demonstrated a statistical relationship between regular playing of violent video games and aggression (Dalquist & Christofferson, 2011; Lee & Peng, 2006).

The same results are echoed in several other literature reviews and reports on the subject that span a wider range of literature (Lee & Peng, 2006; Weber et al., 2006), and while the aggregate data indicate a significant relationship between games and violent behaviour and attitudes a commonly reiterated opinion among authors is that the jury is still out when it comes to the extent that games influence their players (Anderson & Dill, 2000; Dalquist & Christofferson, 2011). In the wakes of an extensive study published by Anderson et al. (2010), the authors stated that the debate as effectively being settled since the comprehensiveness of their study along with its definitive findings left no doubt that violent games do have a significant positive relationship with aggressive behaviour (Anderson et al., 2010; Huesmann, 2010). Even with these assertive statements, however, the study was criticized by other scholars since it doesn't adequately control for other risk factors (such as personality types and living situations), and that controlling for these factors nullify the effects as they are presented (Ferguson & Kilburn, 2010) – which is also, among the previously stated criticism, a common assessment on most studies in the field (Dalquist & Christofferson, 2011; Squire, 2002; Weber et al., 2006). So, the debate still continues with the research results favouring the conclusion that games do have an impact on their players (Anderson et al., 2010), but the nature of the impact is yet to be conclusively defined (Dalquist & Christofferson, 2011). The debate itself is not without issues, however, and the scientific grounds of both studies proving causality and critique disproving it is also subject to analysis. Huesmann (2010), one of the supporters of the claims made by Andersen et al. (2010), also brought attention to this underlying issue by stating that:

> ...the results [of Anderson et al.'s study are] unlikely to change the critics' views or the public's perception that the issue is undecided... because many people are concerned that the implications of the research threaten freedom of expression, and because many people have their identities or self-interests closely tied to violent video games. (Huesmann, 2010, p. 180)

In summation, it is certainly likely that it will be quite some time before the debate can effectively be settled.

The question of how gender and sexuality is treated in games, and how it affects players, is perhaps even more of a nested issue. Whereas concerns of violence boil down to whether playing violent games translate to violent attitudes and behaviour, concerns of gender representation poses more layered questions. How are women and men depicted in games? What does this mean for the observer? What responsibilities do developers have when it comes to representing gender and sexuality? There's no doubt that games as a medium has been skewed towards appeasing young male audiences, and depiction of women has suffered as a consequence. In 2001, the organization Children Now conducted a survey of 1,716 characters in video games, and found that male human characters outnumbered female characters 4:1. Beyond the sheer difference in quantity, the female characters were also found to be stereotypically depicted as over sensualized (e.g. being having thin waists, very large breasts, being scantily clad, etc.) and often play the role as victims and damsels in distress, whereas males are masculinized and often take on the role of the capable hero (Children Now, 2001). This area of research is gaining increasing traction, and while the procedure of studies and the genre of games vary, all studies on the subject of gender roles and depiction have found the same alarming discrepancies between male and female depiction (Beasley & Collins, 2002; Braun & Giroux, 1989; Mou & Peng, 2009; Smith, 2006; Weber et al., 2006). It's hard to say how this will change in the near future, but the Entertainment Software Association (2013) recently stated that 45% of American gamers were female, which is a clear monetary motivator to be more conscientious of gender portrayal in games to avoid alienating a large part of the gaming audience. But, the decades of seemingly wanton disregard for how gender is depicted isn't something that can be

immediately ameliorated and is still frequently a subject of controversy in the business both as a result of content in big game titles, and behaviour from industry professionals during big events (Mou & Peng, 2009; Pinchefsky, 2013).

There are certainly also many studies investigating the positive social, psychological, and cognitive effects of playing games (Ratan & Ritterfeld, 2009; Weber et al., 2006). For instance, in studies examining effects of cognitive and motor skills the results suggests that games have a positive impact on players (Durkin, 2006). These results are often attributed to games challenging their players to continually tackle new problems, and provide them a playground to experiment with different types of solutions without severe consequences for failure (Habgood & Ainsworth, 2011). Games are also said to benefit various cognitive processes and develop motor skills (Lieberman, 2006). These effects and studies will be described in more detail in the next chapter, as much of the research in this area is done in the area of serious games and learning game studies.

### 3.2.5 THE CRAFT OF CREATING ENTERTAINMENT GAMES

Before closing the chapter on entertainment games and delving into serious games and learning games, a description of how entertainment games are actually created is in order. Here, the descriptions of what games are, what they consist of, and how they are able to provide experiences to their players are useful backdrops to understand the game creation process. An important capstone to this whole section, just as the previous one, is also that game creation is very complex and somewhat messy and alchemical (Irish, 2005). Just as you need to appropriate many different perspectives in order to understand games – you need just as wide an array of expertise to create them. Game development has for a long time been somewhat of a chaotic and mysterious process, but it has in later years become increasingly structured and received more attention from scholars as well as professionals (Hagen, 2010). An indicator of this progress is, as pointed out by Hagen (2012) in his research on creativity and ideation in game development processes, the increasing amounts of books written on the subject. Hagen found that approximately 113 handbooks had been published between 1984 and2010, and that of the full sample 102 (or 90%) of the handbooks were published after 2002 (Hagen, 2012).

Game creation is nowadays seen as a process that unifies programming, animation, modelling, concept drawing, writing, game design, sound design, music composition, and many more disciplines (Irish, 2005). Game development thus requires an understanding of computer science, art, design, and psychology, and dives into different specifics and sub-categories within each of those fields depending on what type of game is being created. This last caveat is also frequently reiterated in handbooks on the subject, as the expertise needed in any given development project does vary greatly, and it's impossible to stake out a definite catch-all description that would adequately describe the way all game development studios work (Hagen, 2012; Irish, 2005). In order to simplify the descriptions a little bit, I will describe some of the more common type of roles you'll find in game development studios and what they contribute to the process, and then briefly describe a few common structures of game development projects. While the descriptions here are very simplified by necessity (writing about each role in detail would be a thesis in and of itself), this general background is important for the end purpose of this thesis as the development of entertainment games guides the practice of serious game and learning game development to a great extent.

The specific role of the **designer** in a development project is hard to describe. It's easy to think of the designer as only being an idea generator, but that is far from the case. In The Art of Game Design, game scholar and designer Jesse Schell describes the designer's duties as "designing game play, conceiving and designing rules and structures that result in an experience for players" (Schell, 2008). So, while the designers of a game certainly does

generate ideas, they also need a firm grasp of what's feasible to execute in a project, how to interpret feedback from play testing and make changes to the design, and also understand why games work the way they do and what types of design decisions lead to what types of experiences and play dynamics (Rollings & Adams, 2003; Schell, 2008). The duties of a designer can be understood through the previously described theories of Game Patterns, MDA and flow as they need a firm understanding of how different mechanics affect the play experience and how players interact with games and each other. As with roles in the other disciplines, designer roles in larger projects are sometimes dispersed over several specific design tasks, such as level designer, gameplay designers, multiplayer designer, interface designer, etc. (Irish, 2005).

**Story writing** has historically been of somewhat low priority in game development, and it's somewhat rare that there's an individual solely devoted to writing on development teams of small- to medium size. The reasoning behind the low priority of writing is reflected in the definitions of games that were described earlier – the story of the game is rarely a necessity, but rather an added extra layer on top of the game mechanics. However, story and scripted dialogue is an integral part of many games, and some form of writing will go into in almost all types of development projects. In bigger development projects, writing is commonly something that is done early on in the production of a game, as changing or adding new recorded dialogue or adding new story events and scenes late in development is a cumbersome process (Irish, 2005). In smaller development teams, writing is often a task done by the game's designer and story often emerges naturally as the game mechanics and dynamics are being invented.

**Graphics** as a general discipline categorization entails anything that has to do with the visuals in a game, and can be separated into modelling, animation, concept drawing and design, and many other subcategories within each of these monikers (e.g. specifying if you work with models and geometry or texturing and lighting, if you create environments or objects, if you're a 2D- or 3D artist, etc.). In 3D development, the objects that are to inhabit the game world are all made through a sequence of:

- Modelling - creating the geometry of the object, in essence providing a mathematical specification of shape and appearance properties that is readable by the computer
- Skinning, texturing, and UV-mapping – treating the visible surfaces of the model, specifying its texture and colours, how light play with it, and how it reacts when it's stretched and moved if the object is animated.
- Rigging and animating – if it's an animated object, it needs to be rigged and given a "skeleton" and joints that both dictate the articulation of the object and gives the animator an easy way to specify how it articulates. Animating is done by manipulating the skeleton rig, and creating animation patterns for specific events (e.g. punching, crouching, etc.).

Bigger development studios sometimes take a conveyor belt approach to graphics creation, where each stage of the creation process is handled by a specialist. In smaller studios, the process is usually handled by one artist, or shared between different artists. In recent game production, alternative means of animation such as procedural animation and motion capturing is becoming increasingly common in bigger studios, making it possible to produce vivid, life-like results rapidly (Shirley, 2005). The creation of 2D graphics can look entirely different depending on the game, and here objects and characters are in certain cases drawn and animated to be inserted into the game without the step-by-step process of modelling and creating the skeleton for the object/character – making the process akin to the one used in traditional animation, except objects are made individually to be independently movable and manipulated in the game world.

The role of a **sound designer** can either be the creation of special effect sounds and ambience, or composing the game's sound track. While sound is often of a lower priority in

game development projects, the value of good sound design is not to be underestimated. When it comes to production process, sound design is pretty straight-forward. As with all other content in the game, the sound designer creates his or her sound effects or music, and the programmer implements it into the game and ties it to the correct type of event or scene. Unlike graphics which usually is produced through a longer sequence and can pass through multiple hands during development, sound effect creation is a more contained process. When it comes to the "mood" of the sound, it can either be influenced by the visual style of the game, or the rest of the game can be influenced by sound (Schell, 2008). Whichever route is chosen congruent and harmonic experience is the end goal (Irish, 2005).

The role of a **programmer** in a game development project is generally implementing ideas and content from designers and artists into functional software. Depending on the project, the programming can entail anything from low-level coding and the creation of a game's entire "engine" from scratch – or more high-level coding in a pre-existing game engine.

> A *game engine* is essentially the software framework that makes a game function. It includes the foundational descriptions of the properties of different objects and how they interact with each other. Physics, artificial intelligence frameworks, rendering graphics, and light properties are examples of engine features.

These different approaches task the programmer's skills quite differently. Creating a game engine for a project requires data manipulation on a very deep level, whereas high-level (high-level in this case referring to the "distance" from the computers base functionality being worked on, not the level of quality or difficulty of the work) primarily tasks the programmers understanding of the engine and how it can be manipulated in different ways. Any decisions regarding the mechanics of a game and the properties of objects in the game world will likely need a programmers attention in some way during development, and unless the game is very simple, and is made in one of the more accessible game engines that are available, a solid grasp of programming is essential to make a development project feasible. It's hard to overstate this, but for the uninitiated an important thing to realize is that every type of object in a game world needs to be specifically directed and told how to function. If ready-made engines or other types of middleware is not being used this is especially laborious as even basic universal constants relevant to the game needs to be coded from scratch.

Beyond the more clearly defined roles already mentioned, there are a couple of other positions that are usually found in game development studios, and those are **leads**, **directors** and **producers**. Leads are roles that are specific to each discipline in a development project, and the lead is essentially tasked with keeping track of the progress their part of the development team is making. When studios grow to larger sizes, having one person that is knowledgeable enough in programming, design, and graphics to understand and keep track of what each part of the development team needs, and how they need to collaborate with members from other disciplines, is neither feasible nor practical. Hence the need for leads that works closely with their own development teams. Having a lead programmer, designer, and graphic artist is essentially a way to keep the flow of information in larger development teams more structured and manageable. Whereas a lead commonly has an administrative function, directors are in charge of keeping the tone of visuals, audio, and design intact and make sure that the game feels harmonious and consistent. Like leads, a director can be working with specific aspects of the game, or have a more general role. The producer is, just as they are in other types of media development,

the person in charge of making sure that the entire game production process is progressing smoothly, often including the promotion of the game, legal protection of the game, and communication with external partners (e.g. publishers) (Irish, 2005).

As a general rule of thumb, all of the roles described here will be represented in some capacity in any game development project. But, a role may not always be confined to a single person; likewise a single person may not be limited to playing one role during development. In smaller development studios, roles are often far less specialized than they are in the studios creating the bigger block-buster titles. In teams of less than 10 people, different roles are often meshed together and attributed to one person, and some roles can be omitted altogether depending on the game being created.

When it comes to development processes there are also plenty of different methods available and utilized in the industry, many of which have their origins in software engineering (Ampatzoglou & Stamelos, 2010). A unifying component of the processes used in game development is that they take a flexible and iterative approach to development, which is to say the game is built in incremental instalments, each of which having more features implemented and refined than the last. The purpose of these types of processes, referred to in software engineering as agile or iterative processes (Pressman, 2005), is to give the developers an opportunity to change directions and omit or add new features during development, as opposed to seeing the game only when it is already mostly completed very late in development as is the case with prescriptive development processes (Eladhari & Ollila, 2012; Salen & Zimmerman, 2004). The agile process gives the developer a chance to see and evaluate their progress and the quality of the game early on in development as a primitive first version, or a prototype, of the game is produced rapidly, and later incrementally refined. The process and its benefits are summarized by Salen and Zimmerman as:

> A rough version of the game is rapidly prototyped... [it is] played, evaluated, adjusted and played again, allowing the designer or design team to base decisions on the successive iterations or versions of the game. Iterative design is a cyclic process that alternates between prototyping, play testing, evaluation, and refinement. (Salen & Zimmerman, 2004, p. 11)

While these ways of production are flexible, they are also quite messy and hard to schedule, and due to this also prone to delays, and the details of how the process pans out often differ from project to project (Pressman, 2005). But, as put in their guidelines on prototype development for games researchers, Eladhari and Ollila (2012) state that since it's almost impossible to foresee how all the components of a game will resonate together, keeping some lee-way for the team to adjust the game along its production and in response to play-testing is a necessity.

### 3.2.6 SUMMARY

This chapter has covered different aspects of entertainment games as a field of research and a practice in order to provide a foundation for the discussions regarding learning games. Learning game scholars frequently turn to theories made by entertainment game scholars to understand how different game designs affect player engagement, but the two areas are also connected in that the popularity and controversies of entertainment games often influence attitudes towards learning games as well. The increasing popularity of entertainment games is certainly a big part of why educators are becoming interested in using them, and the controversies around the games industry also have a deterring effect. For these reasons, being familiar with entertainment games is important for understanding learning games.

Table 3.3 provides a summarization of this chapter.

**Table 3.3:** Summarization of chapter conclusions with examples of sources providing the information.

| Chapter conclusions | Source(s) | Reference |
|---|---|---|
| As a scientific discipline, the field of game studies is strongly multidisciplinary. There's no singular way to explain games as a phenomenon, and even the fundamental definition of what a game is continues to be subject to debate. | Murray (2005)<br>Mäyrä et al. (2012)<br>Alpert (2007)<br>Frasca (2003)<br>Juul (2005) | 3.2.A |
| Game design is not a straightforward practice; it includes psychological aspects as well as aesthetical aspects. Designing a game that resonates with its players is difficult as player enjoyment depends on a game's mechanics, how they're presented to the players, and the players' own preferences and skills. | Björk and Holopainen (2005, 2006)<br>Chen (2007)<br>Hunicke et al. (2004)<br>Koster (2005)<br>Hagen (2009, 2010)<br>Salen and Zimmerman (2004)<br>Schell (2008) | 3.2.B |
| Games cannot always be scrutinized and understood as isolated artefacts, the social contexts that are constructed around a game contribute significantly to the type of experience the game provides. | Gee and Hayes (2012)<br>Malaby (2012)<br>Eklund (2012)<br>Raessens (2005)<br>Stenros et al. (2009)<br>Carter, Gibbs, and Harrop (2012) | 3.2.C |
| The psychological effects of games are still not fully understood. Gender representations and the depiction of violence are still points of contention for people in and outside of the games industry. | Anderson and Dill (2000, 2010)<br>Dalquist and Christofferson (2011)<br>Squire (2002)<br>Weber et al. (2006) | 3.2.D |
| Game development is a complex craft. Game creation is an iterative process involving the efforts of graphic artists, game designers, programmers, and more. | Hagen (2010, 2012)<br>Irish (2005)<br>Schell (2008)<br>Ernest Adams (2007)<br>Salen and Zimmerman (2004) | 3.2.E |

## 3.3 SERIOUS GAMES AND LEARNING GAMES

The downfall of edutainment in the beginning of the millennia was swiftly followed by the birth of serious games in 2002, and to follow up the retrospective provided earlier this chapter, will provide a more in-depth description of what the term serious games means and how they are considered by current communities. The term itself, as it is used today, originated from the launch of the *Serious Games Initiative*, where Ben Sawyer and Peter Smith at the Woodrow Wilson Academy resurrected the term that was originally used in Clark Abt's work back in 1970 (Abt, 1970). Abt had used the term to describe how different types of games, mainly card games and board games, could be used for various "serious" purposes. But, for the purposes of the Serious Games Initiative it was appropriated to mainly describe digital games with purposes beyond pure entertainment (Djaouti et al., 2011).

As opposed to edutainment, however, the serious games movement isn't as deeply ensconced in the strictly educational branch of "serious" endeavours, and cover a very wide variety of purposes that are pursued through the use of games. As of 2009, 68% of serious games were focused on academic learning, 14% were games for social change, 9% were for use in corporations, 8% were within the realm of healthcare, 5% were military applications, and finally marketing games made up less than 1% of all serious games (Ratan & Ritterfeld, 2009). The taxonomy provided by Sawyer and Smith (2008) also visualizes the span of the serious games term (see Table 3.4).

**Table 3.4:** The Updated Serious Games Taxonomy proposed by Sawyer and Smith (2008)

| | **Games for Health** | **Advergames** | **Games for Training** | **Games for Education** | **Games for Science and Research** | **Production** | **Games as Work** |
|---|---|---|---|---|---|---|---|
| **Government & NGO** | Public Health Education & Mass Casualty Response | Political Games | Employee Training | Inform Public | Data Collection / Planning | Strategic & Policy Planning | Public Diplomacy, Opinion Research |
| **Defense** | Rehabilitation & Wellness | Recruitment & Propaganda | Soldier/Support Training | School House Education | Wargames / Planning | War Planning & Weapons Research | Command & Control |
| **Healthcare** | Cybertherapy / Exergaming | Public Health Policy & Social Awareness Campaigns | Training Games for Health Professionals | Games for Patient Education and Disease Management | Visualization & Epidemiology | Biotech Manufacturing & Design | Public Health Response Planning & Logistics |
| **Market & Communications** | Advertising Treatment | Advertising, Marketing, Product Placement | Product Use | Product Information | Opinion Research | Machinima | Opinion Research |
| **Education** | Inform about diseases / Risks | Social Issue Games | Train Teachers / Train Workforce Skills | Learning | Computer Science & Recruitment | P2P Learning Constructivism Documentary? | Teaching Distance Learning |
| **Corporate** | Employee Health Information & Wellness | Customer Education & Awareness | Employee Training | Continuing Education & Certification | Advertising / Visualization | Strategic Planning | Command & Control |
| **Industry** | Occupational Safety | Sales & Recruitment | Employee Training | Workforce Education | Process Optimization Simulation | Nano/Biotech Design | Command & Control |

Parallel to the continued growth of entertainment games, the understanding of what serious games can bring to society has increased rapidly since the inauguration of the term, and in more recent years a perhaps more realistic and objective assessment of serious games is also starting to manifest. Much like the research refuting games' negative psychological effects on players, research pointing towards the positive effects of gaming in the form of serious games isn't without its issues of bias. For instance, there's been a tendency to point towards results from studies with low ecological validity to support and defend serious games and learning games (Simon-Egenfeldt, 2006; Linderoth, 2010) and perhaps that is a heritage from the times when games needed defending against legislations and censorship. But as games have matured and become cemented in modern culture (Bogost 2008), it has also become increasingly clear that the terms "games" and "serious games" describes very nuanced fields of research and development (Squire, 2007; Smith & Sawyer, 2008). As a result of this, the criticism of serious games have started to become more varied, specific and detailed. Serious games is nowadays understood to be an umbrella term that describes games for learning, training, healthcare, persuasion, motivation, social change, marketing, etc. which has been important in furthering the dialogue around them. Furthermore, as opposed to edutainment, researchers in the field of serious games have more divergent opinions regarding how they should impact society. Whereas edutainment titles were mostly assistive technologies aimed at supporting established educational practices, there are many proponents for considering serious games as a subversive force that can reveal the flaws of such institutionalized practices (Bogost, 2008; Laurel, 2003). This movement asks the question whether the difficulty of applying games in educational environments is a symptom of games being a leisure activity unsuitable for such serious contexts, or of the educational environments being constructed in a dated way that prevents participatory, experiential, dynamic, and engaging learning.

As a field of research, serious games often borrow frameworks and theories established by its bigger sibling game studies, and contain similar sub-categories of research disciplines as

you'd find in game studies but with a few added lines of questioning concerning the "serious" part of serious games. Much of serious games research is focused on describing in what way serious games distinguish themselves from games and the theoretical potential and effects that they can have on their users. Serious games have a strong heritage as an ontological field of research as it was established with a taxonomy describing what types of game applications the term actually described (Sawyer & Smith, 2002). Borrowing from the frameworks found in game studies, the definitions of serious games was thus established early on – but while the term has prevailed, these definitions have been increasingly scrutinized and questioned (Egenfeldt-Nielsen, 2006; Bogost, 2007). This has led to a more detailed understanding of the individual subsets that constitute the entirety of the field. Subsequent works, such as Gee's (2003) and Bogost's (2007), have been instrumental in defining why developing and researching serious games is a worthwhile endeavour, and the benefits they may bring if we're able to further refine our understanding of them. Gee's (2003) work provided a solid bases for explaining why discussing and examining games for serious purposes are worthwhile pursuits, and he helped introduce new ways of thinking about how games worked as learning environments at a basic level. Bogost (2007, 2008) has taken a more critical stance towards the field and the direction serious games are moving in. He hasn't done so due to a lack of faith in the potential of serious games, it's quite the contrary as he's adamant about pointing out the wasted opportunity in just trying to tailor serious games to supporting existing organizational practices and resorting to trite practices and standards of quality (Bogost, 2007, 2011b).

To summarize, the field of serious games has been in a state of transition with its infancy predicated on the demise of the edutainment market and its adolescence has been spent clearing the residue of negativity left by its predecessor. The discourse has begun to highlight not just differences between serious games and edutainment, but also the differences between serious games and the popularized and general definition of games, as well as detailed critiques within the different sub-categories of serious games. The craft of serious game development is starting to be seen neither as a subordinate to game development, software development or the development of training, educational, motivational or informational tools, but as a craft in its own right with its own multidisciplinary challenges (Harteveld et al., 2010). In that way, serious games are doing what games did in the 90s – establishing themselves as their own field of research and development with the emergence of theories that, while in part based on theories in related fields, are specific to the craft and its artefacts. With this emancipation the potential of serious games have begun to be better defined and, along with it, the practical barriers that need to be overcome in order to make good on this potential are starting to unravel (Egenfeldt-Nielsen, 2006; Tan, Neill & Johnston-Wilder, 2012; Bogost, 2008). Design theories and models aimed at tackling the barriers preventing serious game from reaching more widespread use are starting to surface (Kickmeier-Rust et al., 2011; Moreno-Ger et al., 2008; Hareveld et al., 2010; Schoppek & Tulis, 2010). This being said, serious games are still in their infancy, and the interest and proliferation of the term is outpacing the development of generally applicable guidelines that ensure that the potential of serious games can be properly tapped into (Egenfeldt-Nielsen, 2010).

In this chapter, research and practice within the field of learning games will be described in detail. Important to note, however, is that much of the reference material used in the description of learning games in this thesis is often not limited to just learning games, but are papers and dissertations that are often directed at the general field of serious games. The reason for having a relatively inclusive scope of what literature to include in the literature study overview is that general serious games research has plenty to bear when it comes to discussing learning games, as the latter is a sub-category of the former. This

relationship works both ways as well, material that primarily makes statements towards learning games specifically is seldom specifically labelled and limited as being "learning games literature", perhaps because the terminology within the field is somewhat ambiguous, but also because most commentary made upon the educational potential of games is highly relevant to the majority of genres within serious games. With this in mind, much of the references used will be serious games research that contains results and conclusions that are suitable for describing learning games specifically, and for the sake of the reader the statements presented here can be understood as statements regarding the field of serious games as well. To point out a specific example, the issue regarding the concept of *transfer* (Barnett & Ceci, 2002; Rick & Weber, 2009; Shaffer, 2012) which refers to how well knowledge acquired within one domain and through a specific mean transfers to other areas of application. Transfer is highly relevant to many aspects of serious games, and will be described later in this chapter.

### 3.3.1 LEARNING GAMES AS A FIELD OF RESEARCH

Just as the broader disciplines of games and serious games research, learning games is a interdisciplinary field of research and the methodological approaches to studying learning games as a phenomenon are plentiful and influenced by different neighbouring research disciplines (Crookall, 2010; Mäyrä, Holopainen, & Jakobsson, 2012). As previously described, game studies have in the past had a tendency to rely on methods found in fields perceived to be more established, which has led to certain identity issues as few methodologies and models existed that were specifically tailored to be suitable for studying and describing games (Crookall, 2010; Egenfeldt-Nielsen, 2006; Harteveld et al., 2010). This has in later years been somewhat ameliorated by new game-specific methodologies being developed and put to use, but there's still some confusion regarding how games can and should be studied, and this befuddlement trickles down to the area of learning games as well. Depending on what facet of learning games the researcher aims to study, different approaches are of course more or less suitable – for instance, there's pedagogical approaches that can be helpful in identifying learning elements in games or assessing learning behaviour during play sessions or learning effects afterwards, cognitive-psychology approaches that make sense of what type of heuristics are being employed during gameplay or what types of challenges the player is experiencing. But, as our understanding of games as a medium has increased more game-specific approaches are starting to surface, and we have a better grasp of how to evaluate a player's experience of certain game mechanics or audio-visual stimuli, or to identify what elements of specific gameplay scenarios are detrimental or beneficial for player engagement (Cowley et al., 2008; McLaughlin, Smith, & Brown, 2010). In learning games, approaches such as these can be beneficial to employ during different phases of a learning game's lifespan, perhaps to evaluate the quality of the game experience during play testing, or to assess if the game effectively conveys the learning content appropriate for a particular curriculum through its gameplay. This chapter will provide a brief overview of learning games as a field of research, as a development and design practice, as well as educational tools in the hand of teachers and students.

#### RESEARCH OVERVIEW

Before delving into more detailed deconstructions of the many facets of the area of serious and learning game research a brief description of how they can be approach is necessary. In *Table 3.5*, the commonly found research approaches in the field have been categorized and are tied to a couple of specific examples found in learning games as well as serious games literature, with a short description of what aspect of serious/learning games the approaches are usually aimed at investigating and a short commentary on their methodologies. The

reason for including more general serious games literature in the summary is that it's difficult to draw a clear line of distinction between what research is only applicable to learning games and not serious games, and vice versa.

The table highlights the importance of being inclusive to many different types of approaches and methodologies within the learning games discipline. Just as a learning game is comprised of a slew of different disciplines that each adds certain essential characteristics to the final product, each research approach is needed to get a complete picture of what goes into the act of making, utilizing, playing and even researching learning games. For instance, as in the cases of the research presented by Kirkley et al. (2005) and Engström et al. (2011), learning games can be examined as a practical craft, and thus research methods such as experimental prototyping and case studies of development projects can yield data that reveals details regarding the processes of learning game creation. Conversely, one can take a more distanced role as a researcher by not taking active part in the creation of specific artefacts. Examples such as Linderoth (2012a, 2012b) and Shapley, Sheehan, Maloney, and Caranikas-Walker (2011) among others who tackle the pedagogical aspects of learning games, often examine them through observation and assessments – either from the use of specific game titles or by analysing collected knowledge of general gaming behaviour and comparing it to behaviour associated with reflection and learning established in pedagogical research in order to speak for the validity of games as learning environments. The research pursuing more high-concept ontological questions regarding what a learning game is often take an even more distanced approach, and discuss the characteristics of gameplay and learning through a more philosophical and all-encompassing lens, which produces important grand scale theories and a more detailed vocabulary that assist further discourse within the field. The other research approaches described in *Table 3.5* exist within this spectrum of practice, hands-off observation and assessment, and philosophizing.

**Table 3.5:** A general overview of research foci and methodologies in learning games and serious games research – coupled with specific examples of published research.

| Category of research | Research examples | Research focus/questions | Methodological approach |
|---|---|---|---|
| Ontological research on serious games and learning games | Crookall (2010)<br>Sawyer and Smith (2008)<br>Ritterfeld and Weber (2006)<br>Squire (2007) | What is a serious game?<br>What categories of serious games are there? | Literature and product surveys<br>Comparisons with literature and products from other disciplines |
| Methodological research | Berg Marklund, Backlund, and Johannesson (2013)<br>Ennemoser (2009)<br>Kickmeier-Rust et al. (2011)<br>Garzotto (2007) | What tools can we use to better understand behaviour during 'serious' gameplay?<br>How can we assess play activity? | Experimental prototype development of games possessing specific methods<br>Case studies, applying experimental assessment methods to analyse gameplay |
| Social constructionism in and around game activity | Dirckinck-Holmfeld and Sorensen (1999)<br>Holmes and Pellegrini (2005)<br>Bennerstedt and Linderoth (2009) | What social constructs arise during, primarily multiplayer, game sessions?<br>How do games affect social interplay, and what are the pedagogical implications? | Observations<br>Ethnographic studies<br>Autoethnographic studies |
| The design of learning games | Annetta (2010)<br>Bellotti, Berta, Gloria, and Primavera (2009)<br>Harteveld et al. (2010)<br>Malone (1980b)<br>McLaughlin et al. (2010)<br>Moreno-Ger, Burgos, Martínez-Ortiz, Sierra, and Fernández-Manjón (2008)<br>Rai and Beck (2012)<br>Pereira and Roque (2009) | How can we improve on the design of serious games and learning games?<br>What types of designs work well with certain subject matters and methods of teaching?<br>How do you balance engagement and learning content? | Experimental prototype development with play-testing sessions with observations and interviews<br>Design studies, examining the validity of certain design choices through practical, purposeful application |
| Educational foundation of learning games | Annetta, Cook, and Schultz (2007)<br>Blumberg and Ismailer (2009)<br>Egenfeldt-Nielsen (2011)<br>Linderoth (2009, 2012a, 2012b)<br>O'Neil et al. (2005) | What, if any, are the pedagogical benefits of using learning games?<br>What types of learning elements do games really possess? | Ecological research that studies the way players approach game tasks<br>Literature comparisons, commonly between pedagogy and game studies<br>Coupling pedagogical practice to specific game characteristics |
| Cognitive / Psychological processing in gameplay | Alexandersson, Linderoth, and Lindö (2001)<br>Ko (2002) | What types of cognitive processes are being put to use in a particular gameplay challenge?<br>Which types of heuristics do certain games require? | Observing play-sessions<br>Think-aloud methodologies<br>Ecological research and discourse analysis |
| Learning outcomes and the effectiveness of learning games | Garzotto (2007)<br>Guillén-Nieto and Aleson-Carbonell (2012)<br>Schoppek and Tulis (2010)<br>Squire et al. (2004) | How effective are games as learning tools?<br>What learning outcomes can be seen from the use of learning games? | Mixed method used to compare learning games to other educational processes<br>Assessing increased computational or conceptual understanding during play sessions<br>Experimental prototype development and evaluation |
| Development of learning games | Engström, Ambring, Dahlin, Sjöstrand, and Håkansson (2011)<br>Eladhari and Ollila (2012)<br>Kirkley, Tomblin, and Kirkley (2005) | What does the process of creating a learning game look like?<br>What challenges do the developers and clients face, and how can they be overcome? | Experimental prototyping<br>Case studies, following development projects alongside clients and/or developers |
| Learning games' as tools in their intended context | Alklind Taylor and Backlund (2011)<br>Egenfeldt-Nielsen (2008, 2010)<br>Nilsson (2008); Nilsson and Jakobsson (2011) | What's the nature of the context where the game is being used?<br>What's the role of the teacher, and how is briefing/debriefing handled?<br>How does the game fit into the broader organization? | Case studies, examining situations where learning games are put to use<br>Observing play sessions and interviewing players are common approaches |
| Perceptions of learning games | Tan et al. (2012)<br>Ruggiero (2013)<br>Wastiau, Kearney, and Van de Berghe (2009) | What opinions do teachers, students, legislators, and parents have towards using games as learning tools? | Interviews, surveys and questionnaires |

Looking at the examined examples provided in Table 3.5, it is also apparent that qualitative methodologies and mixed methods are common approaches to studying many facets of learning games. But, in a few research areas, such as the evaluation of learning outcomes and perceptions of games as educational tools, a more quantitative approach is taken by employing more rigid experiment methodologies and detailed surveys respectively (Schoppek & Tulis, 2010; Tan et al., 2012). A couple of common approaches when it comes to learning outcomes, for instance used by Schoppek and Tulis (2010) and Garzotto (2007),

is to compare outcomes from learning games with other educational methods or measuring the increasing game proficiencies in students that play learning games (Egenfeldt-Nielsen, 2006).

### 3.3.2 THE EDUCATIONAL POTENTIAL AND SHORTCOMINGS OF LEARNING GAMES

A good place to start when describing the nature of learning games is to look at what gives them their raison d'être. From the perspective of educators, games are viewed as a medium in which the current generation excels. Students navigate game environments with ease and regularly employ methods of problem solving, engage in advanced collaborative efforts and communicate complex concepts to one another during their private gaming sessions at home (Bogost, 2007; Egenfeldt-Nielsen, 2006; Gee, 2003). Seeing students relish in and master activities that are fundamentally analogous to what teachers work very hard to interest them in during their time at school is of course a big catalyst for wanting to harness "the power of games" for educational purposes (Kickmeier-Rust et al., 2011; McClarty et al., 2012; Shapley et al., 2011). The basic premise that fuels the ambition to use games for educational purposes is just that observation: advanced problem solving, collaboration, and the invention and communication of ideas and solutions in a technology-mediated setting encapsulates the 21st century skills education should focus on (McClarty et al., 2012; Shapley et al., 2011) and students seem to eagerly devote several hours per day doing these things on their own, so let's take the same types of experiences and lift them into an educational setting. Much of the research within the field has been looking at games in the same way, and has focused on scrutinizing these traits of games and explaining if and how games teach, often juxtaposing pedagogical principles with principles of game design (Egenfeldt-Nielsen, 2006; Gee, 2009; Malone, 1980b).

Many researchers support the notion that games possess various laudable educational qualities based on the characteristics that define the medium (Linderoth, 2009). This often stems from the understanding that the basic premise unique to the medium is that the player develops mastery within a very specific domain, i.e. the game world he/she currently inhabit, in order to progress and achieve goals presented by the game (Gee, 2003; Kirkley et al., 2005; Malone, 1980b). Well-made entertainment games are designed with an incremental difficulty increase and scaffolding principles that "ease" the player into the game world initially and then gradually presenting more tools and opportunities to interact with the world as well as new problems and challenges for the player to solve (Gee, 2003; Kickmeier-Rust et al., 2011). So, in their essence, entertainment games seem to incorporate the core educational principles of scaffolding and problem-based learning to a great extent and also with great success as players' proficiency in most games increases quite rapidly as they play (given that the game is decently designed and put together) (Annetta, 2008; Annetta et al., 2007). In addition to this, games also have a unique way of engrossing the player in a subject matter (Cowley et al., 2008). These are the more common arguments that favour learning games and fuel many researchers' and educators' efforts into understanding, creating, and using them (Linderoth, 2012b), and the question that has often been asked is: how can the high levels of engagement the player experiences and the immense effort they exert to master a game be channelled elsewhere (Annetta, 2008)?

To give a more nuanced and detailed description of the way games cater to pedagogical principle, we can look at the basic categorization of **behaviourist**, **cognitivist**, **constructivist**, and **sociocultural** learning principles and how they manifest in different types of gameplay. As the understanding of knowledge and learning has progressed, the nature of learning games has progressed with it, and design trends can often be directly connected to contemporary teaching practices (Egenfeldt-Nielsen, 2006). The most common types of learning games have historically been the ones based on behaviourism.

Behaviourism is in essence the principle of teaching correct behaviour and action through the use of positive or negative reinforcement, and has its origins in the works of researchers like Skinner, Pavlov and Thorndike (Egenfeldt-Nielsen, 2006; Mödritscher, 2006). In the behaviourist paradigm, the internal functions in the mind of the learner are largely irrelevant, and more emphasis is placed on the observable reactions the learner has to external stimuli (Mödritscher, 2006). In an educational context, this could for example mean rewarding a student in some way when they have correctly solved a number of math equations to encourage persistence of that specific behaviour. A behaviourist approach is very suitable for learning through repetition, as correct actions can be repeatedly rewarded and encouraged and the pattern of behaviour and reinforcement can be solidified (Egenfeldt-Nielsen, 2006). The relatively straightforward principle of action and reinforcement has made the behaviourist approach common in learning game design in the past, as that is essentially how digital games themselves were designed throughout the 70s, the 80s and the early 90s (Egenfeldt-Nielsen, 2006).

However, while behaviourist learning games have been severely declining in popularity the past decade due to their simplicity and somewhat archaic learning principles (Ito, 2009), they shouldn't be totally dismissed. While it is true that behaviourist titles don't develop the player's conceptual understanding of a certain subject matter, repetition and reinforcement can still be an efficient way of practicing computational skills or developing a positive association to certain behaviours (e.g. calculation or spelling, or healthier eating habits) (Egenfeldt-Nielsen, 2006). During the 90s, the reliance on behaviouristic principles declined in educational settings and along with it behaviourist game titles became increasingly sparse.

The behaviourist perspective of learning game design has since been replaced by several other approaches to learning: cognitivism, constructivism and socioculturalism (Egenfeldt-Nielsen, 2006). Cognitivism and constructivism share many commonalities and are primarily focused on supporting the processes being employed by an individual when they develop and understanding of the world around them (Mödritscher, 2006). Cognitivism focuses heavily on the learner, and more specifically the cognitive schematas that underpin human perception and understanding (e.g. memory, reflection, and meta-cognition) (Egenfeldt-Nielsen, 2006; Mödritscher, 2006). As opposed to the behaviourist model, the cognitive approach is based on the idea of intrinsic motivation to learn and discover the nuances of a subject matter by self-incentivized exploration. Thus, the cognitivist approach to learning games view them as an autotelic process in which the act of learning has purpose in and of itself and shouldn't be encouraged by arbitrary extrinsic rewards. The constructivist perspective has a similar outlook on learning but place more focus on the objects that facilitate the learning process and the learner's ability to construct knowledge on their own rather than looking at the cognitive processes of the individual. In terms of gameplay, both cognitivist and constructionist principles manifest in games that encourage exploration and discovery, but they do so for slightly different reasons. A cognitivist learning game incorporates the taught subject matter in the gameplay, and will challenge the player's ability to master the game's vocabulary to solve problems. The problems will be increasingly difficult and further challenge the player's ability to approach the problem and figure out efficient procedures for solving them. Constructivist games don't fixate on incorporating content that accurately represent the taught subject matter into the gameplay to the same extent, and often don't have the same increasingly challenging problem design. Instead, they focus on equipping the player with the tools necessary to express and explore concepts and ideas relevant to the subject matter. Here, the game becomes a vessel for creative expression where students have the opportunity to build, test, observe and reflect on relationships between objects in the game world and thus construct a nuanced understanding of a subject matter:

> In a constructionist perspective… the challenge is not to design an educational video game with relevant content. Rather, the hard challenge is to facilitate playing that makes the player engage with the material, discuss it, reflect on it, and use the video game as a means for constructing knowledge. (Egenfeldt-Nielsen, 2006, p. 198).

Both the cognitivist and constructionist approach have their own challenges and issues associated with them. As they take the more ambitious stance of wanting the player to develop their conceptual understanding of a subject by exploration, discovery, and reflection, the primary issue lies in the transfer of knowledge from the game-world to the real-world (Rick & Weber, 2009; Shaffer, 2012). We need to be certain that the game-worlds accurately describe the nuances of a subject matter and are articulate enough to make sure that the player: a) learns correct information that corresponds with cause-effect relationships in the real world, and b) is given the proper set of tools to explore the nuances of the subject matter without either being led through a pre-established cause-effect situation that negate exploration or make them able to just brute-force their way through the game.

Finally, the sociocultural approach to learning advocates the importance of providing a wider context in which learning can take place (Egenfeldt-Nielsen, 2006). In this paradigm, learning and knowledge is considered to only be "real" or occurring insofar as it is anchored in a broader social and cultural context (Hall, 2007). An individual's social and cultural situation will influence the way (s)he creates meaning and cognitive representations, and the social and cultural context also provide the forum for discussing, reflecting, and sharing gained knowledge (Grabinger, Aplin, & Ponnappa-Brenner, 2007; Hall, 2007). As is the case with constructivism, games that facilitate sociocultural learning processes are required to be open to creative expression and experimentation, but also for socialization. In this case, the game will serve as a basis for discussion and can contextualize a subject matter in a virtual environment – the content of the game is however secondary to the broader educational context it is placed in (Egenfeldt-Nielsen, 2006). Thus, games of this nature places a lot of onus on teacher participation, as teacher-student interactions are crucial in framing the game experience and content in a correct way.

Understanding basic limitations of learning games has also been an important branch in learning game studies and our understanding of how games work as pedagogical tools. Whether games can teach at all is often considered axiomatic at this point in time; if we agree that they are systems that can contain and convey information it would be unreasonable to dismiss the idea that the conveyed information can have some staying power in its recipients. But there are still shortcomings of games as a medium that are highly relevant to learning games. One of the major, more long-standing and recently better understood shortcomings speaking against the teaching potential of learning games is explained by Turkle (1995). From her observations in the game *SimLife: The Genetic Playground* (1992), Turkle distils the problem of knowledge transfer between simulations and reality as an issue of opaqueness in game systems:

> Games such as SimLife teach players to think in an active way about complex phenomena… But they also encourage people to get used to manipulating a system whose core assumptions they do not see and which may or may not be 'true'. (Turkle, 1995, p. 70)

The basic critique is that oversimplifications and false assumptions made in favour of keeping the game-world accessible to players will lead to the players applying the same assumptions they can make in the game to the real world as well, in essence leading to games being faulty and perhaps dangerous teaching tools. This premise often rings true and has been increasingly ratified by researchers and developers (Kirriemuir & McFarlane, 2004; Ko, 2002; Linderoth, 2009; Whitebread, 1997).

An elaboration of this concept is Linderoth's more recent examinations of skill and knowledge-development in video games (2009, 2010). While refuting the inherent nature of games as learning environments, which is a proposition supported by many in the wake of Prensky's (2001) and Gee's earlier work (2003), it further defines the chasm between the craft of game development and serious games development. What Linderoth is critiquing is that the assumption of there being a "... hidden educational grail [in video game design] just waiting to be found and utilized in schools" (Linderoth, 2012b, p. 46) and that this belief rests on a certain amount of ignorance regarding the basic tenets of game design. Linderoth (2009, 2012b) states that if a game environment isn't properly designed to specifically facilitate learning, the players are unlikely to learn anything but the manipulation of game mechanics. As many games are designed around the idea of narrative progression, treating the medium as inherently developmental for skills or knowledge is a false assumption as progression can be, and often is, artificially supported in games to allow players to circumvent too laborious performance practice or exploratory learning while traversing a game (Linderoth, 2009, 2012b).

Linderoth (2009, 2012b) examines the implications of this issue by applying an ecological approach to learning to examples of gameplay, and specifically uses the concept of affordances to point out the fundamental differences between good learning environments and good game design. Referring to the works of James and Elaenor Gibson, Linderoth (2009, 2012b) states that the idea of affordances is:

> ... that an environment with buildings, nature, different objects, humans and animals offers the individual different ways of acting. These offers are called affordances and they are relative to an organism (relative between species as well as between individuals). Water affords breathing for a fish, but not for a human. A chair affords sitting for an adult, but not for an infant. (Linderoth, 2009, p. 10)

An individual develops an understanding of their affordances by exploring and investigating; what can I do with a tree, or a guitar, or what new affordances does a step ladder provide me since it expands my ability to interact with environment, etc. In the real world, people develop the understanding of objects' affordances gradually by exploration and mastery (Linderoth, 2009). The issue is that games often take authority over identifying and utilizing affordance through the use of visual cues, modifying them with power-ups or changing them through other design methods (Linderoth, 2009; Linderoth, 2012b). The players are provided with shortcuts in the game environment that lessen the need for the player to explore, practice and learn as they can just follow these cues and methods to progress. Linderoth's research is not a complete dismissal of the notion that games can be tools for learning, but it's a clarification that games aren't inherently educational and need to be carefully designed to teach in order for the player to learn something, and that such designs may need to deviate significantly from what is usually associated with "good game design" (Linderoth, 2009; Linderoth, 2012b).

Closely tied into Linderoth's claims is another central issue that was briefly mentioned earlier on in this chapter and is often brought up when discussing the pedagogical validity of learning games in general: the issue of knowledge transfer (Tobias, Fletcher, Dai, & Wind, 2011). Transfer refers the transferability of skill and knowledge developed and honed in one particular domain into other domains. Or, more specifically in the case of learning games and serious games – the transfer of skills and knowledge developed in a digital game environment into real world scenarios (Gee, 2003; Rick & Weber, 2009). The core of the problem is the possibility that perhaps the only thing the player learns from playing a game is how to play the game better (Shaffer, 2012). If the skills and knowledge a student has learned inside the game environment can't transcend the virtual world and become useful applicable knowledge in the real world, the learning activity has in the end been a failure, so it's a very important issue to examine closely. This specific issue is especially crucial

when we discuss learning games that are self-contained systems, where there aren't debriefing sessions and discussions coupled with the game session where a teacher or peers can contextualize the learning content from the game and generalize it so that its real-world application becomes more apparent (Tobias et al., 2011). Transfer is an established concept within psychology that is used to describe the level of generalizability of learned skills or knowledge (Barnett & Ceci, 2002). Knowledge that is closely tied to a very specific domain and cannot be applied to understand concepts outside the domain where the knowledge originated is classified as near-transfer and can be considered as relatively shallow (Shaffer, 2012). Conversely, knowledge that is generalizable and can transcend boundaries and provide insights to several domains possesses far-transfer (Barnett & Ceci, 2002). In the field of learning games, this is a very important issue to tackle since a lack of transfer renders educational game activities rather pointless. It's also an issue that isn't really fully understood at this point in time. While behaviouristic game titles where you practice math equations can be considered to have straight-forward transfer, the learning games that take on different types of pedagogical principles in their game mechanics can have a more difficult time discerning how gameplay translates to real-world knowledge. To provide a bigger picture, however, learning games and serious games aren't the only fields that struggle with this issue as the effectiveness of more traditional educational procedures (lectures, text-books, educational films) are being questioned on the same basis. In fact, in their extensive deconstruction of transfer, Barnett and Ceci (2002) point out how researchers within the field of psychology are still in disagreement of whether transfer is possible from text-book or classroom instruction after extensive debate spanning more than a century. This is sometimes used as an argument to support using games for education, as the issues of transfer in traditional educational processes could perhaps stem from the emphasis on passive participation and observation from students, and that the ability to experience subject matters and experiment with them on one's own could be a way to create deeper rooted understanding of the concepts of a subject and increase transfer (Aldrich, 2005; Tobias et al., 2011).

### 3.3.3 ASSESSMENTS AND LEARNING OUTCOMES IN GAMES

Research that evaluates the effectiveness of learning games and describes their effects within formal educational environments is sparser than other venues of research within the field (O'Neil et al., 2005), and there's frequent calls for more empirical studies that can speak to the educational effectiveness of games (McClarty et al., 2012; O'Neil et al., 2005; Srinivasan et al., 2008). There have certainly been many attempts to specifically point out how effective certain games are in certain contexts (Gee, 2011), but many research projects suffer from questionable methodology and execution (Egenfeldt-Nielsen, 2006; Tobias et al., 2011). Many researchers point out issues with ecological validity in particular, and point out that the results from studies were rarely generalizable to learning games usage outside of environments constructed for research (Egenfeldt-Nielsen, 2006; Hays, 2005; Linderoth, 2009; Tobias et al., 2011). In short, there's not much one can say with precision or confidence regarding the effectiveness of learning games, but there's plenty to say about the research focusing on examining that particular aspect of them. In an extensive review of research efforts in the field, Tobias et al. (2011) described the research foci and outcomes for 95 studies on the learning effects of games conducted between 1985 and 2011. The results of the overview was that the conducted research indicate that games hold some promise for the delivery of instruction (Tobias et al., 2011), but that this conclusion should be used cautiously due to certain problems with many of the research efforts presented in the paper. The same results regarding common conclusions in the field were made in other similar research overviews done by Hays (2005), Egenfeldt-Nielsen (2006), and more recently McClarty et al. (2012) as well. While most of the research reviews in the area of

games with an educational purpose differ on certain details, a unifying conclusion between all of them is that there's insufficient data to be certain of whether games are particularly effective teaching tools regardless of which pedagogical principle you want to use as a point of reference (McClarty et al., 2012). It should be noted, however, that lack of conclusive evidence of how effective games are as learning tools isn't the same as proof that no learning can occur in games – it's mainly a question of what the circumstances for learning in games are, and on that point the jury is still in session (Egenfeldt-Nielsen, 2010). One outcome that most research and research reviews support in favour of learning games is that there seems to be sufficient evidence to prove that the retention of student interest and motivation to interact with learning material is increased when games are used as the educational tool (Hays, 2005; Klopfer et al., 2009; McClarty et al., 2012; Tobias et al., 2011; Wastiau et al., 2009).

When evaluating the educational effectiveness of learning games researchers often aim at finding a balance between engagement and learning in their studies – they often evaluate what has been learned, and how engaging the learning process was in the eyes of the student (O'Neil et al., 2005). Many studies are aimed at speaking for the educational outcomes of using learning games instead of using what is often referred to as "traditional teaching methods" and make statements both regarding whether the players learned anything, and how fun or engaging the learning activity was for them (McClarty et al., 2012). In essence, the promise of learning games as environments where learning can happen in an engaging and experiential way marks out a framework which research in the field often follows as researchers often conduct studies where the validity of this promise is examined.

### 3.3.4 THE DESIGN OF LEARNING GAMES

As described in 3.2.5, it's important to make a clear distinction between development and design when talking about the games medium. The design process is a crucial aspect of the development process, but they are far from synonymous. Questions regarding game development processes concerns the challenges one faces during the act of realizing a game concept, for instance how to ensure that the programmers and graphic artists can work together smoothly, how to work with agile development processes, or understanding how the requirements from a client are interpreted and handled throughout a learning game development project. Questions pertaining to the design of a game is, however, focused at investigating the characteristics of the game, how its rules affect the relationships between players in the game, or how the theme of the game affect how a player perceives the game (refer to chapter 3.2. for a more detailed explanation of game design and development). This chapter will provide a description of different approaches to designing learning games, which is to say different approaches to conceptualize the mechanics of the game and balancing all the elements that goes into the learning game experience.

The design of learning games is interesting in that it's a practice that is torn between the challenges of designing a good game and the challenges of designing a good conduit for educational content. In short, good learning games have to take player engagement into consideration, while also containing content that is appropriate for the subject matter being taught (Aldrich, 2005; Egenfeldt-Nielsen, 2011; Harteveld et al., 2010). To this day, very few learning game projects get the mixture exactly right (Harteveld et al., 2010), and either result in a game that may provide lots of enjoyment but have dubious educational elements or the opposite; a game that is packed with accurate and detailed educational material while the gameplay instil distain rather than engagement (Klopfer et al., 2009).

In order to make the discussion in this chapter more manageable, I've divided the approaches commonly taken in learning game design into four camps: the **learning-in-gameplay** camp, the **gameplay-in-learning** camp, the **gameplay-first** camp, and the

**learning-first** camp. This classification has taken inspiration from Egenfeldt-Nielsen's (2006) overview of the research and educational uses of learning games. It should be noted that the presentation of these camps is a bit simplistic and doesn't do justice to all the nuances that can be found in research and practice of learning game design, but it can hopefully provide a solid and brief introduction to key practices found in the discipline.

The **learning-in-gameplay** camp focuses on how learning content can be tied to gameplay elements to solidify a connection between engagement and learning during an educational gaming activity. The basic tenet is that if the same characteristic of the game that generates engagement and motivation, that is to say the challenge of the gameplay, is synonymous with what the player is supposed to learn by playing, and that tying the two together is a good recipe to ensure an efficient learning environment (Annetta, 2010; Squire et al., 2004). This approach can be considered a response to the early critique of learning games that questioned whether progressing through a game actually meant learning anything other than game mastery, regardless of the game's trappings. The critique is still often quite relevant to many learning game titles, but it was particularly so during the edutainment era where the fun of the gameplay was often very separate from the learning aspects of a game – for instance it wasn't uncommon to see games that just interspersed regular school exercises (e.g. solving math equations, vocabulary exercises, geography quizzes, etc.) with some gameplay elements found in popular entertainment games (Egenfeldt-Nielsen, 2011; Habgood & Ainsworth, 2011). What the learning-in-gameplay approach does to ameliorate this is to pay closer attention to how the subject matter can be translated into gameplay mechanics, and understanding that not all types of game mechanics are appropriate for certain subject matters (Habgood & Ainsworth, 2011). For instance, subjects such as social studies or biology that trade heavily on understanding broader concepts and correlations between factors rather than computational skills is probably not a good fit for a game with strict linear gameplay that inhibit free experimentation, but perhaps require an open game environment where these concepts can be explored in depth.

The **gameplay-in-learning** camp sees the game as something you fit into a larger educational context, and thus the game's design needs to accommodate for this in different ways. In essence, these types of learning games often place much emphasis on the social aspects and context surrounding them and figures out ways to work with those elements in tandem with the learning game artefact (Bennerstedt & Linderoth, 2009; Egenfeldt-Nielsen, 2006; Garzotto, 2007; Nilsson, 2008). This approach acknowledges that perhaps all aspects of the learning process cannot or should not be contained within the game packaging, and that there's much to gain by making the student pause and step out from the "gaming frame of mind" in order to discuss, analyse, and reflect upon the material that they've been presented with inside the game world (Crookall, 2010). These periods of reflection and deliberation can be encouraged in many different ways, and often places responsibility on the teachers to be involved in the gaming activities so that they can coach and lead the classroom discussions that are facilitated with the students' shared experiences in the game (Alklind Taylor & Backlund, 2011; Annetta et al., 2007; Shapley et al., 2011). The game *Global Conflicts: Palestine* (2007) is an example of this practice. Global Conflicts: Palestine is packaged with a teacher manual that explains what the students are experiencing in different parts of the game, and how the teacher can guide the discussion appropriately after each gaming session. In the game, the student takes on the role of a journalist in the Israel-Palestine conflict, and the student is tasked with researching and writing about different types of scenarios in one of the more turbulent locales in the conflict. As the student sees events transpiring and interviews people from both sides of the conflict, the game encourages the use of physical note-taking, so that the students are taken out of the virtual world during their sessions. So in essence, learning

game designs that follow the gameplay-in-learning approach try to implement mechanics into the game that encourage deliberation and reflection by interrupting the gaming activity or requires that the student uses knowledge that they have gotten outside of the game world (perhaps from a conjoining classroom discussion) to solve certain challenges (Egenfeldt-Nielsen, 2010).

Proponents of the **gameplay-first** camp is of the persuasion that in order to create a good learning game title, one needs to always prioritize gameplay when facing a dilemma between trying to provide verisimilitude, granularity, and accuracy of the represented subject matter or create engaging gameplay scenarios. In this camp, there's a lot of emphasis on the aspect of learning games that is essentially the point of using a game to teach rather than a book or film, i.e. the interactivity and experiential aspects that games and gameplay provide (Annetta et al., 2007). The gameplay-first approach can be suitable in situations when you want to raise some awareness of a certain subject matter, but aren't too concerned with the outcomes of the gaming activity beyond that point. The learning game can in these situations be an entry-way for students to start getting interested or scratch the surface of some subject that they previously weren't inclined to investigate at all (Ruggiero, 2013) – but since the gameplay is highly prioritized some follow-up with the students to discuss the finer details of the subject matter and to make the activity more educational becomes necessary. An example of this approach is the game *Testament* (2010), a game developed in Sweden to be used in bible studies, and the developers were approached by the Church of Sweden as they saw games as a potential way to raise interest in youths to learn more about events and notable persons from the bible (Engström et al., 2011). In Testament, the player gets to experience iconic events depicted in the bible by taking on the mantle of an angel that help recognizable biblical characters through these events by fighting evil-doers head on and protecting the innocent. The game has very high production values and is well crafted to be an engaging and fun experience as it takes inspiration from the popular entertainment game *Diablo* (1996) and its sequels, but it also contains biblical icons and lines of scripture that players can dig into if they want to get more substance and background regarding the events portrayed in the game (Engström et al., 2011). In conjuncture with gameplay sessions, the teacher can then also follow up with the students to discuss experiences and contextualize the game events to bible passages and events. In that way, this paradigm is similar to the gameplay-in-learning one. The primary distinction lies in the heavier emphasis of using gameplay to introduce and raise interest in a subject matter, and while learning outcomes may certainly occur in these types of games as well they are not as studiously defined and planned out as in gameplay-in-learning designs.

Finally, the **learning-first** camp prioritize the representation of learning content over gameplay quality. As opposed to the gameplay-first approach, this one is seldom concerned with how the gameplay intersects with the learning content, the learning content is the focal point and the gameplay is added as a layer on top of it, often just as an attractive packaging of the content. This was a common occurrence in the edutainment era and learning games designed in this way are often pejoratively referred to as "chocolate-dipped broccoli" (Bruckman, 1999; Habgood & Ainsworth, 2011) or "chocolate-coated cod liver oil" (Sharp, 2011). This approach to learning game design seldom results in successful products, and it is perhaps most often found in projects where developers are uncertain of how to combine the wishes and ambitions of a client with engaging gameplay features (Klopfer et al., 2009). In such situations, a developer is often prone to prioritize the client's requirements for inclusion of learning content over interesting gameplay ideas, and it can result in games that recite information regarding a subject matter at length, interspersed with some minor gameplay elements. But that isn't to say that learning-first designs are only products of miscommunications between game developers and educators, they can

often be found in products where certain types of elements commonly found in games are superimposed on learning activities (Habgood & Ainsworth, 2011). Here, one can imagine a math curriculum being executed in a game environment where the students solve math equations just as they would if they worked with a school book, but they are awarded with points or badges, or they get some minor gameplay challenges such as time-limitations, in an attempt to keep their motivation for the subject matter up. This school of thought often suffers the critiques towards learning games mentioned earlier, where the game elements and challenges are disconnected and quite superfluous to what the student is intended to learn, and in many titles the gameplay can be so understated in the design that it's difficult to justify calling it a learning game at all instead of just an e-learning tool or instructional software (Egenfeldt-Nielsen, 2011). The design method is also for this reason sometimes associated with the gamification movement, and it's currently a hot topic of discussion as it is widely critiqued by many researchers for relying too heavily on extrinsic rather than internal motivation (Bellotti et al., 2009; Bogost, 2008; Guillén-Nieto & Aleson-Carbonell, 2012). Bruckman (1999) summarizes this paradigm as an attempt to make learning processes more pleasant by "add[ing] pretty graphics and breaks to play more fun games, which have nothing to do with the content that kids are supposed to be learning" (1999, p. 75).

These four approaches to learning game design each have their benefits and shortcomings, and can be suitable in different types of educational contexts and situations. Certain design styles have risen and fallen from popularity throughout the years both as our expectations of games change and how pedagogical processes change (Egenfeldt-Nielsen, 2006), and the type of design approach used by a developer can also vary between each development project depending on what the intended audience for the game is (similarly to how it changes in entertainment game development) (Klopfer et al., 2009). As we have seen in all the different approaches to learning game design, the central variable differentiating them is how they tackle the dilemma of balancing learning content and gameplay within a single type of gaming experience. Some of the approaches sympathize more with the educational side of the spectrum, and others veer more towards just focusing on engaging gameplay (Engström et al., 2011), but the more successful approaches that have been gaining traction in later years are the ones who place themselves somewhere in-between. A good example of how the discussion regarding the learning and gameplay dilemma has evolved throughout the decades is the model of *Triadic Game Design* developed by Harteveld et al. (2010). While not specific to educational games (it originated from research within the broader field of serious games), it encapsulates the difficulties a developer faces when setting out to make a game with an instructional purpose. In an extensive design study of a serious game's development process, Harteveld et al. (2010) developed a design philosophy for how developers can approach the task of designing a game with client-imposed requirements. The design philosophy provides some insight into how complex the task of designing a serious game is since the requirements of purpose and outcome lead to "design dilemmas" since some requirements can be contradictive to certain types of designs that are sound according to philosophies of entertainment game design (Harteveld et al., 2010). The philosophy specified play, meaning, and reality as the three crucial aspects that need to be present in any serious game, and describes the dilemmas one faces when balancing the three against each other (as seen in *Figure 3.3*).

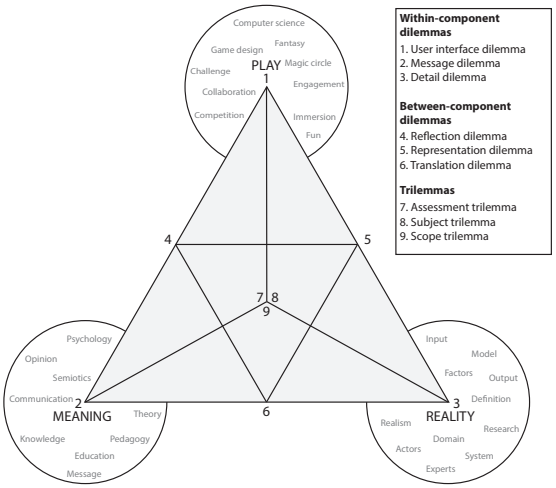


**Figure 3.3:** The Triadic Game Design model as it is described and depicted by Harteveld et al. (2010)

In the model, the challenges mentioned in the descriptions of the four camps of learning game design are described in more detail. For instance, when a serious game designer is trying to make the game experience meaningful as well as engaging, the designer faces the dilemma of how opportunities of reflection and analysis can be included while also making sure that the pacing of the game maintains engagement or the flow of the experience. Such a dilemma needs to be considered, and a good compromise or deliberate concessions on one of the aspects need to be taken. So, depending on which design approach one subscribes to when creating serious games, one would be faced with different types of dilemmas (or in the case of the Triadic Game Design model, "trilemmas" as well). For instance a game ensconced within the gameplay-first paradigm would be occupied with challenges found in the *Play* section of the model, whereas a game developed with the gameplay-in-learning approach would be concerned with the dilemmas and trilemmas found between the three primary poles of the model.

A broader description of these values and how one can strive towards them in the design of a learning game is also given by Egenfeldt-Nielsen (2011), who categorizes the challenges of making a good learning game into the challenge of *integration*, the challenge of *motivation*, and the challenge of *focus*. In this particular work, Egenfeldt-Nielsen (2011) summarizes the previous research within the field of learning games and contextualizes it with his own experiences as both a researcher and developer. The integration challenge speaks to the importance of connecting gameplay challenge closely with the learning goals of the play activity, as previously mentioned in the learning-in-gameplay description. This is coupled with the importance of making sure that the challenges that the game provides are intrinsically motivating to the students. That is to say that the willingness and eagerness to understand and master the game better, and thus also understanding the learning content better if it is tied to the game challenges well, needs to be the driving force behind the learning process. According to Egenfeldt-Nielsen (2011) and many other researchers, this is an area where learning game design can benefit from borrowing theories found in entertainment game design and educational psychology (Blumberg & Ismailer, 2009; Ennemoser, 2009). The challenge of focus pertains to the challenge of making sure that the game doesn't contain superfluous gameplay that detracts from the learning at hand. This is a difficult concept, but in essence it's of grave importance that the gameplay is stripped down to the necessities that are needed to convey the learning content in a challenging way. With a lack of focus, too much valuable classroom time can be lost on

students being occupied with irrelevant gameplay activities, a comparison here could be a history text-book containing paragraph upon paragraph explaining the writing process of the book rather than delving into the specifics of historical events. The authors perspective and process may be interesting in and of itself, but it doesn't bring much to the table when it comes to teaching students useful history knowledge and mainly only helps the student understand the nature of that specific text-book. Learning games can fall into the same trap as well, and contain many gameplay elements that aren't conducive to understanding the taught subject matter, but are only valuable for being more informed or a better player of that specific learning game. Once again, we can see the four approaches mirrored in these challenges, and each design approach tackles them differently or disregards some of the challenges entirely. For instance, the learning-first approach often falls short on the motivation as well as integration side of learning game design, but is very focused on just conveying the subject matter. Egenfeldt-Nielsen's challenges can also be traced back to other research efforts that elaborate on them, such as Linderoth (2009), Nilsson (2008), Malone (1980b), and Habgood and Ainsworth (2011) when it comes to challenges of integration and motivation, and the works of Blumberg and Ismailer (2009) and Westera et al. (2008) when it comes to focusing a game's design to the bare essentials.

### 3.3.5 THE DEVELOPMENT AND USE OF LEARNING GAMES

In contrast to how learning games' educational potential and design have been under scrutiny by many researchers throughout the decades that digital educational games have been a topic of discourse, deliberations on the processes through which they are developed are quite rare (Kirkley et al., 2005; Klopfer et al., 2009). While different design approaches have been invented and put to use to provide new ways of balancing engagement with learning, there hasn't been much progress when it comes to finding sound methods for how learning games can be developed to ensure that the end product is useable. As described earlier, discussing the design of games is useful for examining the inner workings of them and how different game elements can fit together to create an experience. But, merely understanding this aspect of games is like understanding how ingredients come together to make a delicious dish without knowing the process of mixing them together, which cooking utensils to use or even how to set the table for people to be able to enjoy it once it's done.

The lack of a sound "cooking" process and the effects of ad-hoc and haphazard development practice can be made clear by juxtaposing the willingness and efforts to embrace learning games and the resources spent creating learning games, with the amount of successful applications of learning games being used in formal education. First off, it's been proven that teachers aren't averse to using digital games as part of their curriculum. In a study conducted in 2009 by Wastiau et al., including over 500 teachers from 27 European countries, 70% of the teachers polled already had some experience using games in school activities, 60% of the teachers not yet using games were interested in starting doing so, and as few as 10% of the polled teachers were of the opinion that games have no place in schools. A similar effort was done in the US, where 1048 in-service and 656 pre-service teachers were surveyed on their opinions and experiences with using games during their classroom activities (Ruggiero, 2013). While there were variations in the amount of teachers who had experience of using games for teaching compared to the European study (46% in the US as opposed to the 70% in Europe), a common overall opinion were that games could play a role in classroom activities (Ruggiero, 2013). But, as opposed to the positive attitudes being the majority in Europe, more than half of the polled teachers in the US had no inclination to use games in their teaching (Ruggiero, 2013). Here, it's important to keep in mind that the two surveys were conducted differently, with different types of surveys and questionnaires, but the differences in their results do indicate differences between US and Europe in terms of practice and attitudes. Regardless of the positive

attitudes towards game usage in the US being in the minority, there's still an audience of significant size that are eager to use games in formal education. If we couple this with the fact that learning games have been pursued both in research and development for over 40 years (Egenfeldt-Nielsen, 2006), and the increasing amount of game titles, publications, conferences and development efforts in later years, it would be reasonable to expect more well-established successful applications of the concept (Egenfeldt-Nielsen, 2010; Klopfer et al., 2009). While games are evidently being put to use in classrooms today, the prophesized impact of learning games haven't yet been as big as many would have hoped or anticipated. Lately, more research efforts have been put into understanding why that is, and much research points back to the lack of the developers' "cooking" skills (Egenfeldt-Nielsen, 2010; Klopfer et al., 2009), but also is a certain lack of "eating" skills among teachers as well (if we are to continue this analogy further) (Egenfeldt-Nielsen, 2008; Ruggiero, 2013; Wastiau et al., 2009).

In chapter 3.2.5, the situation for entertainment game development was briefly examined and described, and in summary the development processes used in entertainment game development are still hard to pinpoint or generalize as different studios have very different traditions of practice that they've tailored to their own working situations and specific types of projects (Hagen, 2012; Irish, 2005; Rollings & Adams, 2003). For instance, in his dissertation dealing with how design decisions were instigated and kept intact during big game development projects, Hagen mentions that entertainment game developers stick to their own ad-hoc practices that change slightly between projects (Hagen, 2012). When it comes to learning games and serious games, developers have additional pressures and requirements that their end product needs to adhere to once they're finished (Macklin & Sharp, 2012), and we still don't have a very good grasp of how this affects the development processes of these types of games (Annetta, 2010).

The same is true on the educators' side of the fence. There are few described processes regarding how games can be implemented into classrooms and learning activities, and many schools are struggling with even having the basic technological infrastructure to reliably support game-activities in classrooms (Egenfeldt-Nielsen, 2008; Klopfer et al., 2009). Beyond technological infrastructure, there's also the issue of the teacher needing to know how to tie learning games into their curriculum.

### 3.3.6 A BRIEF DISCUSSION OF GAMIFICATION

Before concluding this overview of serious games and learning games it's important to mention and make a clear distinction of the types of serious games and learning games mentioned during this research, and the now quite popular concept of gamification. Gamification is a term that has been rapidly proliferated in recent years, and much like other terms pertaining to make distinctions between different practices within the gaming community its meaning will vary depending on whom you ask and even the origin of the term and its intended use is somewhat unclear. The website gamification.org states that the term was birthed march 2004, according to Wikipedia it was coined in 2002 but has its roots in Charles A Coonradt's *The Game of Work* from 1984, and according to Deterding et al. (2011) the first use of the term was documented as late as 2008.

In their paper investigating the origins of the term, its numerous applications, as well as the lively debate surrounding it, Deterding, Dixon, Khaled, and Nacke (2011) defines gamification as "the use of game design elements in non-game contexts" (Deterding et al., 2011 p. 10). Gamification in its current state is in essence the act of applying a layer of points or other types of rewards to an activity with the intention of making the activity more enticing and entertaining to its participants. The reasoning behind it is that providing more visible, measurable, and comparable feedback for a performing an activity or action will motivate participants as they receive clear rewards for doing so (Deterding et al., 2011).

This is where one point of confusion regarding the term arises, as the term is sometimes used to describe the act of translating an activity into gameplay – for instance creating a game around music creation, running, driving, or any other pre-existing activity. This is an inappropriate, but understandable, use of the term as it stands to reason that the translation of activities or themes into gameplay could be referred to as "gamifying" them. More appropriate examples of gamification are corporate programs such as frequent flier miles that award points and upgrades for loyal customers, or the fitness mobile application *Zombies, Run!* (2012) that applies the theme of a post-apocalyptic zombie-infested setting and digital rewards to a player's real-life running activities.

Gamification has received interest from corporations, educational institutions, and municipalities alike (Deterding et al. 2011), but the term is often critiqued from several corners of the games research and development communities, and it has become quite difficult to describe gamification without sounding somewhat vindictive. The main point of contention the community has with gamification is that it is seen as the antithesis of what games are supposed to be. Games should be inherently rewarding, and strive towards instilling a strong sense of intrinsic motivation in the player (Habgood & Ainsworth, 2011). The backing for these values aren't entirely arbitrary as studies frequently show that external motivation is detrimental to enjoyment, performance, retention, and reflection (Bellotti et al., 2009; Guillén-Nieto & Aleson-Carbonell, 2012). But, the critique is also often fuelled by the perennial debate of games' unique way of communicating with players that should be treasured, and gamification is seen as a way to pervert the language of games and reduce it to behaviouristic exploitation. For instance, the term has been re-dubbed with various portmanteaus, such as *exploitationware* (Bogost, 2011c) (mainly referring to example of gamification used for corporate interests), which is a somewhat accurate summation of the opinions of many game professionals and academics towards gamification.

### 3.3.7 SUMMARY

This chapter has aimed to provide an entry-way into understanding the make-up of learning games both as a research discipline, as well as a craft and educational tool. Just as the parent fields of serious games and game studies, learning games are a multidisciplinary enterprise both in research and development, and researches and practitioners frequently incorporate elements from a diverse array of fields, for instance game design, pedagogy, psychology, sociology, software development, computer science, human-computer interaction just to name a few (Crookall, 2010; Guillén-Nieto & Aleson-Carbonell, 2012; Mäyrä et al., 2012; Ratan & Ritterfeld, 2009). Our current understanding of learning games is that they certainly have the potential to convey educational material and that they can be tailored to accommodate for different pedagogical paradigms (Aldrich, 2005; Egenfeldt-Nielsen, 2004, 2006; Ritterfeld & Weber, 2006), but their actual effectiveness in comparison to other educational methods is still somewhat uncertain (Blumberg & Ismailer, 2009; Ennemoser, 2009; Srinivasan et al., 2008).

There are also many differing opinions regarding how a learning game should be designed and developed in order to make good on the educational promises the field has prophesized since its inception in the early 70s (Engström et al., 2011; Habgood & Ainsworth, 2011; Malone, 1980b). Some developers and researchers factor engagement higher than educational content, whereas some take the opposite stance and some stand in-between these two camps and champion a direction where concessions are made both in how we appraise gameplay and educational processes. The behaviouristic paradigm that dominated the educational game landscape in the past has been on a continuing decline since the edutainment market collapsed in the late 90s, and new pedagogical principles are now influencing learning game research and development, and the porthole through which we

look at them is expanding as a result (Crookall, 2010; Egenfeldt-Nielsen, 2006; Ratan & Ritterfeld, 2009). Teacher roles and competencies, student audiences, limitations imposed by the realities of formal educational processes, and the wider context in which learning games function are subject to increasing scholarly effort (Alklind Taylor & Backlund, 2011; Egenfeldt-Nielsen, 2008; Ruggiero, 2013), and it's apparent that the challenges and issues learning games are facing aren't limited to how they should be designed (Klopfer et al., 2009; Tan et al., 2012). And that is, in essence, an issue this thesis aims to describe further and ultimately start to unravel.

**Table 3.6:** Summarization of chapter conclusions with examples of sources providing the information.

| Chapter conclusions | Source(s) | Reference |
|---|---|---|
| Games, according to many, contain many elements and structures that make them inherently powerful tools for learning. These observations, coupled with the perceived enthusiasm for games and new technologies in today's youth, are the primary motivators for using games in educational and "serious" settings. | Shaffer (2012)<br>Gee (2003, 2009)<br>Prensky (2001)<br>Annetta et al. (2007)<br>Ko (2002)<br>Blumberg and Ismailer (2009) | 3.3.A |
| There is little doubt that games can be used to teach. The way they teach and their effectiveness as teaching tools, however, is still relatively unknown. While some scholars state that games inherently support educational outcomes, others question whether or not you learn anything but game mastery from playing a game. | Linderoth (2009, 2012a, 2012b)<br>Egenfeldt-Nielsen (2004)<br>Turkle (1995)<br>Ennemoser (2009) | 3.3.B |
| There are several different approaches to learning game design, each with their benefits and shortcomings. The popularity and specific expressions of these designs are often dependent on dominating educational principles. | Egenfeldt-Nielsen (2006)<br>Habgood and Ainsworth (2011)<br>McLaughlin et al. (2010)<br>Moreno-Ger et al. (2008)<br>Bellotti et al. (2009) | 3.3.C |
| Teachers' interest in using learning games is high. However, there are few examples of wide-spread applications of using digital games in formal education. | Ruggiero (2013)<br>Wastieau et al. (2009)<br>Tan et al. (2012) | 3.3.D |
| Similarly to entertainment games, learning games can be viewed from a broad perspective where their context of use and the social constructs surrounding the game is examined in tandem with the contents of the game itself. Facilitating learning with games is as much about nurturing an environment around game sessions as it is about creating suitable in-game content. | Alklind Taylor (2011)<br>Crookall (2010)<br>Gee and Hayes (2011)<br>Dirckinck-Holmfeld and Sorensen (1999)<br>Holmes and Pellegrini (2005)<br>Guillén-Nieto and Aleson-Carbonell (2012)<br>Bennerstedt and Linderoth (2009) | 3.3.E |
| Learning game design can be seen as a dilemma, or trilemma, between designing enjoyable gameplay and including material relevant to the subject matter the game is meant to teach. Depending on the type of game being developed, verisimilitude to the represented subject matter can be important as well. | Harteveld et al. (2010)<br>Engström et al. (2011)<br>Kirkley et al. (2005)<br>Egenfeldt-Nielsen (2010, 2011) | 3.3.F |
| The development and use of learning games is little understood. How they function when put into formal educational contexts games is seldom researched, but it is a difficult process and few schools have the necessary infrastructure to make good use of learning games. | O'Neil et al. (2005)<br>Egenfeldt-Nielsen (2008, 2010) | 3.3.G |

## 3.4 ADJECENT FIELDS OF RESEARCH

In this final section of the literature study overview, research from fields adjacent to learning games will be described. To understand learning games better and provide a foundation for the debate of their utility, a few fields of research that deals with technology in education and organizations will be described. Specifically instructional system design, information systems, and technology acceptance research will be presented, which will provide some context for how non-game software is being used to instruct and provide utility in organizations – an important foundation for the later chapters in this thesis.

### 3.4.1 INSTRUCTIONAL SYSTEMS DESIGN

Instructional system design is a field of research dating back to the 50's (Gustafson & Branch, 2002; Tennyson, 2010). Instructional systems design research revolves around finding systematic approaches to developing and using training tools (physical as well as digital ones), and most current methodologies devised on the subject are variations of the *Analysis-Design-Development-Implementation-Evaluation* (ADDIE) approach (Gustafson & Branch, 2002; Molenda, 2007).

- **Analysis** is the early needs assessment and goal specification for the instructional solution. What does the client need, or what does the consumer want? What are the shortcomings in performance we can alleviate with an instructional solution, and in what ways can we design and implement it?
- **Design** means translating results from the analysis into measurable and workable terms, essentially describing what the final product/solution will look like. The team classifies the type of learning that is to take place and the specific learning activities the users will partake in. The team also decides on what type of media platform is suitable to convey the instructional material.
- During **development** the team executes on their ideas as they are specified in the design phase. The nature of development will be very dependent on what type of product/solution the team has decided upon, and can range from preparation of physical course material for an instructor to the creation of training software.
- The team then **implements** the developed product/solution into its intended environment, i.e. provides instructors with the course materials, or distributes an executable of the developed training software.
- Finally, the team **evaluates** the performance of the product/solution. Evaluation usually either takes a formative or summative approach, formative meaning that data is collected to identify where revisions in the instruction are needed (which can lead the team back to reanalysing or redesigning parts of the instruction) and summative meaning a final evaluation of the effects and overall worth of the instruction.

Much like the process of game development, instructional system design and development is a complex, active and creative process that varies somewhat between projects and companies, and many of the models created to describe it take an approach that is both iterative and non-linear. For example, while the foundational ADDIE model looks somewhat linear in its layout, it is understood to be a back and forth where evaluation isn't the end stage, but a constant element of reflection throughout the process (*Figure 3.4* is an example of a common depiction of the model) (Moore, Bates, & Grundling, 2002).

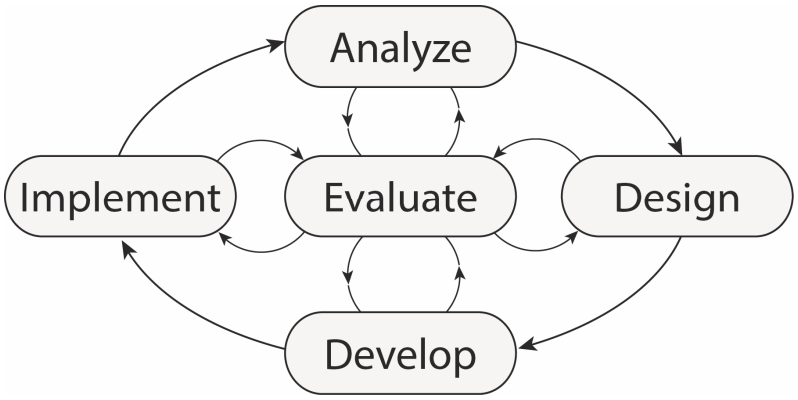


**Figure 3.4:** The ADDIE model as it is visualized by Gustafson and Branch (2002)

Similarly to the situation with the field of learning games, the practice and theories prevalent in the field of instructional systems are also highly affected by research trends in educational psychology (Mödritscher, 2006). Due to this, there are behaviourist, cognitivist, and constructivist ways of approaching instructional design, and there are different models that accommodate for each of these paradigms (McLeod, 2003; Tennyson, 2010). As mentioned in the learning games overview in 3.3.2, the educational paradigm of behaviourism places emphasis on teaching through encouraging proper responses and behaviour with positive stimulation (Mödritscher, 2006). To support this teaching approach, learning objectives need to be divided into smaller, incremental steps of knowledge acquisition that are sequentially linked together, ensuring that proper problem-solving behaviours are learned step-by-step (McLeod, 2003). This also means that progress in learning can be judged on how well the learner has progressed through the sequence, which provides metrics to evaluate both the learner and the instructional system being used. In practice, instructional system designs that follow the behaviourist model for learning primarily manifests in the instructional activity being divided into a hierarchy of small, incremental tasks, and in repetition and rehearsal (Tennyson, 2010).

Finally, another important aspect of instructional system design and development processes is that their structures need to be highly goal-oriented; the requirements placed on instructional solutions depend on their context of use to a great extent, and no single model can sufficiently describe a design process with every possible use context in mind. In their comprehensive survey on instructional system processes and their resulting products, Gustafson and Branch (2002) summarized and divided the field into three distinct categories: **classroom**, **product**, and **systems-oriented** designs. These categories are based on the typical environment or purpose an instructional system is developed to exist in or perform, and the nature of the design process will change depending on what category of system is being produced. Typically speaking, a classroom environment entails the presence of a tutor or teacher, which the users of the software are in proximity to. This places fewer responsibilities on the developed artefact, seeing as there's an authority present that can provide guidance and compensate for any shortcomings or ambiguities in the instructional device. For this reason, a system for classroom instruction is often considered to be the least complex when it comes to instructional system design. Product- and system-oriented instruction, however, are more troublesome. As opposed to the classroom as location of execution, these types of instructional systems need to be able to perform independently to a much greater extent. The product-oriented instruction solutions can for example be modules that are distributed to a wider audience, but are to be used in the context of a specific activity (e.g. instruct on the use of a specific product). The instructional systems are often bigger all-encompassing solutions with many components aiding the instructional goal, and can for instance be entire distance learning courses or degrees programs. Each of these types of instructional solutions require their own design and development approaches, and few models beyond the base-line ADDIE model are widely applicable – project scope needs to be identified early, and an appropriate model need to be settled on. This issue is what Gustafson and Branch has focused on in many of their publications (2002), and the classroom-product-systems categorization serves as a way to alleviate some issues with ambiguousness in what different instructional system models can and should be used for.

All in all, instructional system design is a very broad field as instruction is a concept that can manifest in many different ways. There are many similarities between instructional systems and learning games as fields of research and practice, although they stem from somewhat dissimilar backgrounds. Both fields have struggled with ambiguousness in their terminology, which has caused several taxonomies to arise, e.g. Sawyer and Smith's taxonomy (2008) and Egenfeldt's educational categorizations in learning games (2006)

and Gustafson and Branch's categorizations (2002) and Tennyson's educational categorization in instructional system design (2010).

### 3.4.2 INFORMATION SYSTEMS AND THE SOCIOTECHNICAL PERSPECTIVE

Information systems (IS) is a field of practice and research that spans back to the early 50's and has since its inauguration been through several paradigm shifts (Petter et al., 2012). As is often the case, the field begun primarily as a craft, but as practitioners sought to understand and optimize their working processes a field of research emerged quickly. Socio-technological research has the interrelation of participants, technology and the information that's conveyed between them at its core (Alter, 2010). Alter has defined theories and models both for describing how to conceptualize the function and place of software systems in organizations, as well as how they incrementally take shape and the process of maintenance (Alter, 2006, 2008a, 2008b, 2010). Alter has presented frameworks both for understanding the ways these types of systems fit into broader organizational contexts, as well as the way they take shape, are maintained, and evolve during their design and use (Alter, 2008b, 2010). For example, Alter's (2008) *Work Systems Framework* describes the components of an IS as existing in a broader frame of infrastructure, environment, and its strategies (*Figure 3.5*).

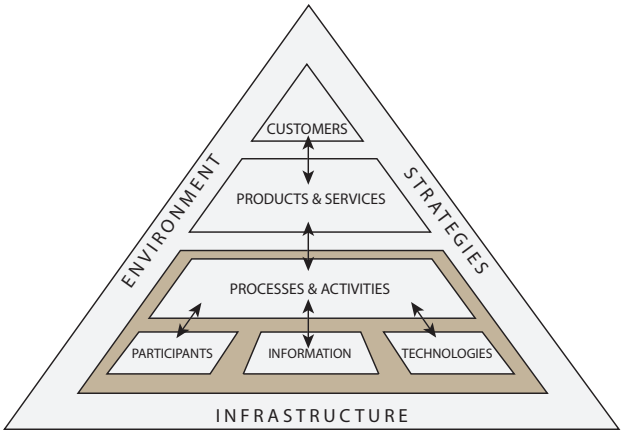


**Figure 3.5:** The Work Systems Framework as proposed by Alter (2008a, 2008b). Systems in organizations influence, and are influenced by, the broader organizational context and its actors.

The relevance of this type of IS research to the subject of this thesis is, much like instructional system design research, the way utilitarian and purposeful systems fit into broader contexts, and how this influences their design and development. Throughout the development, evaluation, and maintenance of an IS (regardless if you're discussing it from an information or working system point of view), requirements analysis and collaboration with stakeholders are crucial (Avison & Fitzgerald, 2006). In Avison and Fitzgerald (2006), these aspects of information systems are described from a practitioners perspective. Much like Alter (2010), Avison and Fitzgerald (2006) views information systems as something that can exist in several different ways in an organization. They firmly state that regardless of how specific the function of an IS is in an organization (e.g. to be used within one specific branch of a company) its design and development need to be conscious of the organization as a whole. If the IS is too focused on supporting a small part of an organization, it may lead that specific part to operate to the detriment to the broader strategies and environment of the organization at large. This may seem obvious, but it's

tempting to simplify and distil the requirements and functions of a system within smaller boundaries. As Avison and Fitzgerald puts it:

> Decomposing complex structures is the accepted approach in a scientific discipline, but information systems concern people and organizations as well as technology, and the interactions are such that in these human activity systems it is important to see the whole picture. The human components in particular may react differently when examined singly than when they play a role in the whole system (Avison & Fitzgerald, 2006, p. 51)

So, the IS is not only a product made for a specific purpose, but also itself a product of how it gets used. This reiterates the importance of viewing IS as constantly evolving objects rather than static solutions, thus sharing similarities with instructional system design and development (Gustafson & Branch, 2002). But, it also emphasises the importance of the human components of an organization. Avison and Fitzgerald (2006) recognizes that the end-users of an IS are both unpredictable and not beings of pure logic, which can manifest in everything from positive influences that improve the IS, to resistance of using it and even sabotage (Avison & Fitzgerald, 2006). When faced with a new IS, users can feel that they're being burdened with extra labour as their working routines are being changed, or they can feel as though the freedom and independence their working situation affords them are compromised. These are pressing issues that seldom make themselves known before a significant amount of resources has been spent to design, develop, and implement the IS. The execution of the IS certainly plays a crucial role in how it will be accepted by the intended users, and competent design can alleviate some of the issues with user acceptance (Pai & Huang, 2011). But, a more efficient and accurate method to increase acceptance is to have the IS design and development process open to meaningful user participation:

> User involvement should mean much more than agreeing to be interviewed by the analyst... This is 'pseudo-participation' because users are not playing a very active role. If users participated more, even being responsible for the design, they are far more likely to be satisfied with, and committed to, the system once it is implemented. (Avison & Fitzgerald, 2006, p. 81)

This sort of user participation can be included in IS development in several different ways. A good description is provided by Mumford (1983), who presents three different ways of being user inclusive: **consultative participation**, **representative participation**, and **consensus participation**. Consultative participation is the simplest form of user participation, and borders on the 'pseudo-participation' mentioned by Avison and Fitzgerald (2006). It does, however, separate itself by not only limiting consultation of the users to interviews performed in early stages of the design process, but keeps the users involved throughout the process and encourages feedback that can be used to redesign the IS both during early tests and after implementation. This type of participation is common and comes natural to most IS developers, but in comparison to other participation approaches it is at a pretty low level. Representative participation takes it a step further, by including representatives from the user-group in the design and development process of the IS. Here, the users are not only consulted for feedback on the system, but are actively contributing to it throughout development either through design decisions, requirement analysis and statements, and by providing the development team with insights into the realities of the context in which the IS is going to be used. Finally, consensus participation is the more democratic and all-inclusive of the three methods. This process has the drawback of being significantly slower than non-democratic ones as design decisions can't be made as quickly, but benefits the process as decisions will suit the users well and the users can feel a sense of personal investment in the project – hopefully making them more accepting of it in the end.

### 3.4.3 TECHNOLOGY ACCEPTANCE

In order to further understand what users look for in a piece of technology, we can turn to research in technology acceptance. Technology acceptance research is of relevance to all fields that has been touched upon in the background chapter as it can be used to understand how users adopt technology in their everyday lives, or into their working environment or business. With entertainment games, the utilitarian aspects might not be as pressing of an issue as the consumers seek these products out for leisure - they've already accepted technology so far as to willingly invest themselves in it. In the case for entertainment games, personal enjoyment, taste, and monetary factors play important roles when new technology and software is acquired (Venkatesh, Thong, & Xu, 2012). For information or instructional systems, acquisition and use is more motivated by utilitarian factors (Venkatesh, Morris, Davis, & Davis, 2003). Unlike leisure technology and software, they are sought out by organizations or individuals by necessity and in an effort to seek out utilities that can have a positive impact on its users (King & He, 2006; Venkatesh et al., 2012). They're also used in mandatory or strongly guided contexts (e.g. in corporations, schools, or healthcare). These differences have a significant impact on what a user expects from new technology and what it needs to achieve to be accepted. A common approach to explaining the peculiarities of technology acceptance is to use the *Technology Acceptance Model* (TAM), as proposed by Davis (1989) (*Figure 3.6*). TAM is one of the most widely used models in the IS field of research, and while it has been modified and expanded upon by many researchers since its inception it has been found to be a powerful and robust predictive model (King & He, 2006; Pai & Huang, 2011). What the TAM does well in particular is draw connections between users' perceptions, attitudes, and intentions to how they actually embrace technical solutions in practice once they're implemented.

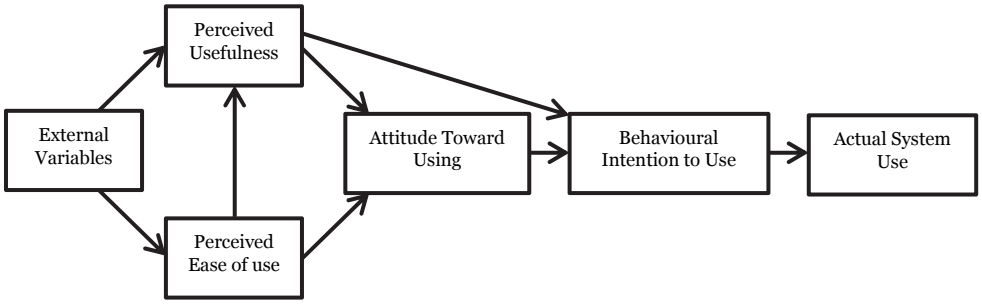


**Figure 3.6:** The Technology Acceptance Model (TAM) proposed by Davis (1989). A user's intention to use and actual usage of new technological solutions depend on how much it is perceived to aid work processes in relation to how much extra work effort it adds.

What Davis (1989) found in his research, which has been ratified by many researchers since (King & He, 2006; Pai & Huang, 2011; Venkatesh et al., 2003), is that the user's initial perceptions of how useful and easy to use new technology is strongly influences their intentions to use it – which subsequently dictates actual use. While TAM established the causality between perceptions, attitudes, and intent to use new technology, the user was still treated as a black-box. You could understand what their perceptions regarding a piece of new technology were, but not what characteristics of a user influenced those perceptions (Pai & Huang, 2011). This has been ameliorated in new expansions of the TAM model, and one particularly useful new model of the concept is provided in Venkatesh et al. (2003). In this relatively recent work, the TAM was revised to mainly include more sociological elements to describe what factors influenced a user's perceptions of usefulness and ease of use. In their work in 2003, Venkatesh et al. placed heavier emphasis on the nuances of the specific user by taking gender, age, experience, and voluntariness of use into consideration

as important factors for technology acceptance. The effects of these factors are also in a mutually influential relationship with the organizational and social variables partly described in the original TAM models (but then in more vague terms, e.g. external variables). The causalities between all these aspects of organization, user, and technology was presented in Venkatesh et al. (2003) as a new model called the *Unified Theory of Acceptance and Use of Technology* (UTAUT) seen in *Figure 3.7*.

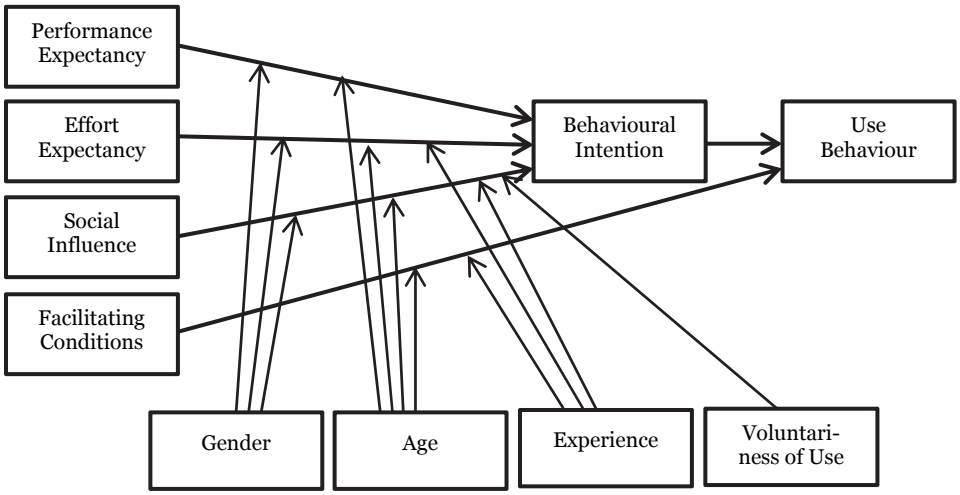


**Figure 3.7:** The UTAUT Model, expanding the variables affecting intention of use and use behaviours from TAM with more specific details of the users and of the context in which the technology is used.

The UTAUT breakdown explains attitudes, intentions, and actual use as a result of expectations and social and organizational influences, which in turn is influenced significantly by the personal traits of individual users. Like in TAM, expectations on technology performance (e.g. effects on productivity) and effort (i.e. how difficult the technology will be to learn and use) still play a crucial role in acceptance (Venkatesh et al., 2003). These expectations are primarily based on gender, age, and previous experience of the users. For example, young males tend to have more task-focused expectations when it comes to performance and their primary concern tends to be how new technology will affect their work productivity and they aren't as concerned with the effort it takes to use the technology (Venkatesh et al., 2012). Social influences on the other hand are affected by all four user aspects. Here other users' opinions toward the technology play a crucial role alongside gender, age, and experience. Previous research has concluded that older users are more susceptible to others opinions, but that these effects are also highly dependent on the individual user's experience (Pai & Huang, 2011). So, the four user characteristics don't always accumulate to change attitudes and intentions in one particular way, they also lessen, increase and change each other. Another important addition is the user's perception of facilitating conditions, which is the user's faith in the organizational infrastructures ability to support the use of the new technology. Here, the user's working experience will be the primary moderating factor, as their judgement of the organization and executions of the technology is dependent on their expertise in these matters (Venkatesh et al., 2003). A distinguishing aspect of the facilitating conditions factor is that it doesn't affect intention of use, but affects the actual use behaviour directly. The reason for this is that intentions of

use are reliant on the user's performance and effort expectancies on the new technology (e.g. how easy is it to use, and how will it help me?), which later translates to use behaviour (Venkatesh et al., 2003). Facilitating conditions capture the elements that aren't captured by user expectations social influences, such as training provided by the organization, which affects use behaviour directly (Venkatesh et al., 2012). The peculiarities of the interrelationship between all the components described in the UTAUT are too numerous and complex to sufficiently describe here, but the model is a useful tool for explaining the factors that affect users' acceptance towards new technologies. In the concluding chapters of this thesis, the importance of understanding the user will be reiterated once again, but then in the context of learning games that are developed for educational contexts.

### 3.4.4 SUMMARY

Table 3.7 provides a brief summarization of this chapter.

**Table 3.7:** Summarization of chapter conclusions with examples of sources providing the information.

| Chapter conclusions | Source(s) | Reference |
|---|---|---|
| The development and design of instructional solutions are both evolutionary processes. Conducting repeated analysis and evaluation throughout these processes is important to ensure that the solution adheres to the realities of its area of application. | Gustafson and Branch (2002)<br>Alter (2008b, 2010)<br>Moore et al. (2002) | 3.4.A |
| As is the case with learning games, instructional system design adheres to different educational principles (e.g. behaviourism, cognitivism, sociocculturalism) depending on their area of application. | Gustafson and Branch (2002)<br>McLeod (2003)<br>Tennyson (2010) | 3.4.B |
| The properties of an organization severely impact the form and function of instructional solutions and information systems. Examining the performance of developed systems after their implementation in an organization is important, as it can reveal that certain aspects of the system needs to be redesigned. | Alter (2006)<br>Avison and Fitzgerald (2006)<br>Petter et al. (2012) | 3.4.C |
| Getting users to adopt new technologies is difficult; co-designing products with the users is a potential solution. However, only polling representatives for user needs in an organization can still be insufficient to ensure that the system has the necessary qualities to function well in its use context. | Avison and Fitzgerald (2006)<br>Mumford (1983) | 3.4.D |
| The final users' acceptance towards a new technological solution is important, and can dictate whether or not a new solution falls into disuse or has a positive impact in an organization. High awareness of the characteristics of the users and their working conditions, is essential. | Venkatesh et al. (2003, 2012)<br>Davis (1989)<br>King and He (2006)<br>Pai and Huang (2011) | 3.4.E |

# CHAPTER 4
# CASE STUDIES ON LEARNING GAME DEVELOPMENT AND USE

This chapter serves as the primary exposition of methodology and the produced data gathered during the case studies. The first parts of the chapter describe the methodology used to structure the studies, and the following sections presents the gathered empirics from educators and developers separately. A brief summary at the end of the chapter merges the results from the studies and provides a transition between the empirics to an analysis of the results in the next chapter.

## 4.1 CASE STUDY METHODOLOGY

The two most common methods used for studying the different types of cases have been participation and interviews. The amount of interviews with each case varied, as did the duration of the interviews. These variations mainly depended on what the interviews served to examine. In the cases where opinions and attitudes were the subject of discussion, one semi-structured interview of approximately 30-45 minutes were usually held. In cases where the process of using development and use of learning games were studied more interviews were held at varying intervals during the process. Here, the amount of interviews and their contents mainly depended on the nature of the different learning game projects. With developers, development projects were usually swift processes lasting a couple of months, and interviews were held in the beginning of the projects to discuss the outlooks of the projects and predictions of challenges and issues, and a later interview at the end of the project would serve as a brief post-mortem of how the project panned out. In cases where the use of learning games was the focus of scrutiny, the projects were considerably more protracted and gave room for more interviews throughout the process with the different participating actors.

I also conducted studies where I had an active role during the development, implementation, or use of a learning game. These studies are categorized as participatory research and entailed me participating as a consultant in the early phases of development or collaborating on design ideas and providing input in regards to what the developers should keep in mind during production. When participating in education cases, I would play a supporting role in making sure the learning game worked, describing the game for teachers, and being actively involved in classroom activities (e.g. coming up with lesson plans, interacting with students, etc.). Participation was used when my involvement would be a pivotal factor for the case to exist to begin with (for example, getting invited to consult

a developer), or when I needed to follow a case in detail during a longer period of time (for example, following the implementation of a learning game in a classroom course). As with any methodology, participation has its benefits and drawbacks. The main drawbacks are reproducibility and the susceptibility to researcher bias, but it can be an efficient methodology when it comes to exploring the procedures, knowledge, and perceptions in the groups being studied (Cornwall & Jewkes, 1995). As the purpose of these studies were to explore developers' and educators' procedures and attitudes, the participatory approach seemed suitable.

## SENSITIVY OF INFORMATION

While I can mention the types of companies I've been in contact with during my research, and what purpose they served towards the overall goal of my research, I cannot divulge any specific information. The reason for this is that the purpose of this thesis (i.e. finding out why learning games are troublesome to create and use) has lead interviews and participatory cases to produce data that criticises both clients and developers. Since most discussions with developers have revolved around games in development with specific game mechanics and designs, talking about them in any detail would make them easily traceable to their source. To avoid including statements that could be detrimental to the companies that participated in my research, quotes from interviews will be somewhat sparse and much of the presented empirics will be stripped of most details of its context.

## DEVELOPER CASES

The studies on developers included a total of nine companies that covered a wide spectrum of developer-profiles. To make them distinguishable during further discussion, the profiles are listed in *Table 4.1*, and I've categorized their relative differences to one another in *Figure 4.1* based on a couple of key parameters that I have found to be useful when analysing the research results:

- **Experience (x-axis)**: the amount of experience the company has with development, judged on a mixture of the amount of time the company has existed and of the amount of titles they have produced.
- **Background (y-axis)**: refers to what type of foundation and experiences the company is built upon, some of the participating developers had a background in the education sector, some were more experienced in game development, and a few fell somewhere in-between.

The motivation for using these particular parameters was that previous studies has showed that these factors are highly influential in how the development processes is carried out (Tan et al., 2012). Here, both IS, game development, and serious games literature were used to support the categorization. Several additional characteristics of importance, such as country of operation, were omitted for the categorization. The studied companies were spread only over a relatively small geographical area that have similar company and work cultures, so these parameters were deemed as less significant in comparison to the effects of the two chosen parameters.

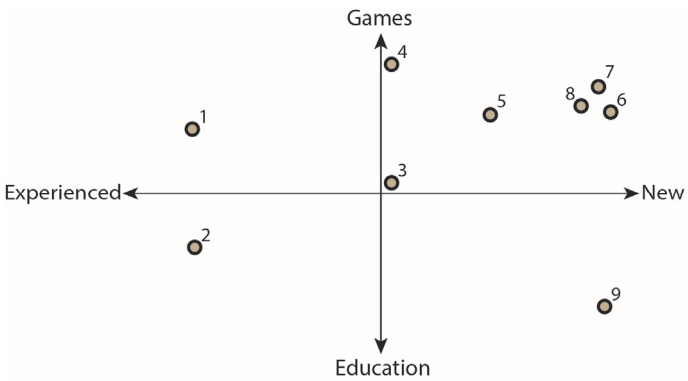


**Figure 4.1:** Distribution of the cases when described on their level of experience (x-axis), and whether their experiences are within games or education (y-axis)

The categorization allows for placement of the cases studies on a grid where vertical positioning indicates *types* of experience, and horizontal positioning *amount* of experience. This visualises the variation of the cases, and can be interpreted in a couple of ways. Firstly, the cases cover a wide spectrum of developer profiles, and a combination of the resulting empirics from the studies should be indicative of a range of practices in learning games and not too limited to a specific type of company. But, even though the cases combined are representative of the learning game situation at large, the small amount of samples make too broad generalizations of practices impossible, and for that reason the categorization also serves as guidelines for what type of learning game development different conclusions are applicable to. Secondly, it's important to point out that the relationships described are relative, and is mainly a way of categorization to distinguish the companies from one another. This is especially important to keep in mind when considering the "experienced" companies – they don't signify the absolute pinnacle of skill one can gain within the field, but rather them being the most experienced of the studied cases.

The developer cases were conducted either with the purpose of gathering opinions and attitudes towards learning games as a practice, or to witness their development processes as they were happening.

**Table 4.1:** Profiles of developers used as case studies, coupled with the purpose each developer had in the bigger context of my research as well as the methods used with each of them.

| Developer | Profile | Purpose | Method |
|---|---|---|---|
| **1: Experienced1** | Established learning game development company | Gather opinions and experiences from an established learning game developer | Structured interview |
| **2: Experienced2** | Established learning game development company with a pedagogical foundation | Gather opinions and discuss experiences and predictions from an established learning game developer | Semi-structured interviews<br>Structured Interviews |
| **3: Semi-experienced1** | Semi-experienced developer of games and animations for children | Following a company's process of designing a learning game for an external client | Semi-structured interviews |
| **4: Semi-experienced2** | Semi-experienced developer publishing on the AppStore, new to learning games | Following a start-up company's process of designing a game for an external client | Semi-structured interviews |
| **5: New1** | Start-up company, mainly focused on entertainment games | Follow a start-up's first experience with learning game creation with an external client | Semi-structured interviews<br>Post-mortem interview |
| **6: New2** | Start-up multimedia company, creating a point-and-click educational game | Follow a start-up's first experience with learning game creation with an external client | Semi-structured interviews<br>Consultation |
| **7: New3** | Start-up multimedia company, creating an entertainment game franchise, examining possibilities of learning games as a new marketing venue | Follow a competent start-up game developer exploring learning games as an alternate venue for products | Consultation |
| **8: New4** | Start-up company, mainly focused on games for the AppStore, new to learning games | Follow a start-up's first experience with learning game creation with an external client | Semi-structured interviews<br>Post-mortem interview |
| **9: New5** | New developers with pedagogical experience embarking on an learning game project | Participate in the initial process of ideation and design, instigated by a pedagogical perspective | Participatory research |

## EDUCATOR CASES

When it comes to surveying the education-side of the learning game industry, I took a similar approach as the one with the developers. The mixture of interviews with pedagogues, principals, and teachers, as well as involvement in processes of utilizing learning games in school exercises provided insights into what it is that motivate educators to using games, and what primary obstacles they encounter when making attempts to do so.

The educator cases are not quite as easily categorized as the developer studies. Educator profiles differed from one another in several ways and cannot be as easily confined within a framework of a couple of parameters. A listing of the types of educator cases studied is shown in *Table 4.2*, and when discussing these cases the educators' roles will be the primary distinguishing characteristic. Another differentiating factor between the developer and educator cases was how interviews were generally conducted. The developers had specific projects and contexts to base their answers on, and as an interviewer I didn't needs to introduce any particular hypothetical scenarios to get a discussion going. The educators, while being similarly familiar within their field of expertise, needed a bit more guidance when the interview went into the learning game territory. This was never the starting-point of the interviews, however, and general instructional technology and their place in education was usually an entry-point for initial interviews.

**Table 4.2:** Educator cases, described according to their professional roles and their general work profiles, as well as the purpose the studies served in the thesis.

| Role | Profile(s) | Purpose | Method |
|---|---|---|---|
| **Principals:**<br>**Principal A**<br>**Principal B** | Principals of different departments in a school with students aged 6-14 | Gather opinions and discuss the general viability of learning games from educator's perspectives – e.g. administrative, technical, or ethical concerns of using learning games | Semi-structured Interviews |
| **Pedagogy specialist** | Working in educational development | Discuss the pedagogical reason for and against using learning games | Semi-structured Interviews |
| **Teachers:**<br>**Teacher A**<br>**Teacher B**<br>**Teacher C** | Middle- and high-school teachers interested in learning games and involved in implementation projects | Take part in and discuss the process of implementing a learning game into school activities | Semi-structured Interviews<br><br>Participatory research |
| **Teacher groups:**<br>**Workshop 1**<br>**Workshop 2** | A group of teachers from Denmark starting a learning game project, and a group of teachers in Sweden gathering to discuss and play or observe learning games | Discuss the motivation for or aversions against using learning games in formal education with groups of teachers. | Unstructured group interviews |

## 4.2 INTERVIEW PROTOCOLS AND DOCUMENTATION

The majority of the data gathered throughout this research is from semi-structured interviews. All interviews followed a general strategy – but the specific questions asked and themes of the discussions varied somewhat depending on what type of subject was interviewed. Educators and developers were asked different questions from each other, but there was also a variation between the individual interviews within the two subject groups as well. It's important to note that the purpose of these studies isn't to produce any sort of statistical analysis of how prevalent certain attitudes or working processes are among educators or developers. The priority is examining what type of attitudes and processes exist, what the thought processes behind them are, and how they impact developers' and educators' work with learning games.

For some of the cases follow-up interviews were held to ensure that their statements weren't misrepresented or misunderstood. This was mostly done with educators, they were in general more "reliable" cases in the sense that they weren't in transitions between different kinds of projects (Specifically **Principal A,** and **Teachers A,B,** and **C**). Follow-up correspondence with **Experienced2**, one of the developers with a more stable working situation, also served to clarify some statements – but this process didn't follow the same interview structure as the normal case studies.

All interviews were conducted face-to-face with the subjects and were either documented through audio recordings or direct text notes. The interviews followed protocols specific to the different categories of subjects, and to clarify how the interviews were conducted, a couple of the used interview protocols will be shown as well as segments of interview notes.

## INTERVIEW PROTOCOL USED IN INTERVIEWS WITH PRINCIPALS

1. What are you looking for in new educational tools such as learning games? What are the parameters you immediately judge their viability on?
2. What current experimentation in new educational technology is being conducted at your institution?
    a. [Sub-categories signify follow-up questions] Why are you examining these new solutions (what benefits are you hoping to attain), and what results are you seeing from using them?
3. Have you seen any changes in the way teachers consider technology and games as potential educational tools?
    a. Are there any particular concerns making them wary?
    b. Have you seen any specific positive changes?
4. In your past experiences of implementations of new educational tools, what would you say the factors for success or failure were?
5. How do new educational tools change your working processes and teachers' working processes?

## EXCERPT FROM INTERVIEW NOTES WITH PRINCIPAL A

Translated from Swedish.

...

Q1: We evaluate new educational tools such as learning games on a series of characteristics:

- Pedagogical fit – whether or not it fits into our curriculum structure. Can we use the tools into a subject?
- How demanding is it on our resources? (resources = working hours, locales, devises)
- How much does it cost?
- Do we have the necessary structures and processes in place to support the use of the new tool? Do we have the necessary service personnel available to support the teachers' work with the tool?
- Do we have the right competencies to use the tool efficiently and can a good outcome be expected?
- How many of our students can benefit from the solution, does it exclude any of them? Is the new solution adaptable for to accommodate for individual students or changes in the teacher's working situation?

Q2. We purchase a lot of new laptops and computers for our students. There was recently a national program conducted to provide all students between 7th and 9th grade with their own computers, so now there's a whole lot of computers all around the school. It works very well, it makes it easier for students with particular needs. Teachers are starting to adapt their teaching accordingly, and they are feeling increasingly safe with using technology in their work.

- Interviewer: Why are you pursuing more technology availability, what are the benefits? -

Technology is so prevalent in society in general, and as a result schools started pursuing technology more and more – we're now at a point where we have to start adapting to these things.

...

## PROTOCOL USED IN INTERVIEWS WITH EXPERIENCED DEVELOPERS

1. What made you gravitate toward the market of learning games?
2. In what ways does creating a learning game differ from other types of development projects?
    - If subject is knowledgeable in game development – how is it different from making and marketing entertainment games?
    - If subject is knowledgeable in education – how is it different from creating or marketing more 'traditional' educational tools?
3. What, in your opinion, makes a successful learning game?
    - Are there any specific components necessary for a learning game to be successful?
4. In your experience, what values are held in high regard by your clients?
5. Conversely, what values do you regard highly when it comes to learning game development?
    - If the priorities held by you and your clients differ, how are those differences overcome? How does it change the design and development of the learning game?
6. Are there any common misconceptions among your clients towards learning games, and how do you handle those?
7. How do you market yourself and your products, how do you find your clients or make sure that potential consumers find your games?
    - How does the process of conducting business in the learning games market differ from other markets (e.g. entertainment games)?

## EXCERPT FROM INTERVIEW NOTES

The interview was held with two subjects.

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Q6. (1) We've had a little bit of both. Some of our clients don't really see the value in making sure that the gameplay is engaging.

(2) Yeah, in our first project we were approached by a client that knew what type of game he wanted to have made, so we had a solid foundation to start out from. In other cases clients can be less informed, and it can be difficult to interpret their requirements and explain why certain gameplay decisions are important.

- Interviewer: Do clients normally commission you for work? How do you market yourself and find clients?

Q7. (2) Currently we're mainly trying to find clients to create games for. But we also have a title in development that we hope to sell to schools.

- Interviewer: How do you make sure that the game in development is attractive to clients?

(2) We try to look at the curriculum and keep up to date with what the school board wants to focus on in coming semesters – and then we try to imbue the game with those types of challenges and learning elements.

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## 4.3 CASE STUDY OUTCOMES

The presentation of the case study outcomes is organized to separate the empirics gathered during studies with educators from the ones gathered from developers. The different studies are introduced with a short summarization of the common topics of discussion during the interviews and a characterization of the differences between the different subjects.

### 4.3.1 EDUCATORS

As previously mentioned, several different roles at different organizational levels where included when studying learning games in education. The hierarchies in the educational organizations were well defined, and the responses and direction of discussions would differ between personnel in different positions in the organizations. The common topics of the interviews with the educators were:

- Their motivation for wanting to understand or use learning games in schools and what they think learning games and technology can add to educational processes.
- The challenges and concerns that complicate the use of learning games.
- What elements they consider crucial for learning games to function well in their school or organization.

These three topics of discussion will be recurring for each category of subjects in the presentations of empirics below. All quoted statements from educators are translated from Swedish to English.

#### INTERVIEWS WITH PRINCIPALS

Principals are the educators that work within specific educational institutions at a management-level. During the studies, two persons with such roles were interviewed (**Principal A**, and **Principal B**). One of them was interviewed on four occasions spread over a school-year – two times independently of, and two times during, a learning game project. The second was interviewed on three occasions, all of them in relation to a learning game project they had close involvement in. The interviews that weren't tied to a specific learning game had a more general skew and covered many aspects of how instructional technology fit into educational institutions. The project-related interviews were focused on discussing how the process of using a learning game should be conducted, and the ambitions and concerns of the interviewees regarding it.

The main motivator for investigating learning games, according to the interviewees, is seeing the necessity of catering to their students on a platform that is familiar to them – which will hopefully increase academic effort. **Principal A** explained that as technology has become increasingly ubiquitous in society, and as students are becoming increasingly proficient in using it and are also starting to expect the possibilities technology affords them in most everyday situations. Education is no exception to this, and one of the subject expressed that teachers now "have to" start familiarizing themselves with the types of technology students frequently use to reach them. That motivation drives the use of most instructional technology in schools, but when it comes to games specifically it's more a question of catering to very specific student cases where traditional educational means fall short. Whereas information technology in general is approached as a more efficient means to communicate with students and parents and make lectures available through new venues, games is seen as a potential new venue to capture the elusive sense of motivation and will to learn that schools often struggle with. Indeed, in the learning game project conducted during the study with the help of one of the interviewees, motivating students that the school had failed to engage in any other way was the primary goal.

Whenever new educational tools or solutions, whether technical or not, is considered for use in their school there is a series of categories that guide the appraisal process. Early appraisal is guided by:

- Curriculum appropriateness
    - Does it fit with current curriculum scheduling?
    - Does it speak to the values emphasized in current curriculum updates?
- Resource requirements, taxation on infrastructure
    - How does it affect teachers' work effort for each class?
    - Do we have the technological infrastructure to keep the system functioning smoothly?
    - Do we have the necessary teacher competencies to make the system useful and beneficial from a pedagogical perspective?
- Up-front investments
    - What does the system cost?
    - What is the process of implementation like?

These factors are compared to other available educational means, and decisions regarding whether new tools should be implemented is judged whether they can add some value to the educational process without disproportional investment.

In previous efforts the subjects had done vis-à-vis implementations of instructional technology, pioneers have been crucial to capture the acceptance and enthusiasm of teachers. These pioneers often have previous experience and expertise with a new tool (e.g. games), and can ensure that the necessary infrastructure is present in their classroom to use the tool well. So it's often a case of nurturing the enthusiasm and drive of teachers willing to embark on these types of experiments, as it can push the envelope for the school's capabilities and the competencies an individual teacher gains during these types of projects often spread to other teachers:

> "There needs to be a certain drive there beforehand. It's common [for teachers] to rely on tradition rather than inventing new things, you're already overworked and have a lot of demands. But, if the drive of using games is already there it's important to give them a venue to explore it." **Principal B** in interview

This being said, both **Principal B** and **A** states that there's a lot of new technologies that could be beneficial in educational settings that haven't yet been explored – learning games is one example of fringe technologies that have started to be explored more and more in recent years. One reason that new technologies have seen somewhat limited application as of yet is that there is some resistance when it comes to teachers' acceptance towards new educational tools. The resistance often boils down to concerns of added workload, but also trepidation of relinquishing control of educational processes. Both subjects spoke specifically about the risk you take as a teacher when adopting opaque tools, which modern technology often is, into your classroom. To clarify the concept, an opaque tool here refers to tools where the inner workings of the tool (e.g. a computer terminal, mobile device, or piece of software) aren't visible to the users. In essence, you use the opaque tool and see the results and outputs it provides, but you don't know the process it went through to produce them. This is a big hurdle for technology acceptance among both teachers and principals, and **Principal A** expressed it as "a change in culture where you relinquish understanding and the control that comes with it in favour of accessing new types of actions."

A big deciding factor when it comes to investing in new educational tools is also the amount of funds available and the tool's expected performance. **Principal A** specified that the budget for teaching-materials in Swedish schools is divided between individual students, starting at 1000 SEK (~115 €) per calendar year for students up to grade 6 and increasing to 1750 SEK (~200 €) in grades 7-9. The budget needs to be divided into all the subjects an individual student takes in a calendar year, which puts some pressure on the purchased tools. With funds being limited, spending them on new learning games, which aren't easy

to use or proven to work well, can be a risky proposition. The learning game would thus need to be cheap to purchase, or be able to promise good educational outcomes to compensate for a higher price tag.

However, even though these challenges still exist, the subjects felt that they are constantly making headway in developing their internal infrastructure both when it comes to teacher competency and technology availability in their schools. By various new implementations of technology in the classroom, the collective knowledge and experience of the teachers of the schools were steadily increasing, and new experiments with new tools were continuously performed by teachers (e.g. releasing lectures on YouTube). So, the resistance and barriers for technology acceptance is slowly evaporating, but is currently still something to be considered when considering the implementation of more advanced instructional technologies such as learning games.

## INTERVIEWS WITH PEDAGOGICAL SPECIALIST

In this research, pedagogical specialist is a categorization of subjects who have a high degree of knowledge within pedagogical practices and educational psychology. A distinguishing characteristic is also that they work in municipalities, or as consultants and lecturers, and aren't bound to a specific role in an educational institution but more in charge of general competence development and evaluations of teaching practices within or between organizations. During the studies, one person that fall under this description was interviewed on two separate occasions, and the topic of discussion was how learning games and instructional technology fits into the progress of pedagogical practice in general and didn't revolve around specific learning game examples. The interviewee's in-depth understanding of the discussed subject matter also led to referrals to previous research and studies to a greater extent than educators in other roles.

Two themes were particularly prevalent during these interviews: the process, effects, and current status of instructional technology being assimilated into educational institutions, and the arguments for and against pursuing learning games based in educational theories and current issues schools.

The assimilation of technology was described as a process that has gone through a series of stages - starting with reluctant inclusion, becoming a superfluous addition to the school experience, and currently approaching a stage where they can be considered as more solid support for educational processes. Here, a model proposed by Puentedura (2009) was specifically pointed to (*Figure 4.2*). The interviewee had encountered the model when discussing the issue of technology assimilation with teachers, and found it useful to explain what they should strive towards when using instructional technology in general.

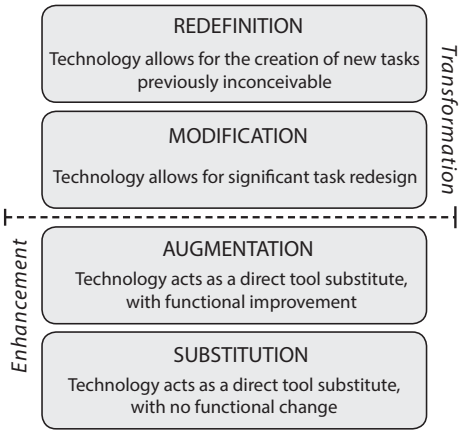


**Figure 4.2:** Puentedura's Substitution Augmentation Modification Redefinition model (2009), explaining the different levels of technology use in education.

So, the model can be seen as a description of previous attitude changes among teachers, and where attitudes need to be heading to truly start making instructional technology useful and impactful in educational contexts. The point made by Puentedura (2009) is that there's a wide spectrum of how instructional technology can be used in formal education. Merely looking at technology as substitution or even augmentation to current practices may be limiting the potential of the possibilities technology has to offer since you're always considering and comparing its utility in relation to previous practices. Currently, the interviewee considered formal education to be at a point where technology had an augmenting effect on pedagogical practice but that learning games offered the experimental and experiential elements that would make task modification and redefinition possible. As stated by the subject, the possibility to be in charge of, and interacting with, the components of your learning rather than primarily being a passive receptacle for it is a direction that should be lauded and pursued, and holds much potential to solve several issues the educational system is currently facing.

Continuing on the subject of why it would be beneficial to pursue learning games, motivation was a commonly recurring topic. In this context, learning games were seen as a potential way to engage students that were difficult to interest through traditional classroom instruction. The interviewee pointed to specific issues with keeping intrinsic motivation intact throughout a young student's educational progression, and that previous studies and their own experiences pointed towards intrinsic motivation declining dramatically in children as they approached high-school studies. One part of this many-facetted issue can be the previously mentioned passive role a student has in many educational situations. As children move up the ages, the educational practices often become increasingly formalized along with more rigid curriculum demands, and motivation often decreases as a result. The active participation in learning provided by learning games was once again pointed to as something that could alleviate this issue, and reason to pursue them as a part of redefining the nature of many educational tasks.

A final note that often sprung up during the interviews was another conceptual tool that had been used to discuss learning and what instructional technology in general need to model itself on was "The big five", which is a summarizing categorization of the abilities educators aim to help students developing:

- Analytical ability
- Ability to communicate
- Meta-cognitive thinking
- Information processing
- Conceptualization

These five "big" abilities is a summation of a much more detailed list of abilities schools need to nurture in students through their educational activities – and by extension they are educational guidelines that learning games need to adhere to in some way as well. The interviewee added that a single learning game doesn't need to cater to all of them, and that's not a requirement placed on other educational tools either, but one or a few of them need to be nurtured in the game experience.

As a final note, the interviewee also stated that the use of technology in schools is becoming one of the most prioritized subjects of debate during events he had been partaking in. There were a general shift of attitudes from *if* information technology should be accepted and become used in schools to a greater extend, to *when* this assimilation would take place and how to do it in the best way possible. There was still some wariness regarding instructional technology in general and perhaps more so when discussing games in particular. But, the conversations had a generally optimistic tone and the subject was approached as an important problem to understand and overcome rather than something to be feared and avoided altogether.

## TEACHERS

A lot of what was said by interviewed teachers ratified the concerns of the principals and the pedagogical specialist. During the studies, different groups of teachers from different schools were interviewed at different points in time. The main source of empirics here came from a long participative study where I collaborated with three middle-school teachers (**Teacher A**, **B**, and **C**) in using a learning game in two smaller classes (of 2-5 students) for a semester. On the side of the participative studies and working alongside the teachers, four interviews were conducted with them as well – one as the project was initiated, two during, and one at the end of the project to summarize their experiences. Besides the teachers involved in the collaborative project, there were an additional group of teachers at a secondary education school in Denmark participating in a small group workshop regarding learning games (**Workshop 1**), as well as a larger workshop organized in Sweden for teachers on the subject (**Workshop 2**). These workshops helped cast a broader net, and include a larger amount of teachers in the research process to make sure that not all opinions and attitudes were gathered from the same school.

Somewhat contrasting the broader issues brought up by the other subjects, the teachers' concerns were in general more practically oriented and connected to their own classes and students. Common themes of discussions were: how the game could be started up during class; how they could be sure that they knew what was going on in the game and assist their students; how they would be able to evaluate student performance; and how to ensure that the games adhere to the requirements of the national curriculum. But alongside these concerns, there were also large amounts of interest in using games in education. The interviewed teachers that already used games to some extent in the classroom were interested in furthering their use of them, but also stated that colleagues were often intrigued by the idea when the subject was discussed in their institution. Overall, the issues of accepting games as something that's worth pursuing wasn't seen as being near as prevalent as they were just a few years ago, and when discussing the subject **Teacher A** stated that "there's not many doubts whether you can learn something [from games] or not" that he could see – but he added that there are still many concerns regarding how

feasible it is to actually utilize them in educational environments given the many practical issues they bring to bear.

One of the teachers interviewed during the learning game project also supported the view of the pedagogical specialist in that using new educational tools such as learning games will require redefinitions of classroom education. **Teacher A** stated that "[as a teacher you think] I'm the pedagogue, I'm conveying the knowledge. I think it's important to rethink that hierarchy." A different way of approaching education with learning games, he continued, was to consider the teacher the facilitator and director of student driven activities – giving the student the tools, environment, and the seed of knowledge needed to start learning on their own through collaborations and explorations in learning games. However, **Teacher A**, **B** and **C** also stated that teachers being the sole providers of challenges and educational tasks would likely lead to unsuccessful learning game attempts, both as it would increase workloads for the teachers but also in that it limits the students' sensation of having an active part in their own learning activity. In a larger class of students, devising exercises that caters to everyone's level of proficiency would be unfeasible, so aiming to provide a flexible environment where students have more control would be a more sensible alternative.

**Teacher A**, **B** and **C** frequently made similar statements regarding what it would take to make learning games make their way into their own school environments as the principals did. It was primarily a matter of providing a stable environment for using the learning games, but also a matter of developing teachers' understanding of learning games through spearheading initiatives in schools. With "spearheading initiatives" – that is to say investing resources to help a few teachers develop their competencies in using learning games rather than having more universal training for the entire staff – examples of success could be facilitated and show other teachers how learning games can be used in certain subjects. It also serves to give a school an injection of learning game expertise that can be spread to other teachers from within the organization, making the change something that happens on the organizations own terms and with their own traditions in mind instead of being dependent on an external actor. As for success factors that learning games need to provide themselves (the previous one being a question of teachers' skills), stability was one of the primary factors – even more so than the specifics of the game's design. Continuity and reliability were specifically pointed to as the most important aspects that need to be in place for these types of activities to work and have an impact. Feeling that they're working with a dependable system, that will always be there and work every day as class starts, is crucial for most teachers to even start considering any type of instructional technology as relevant as an educational tool.

### 4.3.2 DEVELOPERS

When looking at the empirics from studies on developers, it quickly became apparent that there's a big difference between what experienced and new developers have to say about the craft. The studies included two developers that are considered experienced and have worked with learning games exclusively for more than three years. The other developers had varying degrees of experience working with entertainment game development. Most of the newer developers were incubator companies and had previously done small releases of games for the mobile devises or were still working on finishing their first titles, but they were all new to developing learning games for specific clients in education. An early observation during the interviews with these developers was that they primarily considered learning games as an alternate source of income and a way to fund their other development projects. With learning games still being a buzzword with high traction, many projects are carried out to allow developers and educators to explore the concept in various ways, and receiving grants from these projects can be a good source of income in an industry that is

otherwise hard to stay lucrative in for start-ups. This meant that the developers were in a difficult position of balancing development of their companies' "core" titles and the learning games for the project.

The common topics of discussion during the developer interviews were:

- Their relationship with their clients, how did they find their client and in what way did they communicated and collaborated with each other.
- How they handled the learning requirements put forth by their clients.
- How learning game development differed from the types of development projects they were previously accustomed to.
- Their own ambitions with learning game development, why they got interested in them and what they hope to achieve with them.

To make the results of studies with developers more manageable, I've split the empirics into categories depending on the context in which they were gathered. Most of the studies were conducted with developers who were carrying out the entirety of a learning game project at the time, which made the interviews and the participatory research more focused around a specific game concept and their attitudes and processes could be studied as they progressed through the projects. Other studies, primarily the ones with the more experienced developers, didn't revolve around a specific project and were more focused on general state-of-the-art discussions – both in the context of how their companies operate at large, and how they look at the challenges of creating learning games after having experienced it themselves.

## STUDIES DONE DURING LEARNING GAME DEVELOPMENT PROJECTS

The learning game projects were structured so that the developers were matched with different types of clients from the educational sector. During workshops at the start of the project the clients presented their ideas and what type of learning game they wanted out of the project, and the developer and client then discussed the ideas and codified them into a game concept. The developer had two months to execute the idea, which made design simplicity crucial and led many of the projects to aim for creating a prototype or proof-of-concept rather than a full-fledged game.

During the initial interviews with the developers, a common difficulty they were dealing with was that their clients weren't very familiar with games as a medium – which led to some difficulties in the early discussions in the projects. The intensity of the issue varied somewhat, and some of the clients were described as having no real understanding of what could be created during the limited amount of development time or the basics of what a game is, whereas some other were familiar with games that were popular among their students and wanted something similar but with added educational elements. For some of the developers, early talks had revealed their clients to be too poorly informed to collaborate with to a greater extent, and the projects started out with the developer having to fight an up-hill battle of trying to get more reasonable requests out of their clients. Other developers that got more specific requests (e.g. make a game with similar elements as another popular title) were working more on the challenge of seeing how educational elements would fit into the game concept they were given as a reference.

Developer **New1** was one of the developers that worked with a popular title as a frame of reference. They were also one of the developers that seemed to have struck a good collaboration with their clients, and had the opportunity to discuss learning goals and ambitions for the project at length with them. They explained that some of the bigger concerns of their client was to make sure that the game appealed to girls as well as boys in their class (the target students were of ages 8-10), and made some suggestions on what

they thought would be appealing or un-appealing for them. For instance, boys were considered to be more interested in competition, whereas girls would be more interested in collaboration or more mutually encouraging experiences. Requests such as these helped the developer steer development somewhat, and as they started out with a popular game title as the frame of discussion they could rapidly discussing specific design ideas with their clients. One particular quirk of **New1**'s client as well, which wasn't the case with the other projects, was that the client wanted a game that the students would play outside of school as an extracurricular educational activity or "homework".

A stark contrast to this was the project assigned to developer **New2**, as the client in this case was perceived as having very grandiose and misinformed ambitions with the project that made early communication difficult. Beyond the unrealistic scale of the project, the client also had limited understanding of what was possible to do in a game environment or what can or should be conveyed through the medium of games. This lead to a frustrating situation both for the developer and the client, and the communication between the two was explained as being difficult as they had two separate ways to consider the project and a different understanding of the medium of games in general. At the end of the project, the developer said that they had to concede to the will of the client as they didn't perceive as they were in a position to renegotiate and completely revise the client's requests. This had led to the creation of a product that **New2** was unhappy with and a stressful process of development as the game had to be significantly scaled back as it couldn't realistically cater to the requirements of the client.

When looking at the projects that **New1**, **New2**, and **New3** were involved in, a pattern also emerged regarding what role their games were going to play in the educational context. All of the developed games were intended to embody the entirety of some traditional educational process. For example, in the case of **New1**, the game was intended to provide motivation, convey the subject matter, and provide assessments of students' progress. In the case of **New2** which was perhaps the most severe, the game was intended to replace an entire lesson plan for a course lasting several weeks – containing introductory material, course guidance, and student assessments. The observation here is that it was rare that the game was approached as a part of a sequence of educational activities, and is more often seen as something that could either be a stand-alone extracurricular activity or replacing a course altogether. Another observed pattern was that technology availability was rarely a topic of discussion during interviews, and at the end of the projects there were issues with some schools not being able to use the developed games due to technological issues, the distribution of the games to schools being difficult, and in some cases the games being developed for the wrong types of platforms. This differed somewhat in the approach taken by the semi-experienced developers, and they frequently referred to their games as being a part of a bigger educational process. **Semi-experienced2** specifically pointed to how they wanted their game to facilitate classroom discussions and collaborations, and that their game would primarily be a platform for students to exercise and experience problem-solving together, but that the primary learning would probably happen during reflection and analysis of the game sessions that would take place in the classroom afterwards.

The case of **New5**, a project I had a more participative role in, was quite different from the others. This project wasn't conducted the same way as the previously described cases, and was completely initialized and conducted solely by the developer. This developer had a strong background in both practice and theories of educational processes and learning, but less so when it came to game development. The inspiration for the project came from seeing how games could cater to students that were problematic to keep engaged with traditional educational means – and the goal was to create an educational space where these students felt in control and skilful. As opposed to other development teams, this developer approached the project with the goal of appropriating an already existing game

title to be more easily usable in schools. The project was thus focused on creating a service for schools based on the game, rather than creating their own game. During project meetings, discussions initially revolved around understanding the game and what it is that made it fun and engaging for students, and how these elements could be made more accessible for teachers and usable in classroom settings. When they moved beyond discussions of the game's mechanics and design, a large portion of the discussions revolved around what they needed to add to the game to make it usable for teachers in classroom contexts. The questions were often practical, for example how they could make work assessments easier for teachers, and how lesson plans could be distributed to students inside the game and also shared to other teachers. All in all, with a solid game that was considered to contain educational potential to build from, **New5** focused heavily on how to add elements that would make the game more usable in formal educational contexts. But, an important note to end on is that this developer, while being experienced educators, had little understanding of the process of game or software development. Elements were discussed on the basis of what they would provide the users when implemented, but the way these things would be implemented and constructed was largely untouched.

## STUDIES UNRELATED TO SPECIFIC LEARNING GAME DEVELOPMENT PROJECTS

The two experienced developers included in the study had differing backgrounds – **Experienced1** was an experienced developer and their primary background was in game creation, **Experienced2** instead had a strong background in education. These backgrounds are reflected in the points brought up by the developers, and have a clear influence on the way they both approach learning games as a craft.

With **Experienced1**, matching subject matters up with appropriate game mechanics had been a common way to approach learning game projects. Listening to what the clients wanted, and using their knowledge of games to find suitable mechanics that could accommodate for the client's requirements had been a good way to keep development projects focused and facilitate communication with clients. The bigger projects they had been working on all emphasised educating and assisting the teacher as well as the students, and they developed instruction manuals for teachers that suggested ways of using the games in the classroom that were delivered alongside the actual game artefact. One thing prioritized by the developer was maintaining the core experience of the game in their products, and not letting the educational content take precedence if it infringed on the elements that made the game engaging too much. Choosing a known game concept or genre in early talks with clients helped towards this goal as well, as knowing what elements were crucial in making a game engaging made it easier to identify where compromises could or couldn't be made in pursuit of including educational goals.

The experienced developers brought up similar points to one another when it came to the financial aspect of creating learning games. Each of these developers aimed to work with learning games independently of project grants, and had been moderately successful in doing so for quite some time. For **Experienced2**, this meant that they had to find educational institutions to purchase their finished product. **Experienced1** had taken this approach in some cases as well, but had more frequently been seeking out customers that wanted to make learning games and could commission games from them. For the latter approach, finding clients that want to commission games is a difficult proposition, and they were often forced to be soliciting for projects rather than being contacted by interested parties. **Experienced1** had also made attempts to create prototypes and games to show for clients that would be suitable for them (for example, showing a prototype for a math game to principals or teachers), but it was still difficult to find clients who could support the costs for entire development projects. This approach was also used by **Experienced2**,

but they had found ways to make that business model work. Their background in education made it easier for them to describe the benefits of their game to teachers, and had specific strategies to make sure that their product worked well in schools by educating teachers in using it, and thus building up their own audience. **Experienced2** stated that they had already reached a large audience with their learning game, but that merely selling game copies had not been enough to remain profitable long-term. This had encouraged them to think of the game as being the core of a broader solution, but that it wasn't the entirety of the product they would offer. Their game wasn't specifically niched to be used in a specific school subject, and their focus was now on constructing supporting services and solutions around the game to show existing and new customers different ways of using the game in classrooms.

On this topic, **Experienced2** pointed to several aspects they considered made a learning game successful. Specifically, a game needs to provide accessible means for lesson assignment, monitoring the play sessions, and assessing student progress and involvement in activities inside the learning game. These three specific aspects had been found to be highly valued by teachers they had worked with previously. Furthermore, both experienced developers also emphasised the importance of seeing a learning game as a tool existing in a broader classroom context. The game doesn't have to provide a thorough explanation of the subject matter, or all necessary contextualization and reflection regarding what the game activity portended to teach the player – there's a teachers present in formal educational context, and it's important to make them involved in the gaming activity. The teacher can serve an important role in setting up learning game activities, and to discuss the content of the learning game with the students before, during, and after the game session. Here, **Experienced2** also emphasised the need to help educational institutions in implementing their game into the teaching environments, and hosted workshops and had continuous online interactions with teachers to make sure that they would find the learning game useful. This in and of itself was an interesting unifying characteristic of both experienced developers as they made significant efforts to cater to teachers, rather than solely focusing on making an experience that would be compelling for students. Here, both developers took a similar approach in basing their product on well-known game concepts to ensure an engaging experience, and then focused on implementing tools, explanations, and instructions that would make the game more accessible for teachers. For **Experienced2**, this entailed being very specific of how their game would fit into a classroom context, with explanations of how to prime students for game sessions, how teachers could participate during game sessions, and how to discuss the session afterwards and encourage reflective and analytic play from their students. **Experienced2** acknowledged (just as **Principal A** and **B** did during interviews) the importance of supporting the teachers that were passionate and experienced in using games for educational purposes, as they were important in introducing learning games to their colleagues. **Experienced1**, however, were more focused on creating functional learning games based on their clients' requirements, and certainly understood the importance of making their games accessible to the teachers that were supposed to be using them. But, they didn't specifically mention any bigger agenda of growing their audience in schools, and making schools more familiar with games, beyond that.

## 4.4 SUMMARY

The case studies were divided between educators and developers, and I continuously bounced back and forth between these two groups during the research process. This interplay allowed the two "types" of cases to inform each other – attitudes and procedures discovered during studies with developers could be used as inspiration to the design of the studies involving educators, and vice versa. The multi-method approach and inclusion of

several perspectives on the same phenomenon has been a good way to tackle that challenge and has produced empirics that can be used to answer the stated research question, but considerations need to be made of the method's primary shortcomings: reproducibility and generalizability.

The studies showed that learning game development is an affair approached from several angles among developers. There are differences in business models and attitudes, and from the companies interviewed these differences mainly stem in part from level of experience, but also from the developers' different ambitions with what they want to do with learning games. Companies that professed to be learning game developers approached the development with more deliberation, and discussed the working situation and context their clients were working in to a greater extent than the developers who considered learning games as an alternate venue of income. Many of the learning game developers working in projects at the time professed that there were some difficulties in communicating with their clients, as they had different frames of reference and understandings of games as a medium. This could lead to unrealistic expectations and requirements from the clients and difficulties to come to a decision of what to create during the project in discussions between clients and developers. Some developers that provided clear references for the discussions with their clients, either through popular game titles or descriptions of stories and game worlds they had built previously, seemed to have an easier time discussing the project with their clients.

The more experienced developers mentioned difficulties with finding a business model suitable for learning games. Keeping a company running by the sales of game copies alone was considered unfeasible, and it was important to consider learning games more as a long-term service than as something that is created and then sold for an up-front cost. Another venue for income was being commissioned for creating learning games for specific client, which is a practice common among many learning game developers. The problem with this type of company strategy is finding clients, and for that reason it's an uncertain way of working.

The developers' backgrounds also seemed to influence their practice and priorities during development. For **Experienced1**, building on a background on game design and development, a common approach to their projects were evaluating subject matter and finding out what types of gameplay mechanics would be suitable for conveying it. They also often identified what challenges different types of gameplay provides and what problem solving skills specific game genres required from their players. For **Experienced2**, making sure that the game would fit into an educational context and be usable was of high priority. Ensuring accessible ways for teachers to assign game-tasks during class, capabilities to monitor play sessions, and to evaluate student participation and performance, was three of the more important functionalities their customers wanted out of the game.

For educators, there's plenty of enthusiasm when it comes to trying to appropriate new technologies in formal educational contexts, games being among these technologies. While interest was high, and increasing still, instructional technologies hadn't significantly impacted educational processes as of yet and primarily augmented previously established educational processes rather than being used to innovate and restructure them. The most pressing issues of using learning games in the classroom was teacher competencies in utilizing games efficiently, and the technological infrastructure in schools needed to ensure that the games would function reliably. If an educational tool can't be counted on to perform as expected, it had very little chance of being attractive for educators. There's also an issue of learning games increasing the workload of teachers, and if games required too much precursory work to perform well in classes, or if they were too complex and required a lot of additional tutoring for all students to be able to use it, the potential benefits of using

a learning game would be outweighed and there were often already more effective solutions being used.

The way games usually made their way into schools, as stated both by interviewed teachers and **Experienced2**, was through teachers who were already familiar and knowledgeable with the medium. Through their own initiatives, these types of teachers would implement games as parts of their classes, and successful efforts would often spark the curiosity of the teachers' colleagues and further the discussion of the merits of learning games. Both educators and **Experienced2** pointed out the importance of supporting these types of efforts and personalities if learning games were to make some headway in the realm of formal education.

Table 4.3 provides a summarization of the conclusions drawn from the case studies.

**Table 4.3:** Summarization of chapter conclusions with examples of sources providing the information.

| Chapter conclusions | Study source(s) | Reference |
|---|---|---|
| Educators evaluate new educational tools on a series factors spanning from resource requirements and their accommodation for learning goals stated in the national curriculum. Teachers specifically valued reliability and ease of use and ability to use educational tools on a large portion of their students. | Principal A and B<br>Teacher A, B, and C | 4.A |
| One of the primary concerns educators had with using games were their requirements on technological infrastructure in order to function reliably. | Principal A<br>Teacher A, B, and C | 4.B |
| Educators work under severe monetary constraints; the allotted budget for all school subjects a student attends in a calendar year puts severe limitations on what types of teaching tools the schools can purchase. This limits the purchasing power of the audience for learning games and affects the financial situation for developers. | Principal A<br>Pedagogical specialist<br>Experienced2 | 4.C |
| The interviewed educators stated that the general attitudes towards games as teaching tools were positive, but that many are still wary of their reliability and their actual educational value. | Principal A<br>Pedagogical specialist<br>Teacher B | 4.D |
| Both educators and developers stated that the most common way for games to make their way into formal education was through passionate and knowledgeable teachers who could handle the intricacies of implementing a game into their teaching. | Principal A, and B<br>Teacher A, B, and C<br>Experienced1, and 2 | 4.E |
| Expectations that games should represent an entire course curriculum and function as stand-alone teaching solutions are still present among some teachers and educators. | New1, New2, and New3 | 4.F |
| Developers that worked out the requirements and design of a game together with their clients at an early stage, using existing entertainment game titles as a point of reference, seemed to have an easier time throughout development process. | New1<br>Experienced1 | 4.G |
| Some developers experienced great difficulties when communicating with their clients. The issues varied from resolvable differences in priorities and ambitions, to more lasting differences in the opinions of what a "game" is and what it can reasonably be expected to do. | New2<br>Experienced1 | 4.H |
| Developers had two different approaches to creating learning games. The developer knowledgeable in game design matched subject matters with appropriate game mechanics, and the developer knowledgeable in education focused on making a game that could easily fit into and play a specific part in a broader educational contexts. | Experienced1, and 2<br>New5<br>Semi-Experienced2 | 4.I |

# CHAPTER 5
# ANALYSIS AND CONCLUSIONS

As a preface to this chapter I would like to encourage the reader to keep my own background, which is in the design and development of entertainment games and serious games, in mind when interpreting my results and my description of how aspects of formal education influence learning game development. As will be apparent, most of my conclusions are written from the perspective of how game experience is influenced by the need to provide utility, but there are fewer arguments for how this relationship can be looked at from the opposite direction as well, i.e. how the utilitarian perspective can be influenced by the need to provide a good game experience.

A valid critique of my research is that I treat game design as something that has generally been "figured out" in serious games and entertainment games, which is why I consider the bottleneck for making impactful learning games at this point being a lack of understanding of the characteristics of formal education. The reason for this is that my background is in the area of games and not in the field of education. Confining my conclusions and analysis to the challenges added to the design and development of learning games has been a necessity as I'm not well versed enough in the details of educational practice and how they are impacted by introductions of new information technology. That's the only lens available to me when examining the problem, and as a result games are the objects put under the microscope in my research – which I fear lead this text to perhaps come across as overly critical towards games and more reserved in critiques of formal educational practice. In reality, the issues and complexities are not flowing from a single direction and the games medium isn't the only part of the learning game equation that needs to be tweaked and reinvented in order for us to find a better solution to it down the line.

## 5.1 CREATING A UNIFIED PICTURE OF LEARNING GAMES

In the beginning of this thesis I described the reasons that fuel educators', researchers', and developers' pursuit of making learning games fit into formal educational contexts, and subsequently delved into the more obvious practical obstacles that made this process difficult. The practical obstacles produced by the realities of formal educational contexts have been examined by researchers before (Egenfeldt-Nielsen, 2008; Macklin & Sharp, 2012; Squire, 2005), and researchers as well as developers have also started to produce guidelines on how to circumvent them (Linehan et al., 2011; Westera et al., 2008). Both previous research (Squire, 2005; Squire et al., 2004) and results from my own case studies

have shown that games remain on the fringe of formal education, and that they are still primarily used to capture students that traditional educational means have failed to motivate. In my research, I have examined the details of the practical obstacles introduced by the formal education setting and the ways learning games are currently being used and developed for education with the aims of proposing a new model for understanding learning games both as games and as educational utilities.

The research was initiated with a foundation primarily built on serious games research and studies on game design and development, but it quickly expanded to include fields of research that could account for the organizational and sociotechnical aspects that I found useful to understand all the peculiarities of learning games. These different disciplines and the way they have come to mesh together in this thesis are:

**Game design and development** continuously influences the way learning games are made, and their growing popularity and technological sophistication inform interest and expectations educators and students have in them.

**Serious games and learning games** research and design guidelines are useful for explaining how learning and engagement is provided in learning games, and what learning principles learning games can cater to.

**Instructional technology and information systems** can provide theories and frameworks for understanding how information technology and instructional solutions fit into organizational contexts (e.g. in formal education), and how design and development processes can make the process of implementation smoother. A particularly salient point made by IS researchers is organizations themselves need to adapt to new technology as well, and introductions of new software solutions can reveal flawed or outdated practices.

This chapter will discuss the findings produced through the systematic combination of the theoretical framework gained from literature studies within the three disciplines, and the results produced from case studies conducted throughout my two years of research. My interpretation of these results and their implications on learning games as educational tools and game development projects will be presented along with a critical examination of my chosen research methodology and its execution.

## 5.2 LEARNING GAMES – A MERGER OF UTILITY AND GAME EXPERIENCE

To encapsulate the discussions and conclusions of this entire chapter early on, I'd like to present the model that I've devised and been relying on extensively to describe the different participants and concepts that converge during learning game projects (Figure 5.1). Previous research in serious games and learning games has emphasised the compromise between educational and engaging content, and there has been plenty of suggestions of how to reach optimal compromises through appropriate design decisions. While this may be a reasonable approach for games that aren't intended for use in formal educational contexts, it is insufficient when strict parameters for a game's use are introduced. No matter how well the developer manage to strike the difficult balance of providing transferable learning and an engaging game experience, the utilitarian aspects of the game will determine the impact the game will have in the educational environment. But, it's important to add that the formal educational context isn't always detrimental for learning game development and design, and that it provides several opportunities for developers that can elevate the quality of their products. The intent of the new model is to codify the many crucial components of learning games into an easily accessible format. The model both explains the actors and components that are a part of learning games' make-up, but also the tensions and dilemmas that can arise between them. Thus, both the purpose and

the final appearance of the model shares many commonalities with Harteveld et al.'s (2010) model for serious game design, but rather than focusing on design dilemmas this model deals with the peculiarities of development and implementation by including the contexts of use and participants of the process.

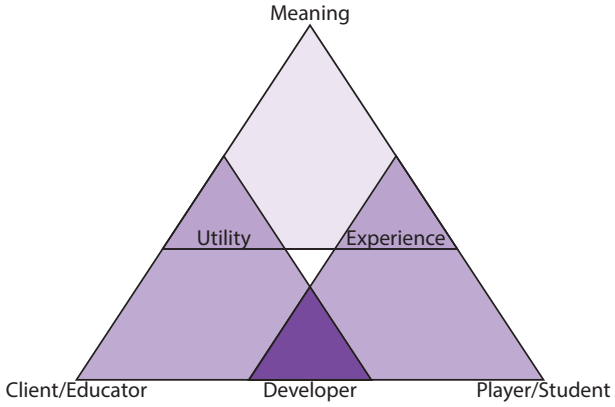


**Figure 5.1:** The Learning Game Utility and Experience model.

The model is a depiction of how the different participants and values present at some point in a learning game's lifecycle relate to one another. I argue that the concept of learning games boils down to a merger between experience, utility, and meaning.

- **Experience** refers to the dynamics and aesthetics of a game, and the engagement and enthrallment the game world provides players that enter it. In essence, experience refers to game experience.
- **Utility** refers to the way the game fits into the broader formal educational context, the aspects of the game that transform it from leisure activity to educational instrument – reliability, means for assessment or monitoring, and administrative tools for teachers are examples of utilitarian aspects of learning games.
- **Meaning** refers to the educational significance of the game's contents, and is affected by the interplay between experience and utility. While the aesthetics of the experience and utilitarian additions can sufficiently encapsulate the "physical" appearance of the game, the meaning refers to the learning derived from play sessions (e.g. subject matter representations, collaborative problem solving, communication-driven challenges)

While these are the three cornerstones that I consider constitute a learning game, the properties of experience and utility are results from collaborations between the actors participating in the creation and use of the learning game. The bottom part of the model doesn't only describe the way the different actors fit together and what they produce (e.g. developers and clients come together to create an object with utility), but it's also meant to indicate how the collaborations can be understood.

When it comes to constructing experience, developers often directly collaborate and conduct playtests with the intended players of the learning game, or they indirectly analyse their target audience to understand what type of experience would be appealing to them. To understand these relationships we can return to the theories presented in the background of entertainment games. The MDA framework (Hunicke et al., 2004) can be seen as an explanation of the way the developer and player/student produce an experience together, or the descriptions of pleasurable experiences in flow theory (Chen, 2007; Cowley et al., 2008) and the theory of fun (Koster, 2005) can provide guidelines to crafting engaging games by understanding the psychology players.

On the other side of the model, utility is a product of collaboration between client and developer. The client brings a specific organizational context to the collaboration, and developers need to understand the culture, environment, and infrastructure of this context in order to create something that provides utility. Here, models such as Alter's work systems framework (2008a, 2010) and models from instructional system design (Gustafson & Branch, 2002; Moore et al., 2002), can be useful for explaining the process of developing these types of utilitarian learning games and the context they are to be used in. Another important step in ensuring utility is to acknowledge that the design and development of a system doesn't end once a product is created, and that it has a chance to evolve inside its intended organization. An important part in the ADDIE model (Gustafson & Branch, 2002; Molenda, 2007) as well as the sociotechnical design model (Alter, 2010) is their emphasis on continuous evaluation and refinement of developed information and instructional systems.

So, both utility and experience is created in collaborations between developers and their clients, and between developers and players. But, clients and players don't merely assist in creating these elements of learning games, their properties and characteristics heavily influence the way utility and experience. The role of the developer is not only to collaborate with both clients and players, but also to interpret their characteristics and tailor the experiential and utilitarian aspects of the developed learning games accordingly. Through subsequent use of the game during school activities, experience and utility will be provided to educators and their students, which in turn combine to produce meaningful play sessions.

## 5.3 FORMAL EDUCATION AND LEARNING GAMES

While the model presents a way to characterize the anatomy of learning games for formal education and hint at their complex makeup, it doesn't present challenges and concerns specific to different sectors of the model. With the model of learning games as a backdrop, the remainder of this chapter will focus on explaining nuances and tensions between the different actors and values presented in the model.

The creation of learning games is difficult regardless of where they are to be used, but the formal educational context adds certain unique challenges as well as certain opportunities. The challenge of designing a game that both contains learning elements while remaining engaging is certainly difficult, but the schools and classrooms provide challenges that aren't just solvable through good design choices. I've divided the primary concerns found in the case and literary studies below in their own categories. Some of the concerns are more abstract and don't necessarily speak towards the practicalities of learning game development, and could be considered as ontological questions that are of more relevance to academics. Most of the described tensions, however, can be seen as informative or predictive to the practical side of learning games. Some of these sections will speak to what you need to keep in mind when trying to create a utility, some will cover tensions between actors, and some will contain a little bit of all aspects of the learning game model.

### 5.3.1 THE CLASSROOM AS AN AUDIENCE

A major discrepancy between learning games for formal education and games used as leisure activities are the audiences they are obligated to cater to. In the case of entertainment games, or learning games that aren't bound to a specific educational context (e.g. games with educational elements purchased for home use), the audience are opt-in consumers and the developer has the creative license to focus their game aesthetics to resonate with a certain type of individual. In these cases, developers aren't obligated to

cater to everyone, and the consequences of focusing their product only means that the consumers that aren't attracted to the game concept and engaged by its contents simply won't purchase the game. Learning games that are to be used in formal education however, have far more intense requirements of audience appeasement – and a more heterogeneous audience they need to appeal to. As stated by the principals during interviews, new educational methods and tools need to work for every student in a classroom in order to be considered usable.

The problem for learning games here stem from the fact that the average classroom consists of individuals whose primary unifying characteristics are their age and geographical location. If you look at a classroom of 20 or 30 students, you will likely find that there are 20 or 30 individuals with varying interests, backgrounds, degrees of computer and gaming literacy, and different amounts of knowledge within the subject area being taught (Kickmeier-Rust et al., 2011). Trying to cater to all these individuals with a game title is an immense undertaking, and it's unlikely that a game that isn't thoroughly adaptable or player-driven will work well in a classroom environment.

As an example, in an attempt to use the complex historical strategy game *Europa Universalis* learning game scholar Egenfeldt-Nielsen (2008) observed severe differences in how quickly students were able to learn the game, some spending several weeks trying to grasp the basics of the game's interface. For these students, just getting to the level of expertise needed to interact with the content meant to teach the subject matter consumed several valuable classroom-hours (Egenfeldt-Nielsen, 2008). Instead of being able to discuss the subject matter, teachers also had to spend a significant amount of their student-teacher time teaching the students how to play instead. Granted, Europa Universalis is a complex game, but there's no solution to be found in just focusing on making learning games easier either.

The principle of "flow in games" described on page 25 gives some further ratification for why the classroom audience presents some unique difficulties. If player engagement depends on the relationship between the intensity of game challenges and player skill, and if player skill varies greatly in your intended audience, creating an engaging game becomes very difficult. There are also several parameters other than player skill that dictate game enjoyment and that varies greatly between individuals in a classroom as well (Kickmeier-Rust et al., 2011; Squire, 2003). Subject matter familiarity, gaming literacy and proficiency, and computer experience will certainly all have their averages that you can cater to as a designer or developer, but depending on the type of classroom it's difficult to create games that don't alienate some individuals due to the fact that they have widely different preferences and abilities (Law, Kickmeier-Rust, Albert, & Holzinger, 2008). For this reason, more focused types of classes are likely easier to create learning games for as their variations aren't as severe – for example, niche programs in secondary education may attract a certain type of student, and add more commonalities in the audience than just their age as is the case in lower tiers of education.

For these reasons, creating an engaging learning game for classroom environments is difficult, and unless the classroom is homogenous or if the game is made highly adaptive, a significant amount of students may rapidly become disinterested in the learning game experience. There has been plenty of research made in the realms of adaptivity in serious games (Kickmeier-Rust & Albert, 2008; Lopes & Bidarra, 2011), which can provide parts of the solution. But games that adapt to the personalities and proficiencies of individual players are difficult and time-consuming to create, and requires thorough understanding of how to assess player behaviours to know what adaptive measures need to be taken (Kickmeier-Rust et al., 2011; Schoppek & Tulis, 2010). But, as noted by Egenfeldt-Nielsen (2008) and Squire (2005) in their studies on the implementation of learning games in classrooms, failing to motivate isn't the only challenge of catering to these environments.

Time spent on mastering game mechanics, for instance, is time taken away from learning the subject matter (Macklin & Sharp, 2012; McClarty et al., 2012; Squire, 2005).

### 5.3.2 THE SCHOOL INFRASTRUCTURE

Infrastructure in this context refers to the condition of the resources needed to support the use of learning games in classroom environments. The elements, which were specified by both principals and teachers in interviews, can be roughly divided into human factors, technological factors and organizational work structures (Table *5.1*).

**Table 5.1:** The organizational factors of schools that affect learning game use.

| Category | Participants, technologies, and practices |
|---|---|
| Human factors | Culture and attitudes |
| | Administration and support |
| | Teacher's experience and expertise:<br>• Gaming literacy<br>• Technology and computer literacy |
| Technological factors | Device availability (e.g. PCs, tablets) |
| | Network availability and security |
| | Technology reliability |
| | Information storage and access |
| Organizational work structures and praxis | Schedule restraints |
| | Curriculum guidelines |
| | Preparation time |

The teacher's experience and expertise is crucial for the use of a learning game. The teacher needs to understand the game in order to understand what students are doing within it, and be able to translate game progress to curriculum progress and learning goals. The teacher also needs to be proficient in setting up play sessions in a limited amount of preparation time, and assign tasks and support their students during the play sessions. Teachers also serve the important role of conduit between learning context and play context, and need to know how to contextualize the game content to the subject matter being taught. A deep understanding of the game being played can also be important for evaluating student progress through the curriculum. The organizational culture of an educational institution also has to be receptive to games as a medium – luckily, acceptance towards games have taken great strides in recent years. Recent research points towards a high acceptance of games as potential teaching tools by parents and teachers (McClarty et al., 2012; Ruggiero, 2013; Wastiau et al., 2009), and the interviews held with educators during this research indicate the same. But, there are still teachers, principals, and parents that remain wary of games in schools, and with valid reasons. Since the learning outcome of gameplay isn't yet fully understood, and since cyber-bullying and negative psychological effects of games remain pressing subjects, it's understandable that there are some reservations in schools when it comes to employing learning games on a larger scale. In order for a game to find traction, an organizational culture that understands games and knows how to contextualize game contents to students and parents is necessary. These types of cultures are hard to cultivate by educators too as games manifest something of a cognitive disconnect in educational processes. As the interviewed principals both stated, there's some trepidation among principals and teachers when it comes to adopting instructional systems whose inner mechanics are largely indecipherable to them due to the opacity of modern technologies.

On the technological side of things, all necessary components need to be in place to support the teacher. To refer back to a statement made by Teacher A during an interview, reliability and continuity is crucial in order to make a learning game an attractive proposition for teachers. Simple practicalities like device availability and reliable ways of conducting play

sessions can be difficult to maintain but are necessary to retain continuity in play-based lessons. There are also more complex matters of being able to monitor play sessions, either in real-time in order for teachers to moderate classroom play sessions, or in order to store information from sessions for student assessments. It's important to realize that traditional means of education provide easy methods for assessments and evaluations, and in contrast learning in games can seem indecipherable and difficult to codify. To support this, the learning game can be developed with teacher involvement in mind, and provide specific guidelines for how the teacher should discuss and evaluate play sessions by traditional means. The game Global Conflicts: Palestine (2007) that take this approach – and provide instructional manuals for teachers explaining how play sessions should be introduced, and how the debriefings after play sessions can be conducted to both contextualize the game experience in the subject matter being taught and to evaluate students' understanding of it. Another approach that is somewhat more advanced and technical is to implement ways to track various metrics from play sessions, for instance providing data of where students journeyed in a game, what characters they talked to and what dialogue options were chosen, or how the student experimented and interacted with the game world. Making such data available for teachers is, however, only valuable if the teacher knows how to interpret it, so it can require some training on the part of teachers – but otherwise built-in means for student assessment can be a potential way to make a learning game more appealing for teachers.

The organizational practices common in formal education (described in *Table 5.1*) that put restraints on how a learning game can be put to use and that are somewhat antithetical to the way games function. School days are normally scheduled in a way that fragments play sessions. If lessons within a specific school subject are spread out over an entire school semester, there will be few classes per week for the subject. This has some implications for how games need to perform and their ease of use, as well as how they need to be designed in order to provide a solid game and learning experience rapidly. In entertainment games, players can spend several consecutive hours to get immersed or engaged by a game experience and familiarize themselves with the game mechanics and interface. Placing fixed limitations on play-time and length of interims between game sessions interrupt the rhythm of normal gameplay. Getting back into a game and entering a state of mind where you can get enthralled by the experience can take time, and designing learning games as lengthy epics may for this reason be a poor choice. Episodic gaming, or independent and bite-sized game challenges could be more serviceable in the fragmented environment of formal education.

But, regardless of specific solutions for these types of issues, educators and developers should be aware that learning games require a great deal from a school's infrastructure in order to work well and awareness of infrastructural concerns can be as important during learning game development projects as understanding the taught subject matter. However, it's important to look at the organizational aspects mentioned here as malleable constructs, even though changing them may seem overwhelming in the short term. As new technology makes its way into formal educational settings traditional practices and structures will likely start changing.

### 5.3.3 COMMUNICATION BETWEEN DEVELOPERS AND EDUCATORS

As indicated by several of the interviewed developers during my research, communication between developers and their clients in education was difficult. Comparing what developers and educators prioritized during their discussions regarding learning games also gives some indicators to where the problem lies – developers value the integrity of the gameplay and most points are made in reference to it, educators value utility, reliability, subject

matter representation, and learning outcomes. Beyond the different priorities, their perspective of what a games and a learning games are can also differ at a fundamental level, as was evident in the case of developer New2 that found little common ground with their client. This point has also been brought up in other serious games research (Harteveld et al., 2010; Tan et al., 2012), as well as in instructional design and IS research, and there's no doubt a divide between game developers and educators both when it comes to what they prioritize in the design of learning games and how they articulate their expectations and ambitions.

The challenges introduced to the design process when the world of education mesh with the world of games is also described by Harteveld et al.'s (2010) Triadic Game Design model. In any type of serious game project involving a client design decisions are made collaboratively between different parties with different priorities (Engström et al., 2011). Clients may for example value realism and fidelity in subject matter representation, which will have implications on what the game's designer is able to do (Egenfeldt-Nielsen, 2011). This dilemma, referred to as the dilemma of representation in Harteveld et al. (2010), needs to be solved through extensive communication between the developer and the client. The possible compromises, game elements that need to remain intact in order for the game to be at all engaging, and subject matter components that need to be represented for the game to be meaningful, need to be articulated clearly by both sides for the dilemma to be resolved amicably.

With the vocabularies of educators and developers often being very different from one another, this type of communication can be difficult to establish. This divide is also visualized in the presented learning games model, and the onus is often placed on developers to understand development from both the utilitarian and experiential perspectives. This is not to say that developers necessarily need to understand both these sides in great detail, but awareness of the difference between what educators can emphasise when they talk about learning games and what it takes to provide engaging game experiences is important. Some of the interviewed developers had found that having a specific type of game to make references to when working out the design of their learning games with clients was a useful way of lubricating discussions. Instead of making guesses as to how different design choices would manifest in the final product, educators got an opportunity to witness it directly. Rapid prototyping, or using pre-existing games as points of reference, could hence be a way to unify the vernacular used by developers and educators in a project.

In many serious game and learning game development projects involving a client through the development process, a stable environment of open communication is difficult to achieve. The reality of many developers is that they are put in a position where they perceive a need to accommodate a client's requests. The fact that the developer is being paid to deliver a service that helps further the client's education or training ambitions means that specifications of the software isn't negotiated on equal terms, and standing firm on certain aspects of the game's design takes an immense amount of courage on the part of developers. This may lead to subject matter representation and client requests often taking precedence in serious games and learning games, leading to games that are dull but saturated with an immense amount of educational or training content.

### 5.3.4 TECHNOLOGY ACCEPTANCE AND TAKING RISKS IN FORMAL EDUCATION

A recurring theme in the discussion with educators was that attempting to use learning games in the classroom was essentially a risky move. It's a sensible concern; to some extent educators throw guidelines and regulations to the wind when using learning games instead

of traditional educational methods. If curriculum goals then aren't achieved, the teacher or principal is the one held accountable and not having the safety of operating within the boundaries of established guidelines puts the educator in an exposed position. In the participatory studies I conducted in this research, the students we directed learning game efforts towards where cases where the teachers were already operating outside the realms of formal guidelines: the fringe cases where students have already fallen beyond the point where traditional education was an option. For educators, these are safer petri dishes in which they can experiment with new types of educational tools – but in larger classroom contexts the stakes can perhaps be perceived as slightly higher, along the practical facts that introducing new types of tools is more cumbersome and involves more complex logistics when 20-30 students are involved instead of the smaller amount of students in special educational settings.

Another aspect contributing to the aversion of attempting to use learning games more extensively comes down their unknown effects on psychology and behaviour. There are many different opinions among research regarding what the specific psychological effects of gameplay are (Ferguson & Kilburn, 2010; Ko, 2002; Lee & Peng, 2006; Washburn, 2003). For this reason, a developer needs to show awareness of the potential issues of haphazard design decisions and audio-visual representations, and create experiences that are tasteful and appropriate. But, another important concern brought up by teachers during interviews is the one of online bullying and student safety in technology-mediated interactions. This isn't a problem that's easily solved with clever design choices, but instead by teacher involvement and awareness.

These aversions and concerns aren't specific to new technologies and learning games in school environments. As the previously mentioned UTAUT model describes (page 59), facilitating conditions within organizations, social influences from co-workers and the expectancies of required effort and end performance of solutions are all significant factors that can make or break the introduction of new technologies in organizational structures (Pai & Huang, 2011; Venkatesh et al., 2012). The facilitating conditions teachers and principals are subject to are specifications established both within their own institutions, performance pressures from parents, as well as grander politically established national guidelines and performance requirements. Social influences when using learning game are commonly the preconceptions of games as being frivolous activities for adolescents that are still prevalent in society in general, as well as the fears of unknown psychological effects games may have on children. Factors such as these influence the intention educators have on utilizing learning games, as well as how they do use them once they are provided to them. In the participatory studies, workshops, and interviews with teachers concerns regarding their institutions acceptance, other teachers' and parents' opinions, national curriculum specifications, and work effort required to use learning games were all brought up on several occasions. Once again, these aspects aren't solvable with cleverer learning game design or awareness on the part of developers. While competent development and design does help, these concerns are in the hands of educators and legislators, and the current socio-political landscape regarding games and didactics can hinder introduction of learning games in education.

### 5.3.5 RETURN ON INVESTMENT

Finally, the current situation of learning games can be pondered on their merits of providing return on investment – both from the perspective developers and educators. Increased motivation, retention, deeper learning, and the ability to interact with and experience a subject as a participant are some of the benefits usually touted when the merits of learning games are evangelized. But with the issues of audience heterogeneity, practical obstacles inherent in formal education, and development costs, can learning

games provide enough return on the significant amount of investment needed to create, implement, and use them? Figure *5.2* provides a rough visualization of the added educational values promised by learning games, juxtaposed with the resource investments required to use them.

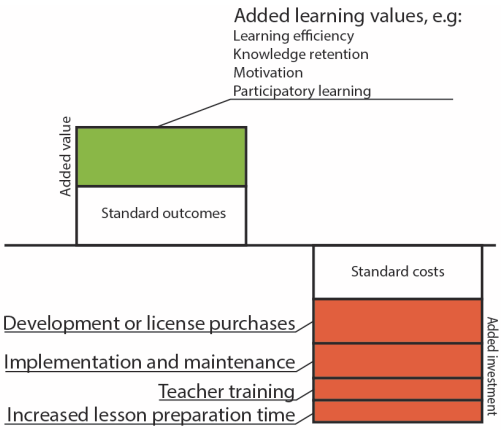


**Figure 5.2:** The added benefits (left stack) and added resource investments (right stack) of learning games. The figure does not present proportional investments, but roughly visualizes the struggles of providing benefits equal to investment with learning games.

Return on investment is essentially a two-variable equation, and for interviewed principals and teachers the return is not "what does the game teach?" but "how much better is the game for learning than previously used methods?" In evaluations of new teaching tools, pedagogical value isn't judged in a vacuum but in comparison to other available methods, and primarily methods already being used. Learning games for formal education are always competing against other methods of education, and it's an uphill battle in many cases as the infrastructure of educational institutions is built to support traditional educational methods. Learning games need to burst through a context that isn't currently built to support them, and in that context perform better than means that teachers and students are previously familiar with and adept at using.

As for investment, learning games are once again in a position of some difficulty. But the severity of the investment varies depending on how the recipient organization is acquiring the learning game. A common approach is to commission the development of a learning game to cater to specific educational needs, but there are also some examples of off-the-shelf solutions that aren't specifically tailored to the practices of a specific school. Both of these approaches have their own benefits and shortcomings. Tailor-made games will adhere to local school practices well, and will likely require less preparation and specific game-knowledge of the educator since the game has already been specifically adapted to the subject matter and classroom environment. Off-the-shelf games are likely to be cheaper up-front since development has in effect been taken care of without the monetary involvement of the school. But, the game won't be developed with the specific school or classroom in mind, and thus the work of adapting and re-working the game falls upon the educator.

The trade-off between off-the-shelf and tailor-made games is primarily how one wishes to distribute investment. Off-the-shelf games are cheaper in game development and maintenance costs, but their necessarily general structure place heavier onus on the side of the educator. The infrastructure, teaching-styles, and student characteristics that are unique to the specific school aren't specifically catered to, so the schools need to make these adaptations and re-interpretations of the game content themselves to make it usable

for their teaching goals. Tailor-made games take the specific concerns of the educator in consideration to a further extent, and will also be built together with the educators that intend to use them, which leads to a more directly suitable game once it's been developed – but educators will need to make resource investments on creating and maintaining the product's functionality (e.g. spending teachers' work hours on workshops and tests on the game, and maintenance costs, paying developers for their services). Compounding this issue is the fact that educators usually don't have spending money lying around for experimenting with and developing new educational tools, as stated by principals in the interviews. This severely limits the possibilities of establishing long-term maintenance of a tailor-made title, and can be prohibitive to incremental and evolutionary development along the guidelines established in instructional system design. For instance, all but one of the developers (Experienced 2) interviewed during this study had all their learning game development tied to specific projects, where a piece of software was the end-goal rather than establishing a long-term collaboration with the educators.

From the perspective of developers, the return on investment equation is troublesome as well. Both of the experienced developers interviewed during this research stated that they had some difficulties remaining profitable. The two experienced developers had widely different business strategies, one selling licenses of their educational game to schools and the other looking for clients that could commission projects from them. Each of these strategies is inherently troublesome, but neither is impossible to make profitable. The difficulties of the learning games market boils down to the size of the market, the properties of the costumers, and development costs. The amount of money a school can spend on material for individual students, or entire subject curriculums, is often severely limited. For example, as previously stated Principal A specified that the budget for Swedish schools were 1000 SEK (~115 €) per calendar year for each student in grades 1-6, and 1750 SEK (~200 €) in grades 7-9. This money needs to be distributed over all the subjects a student takes throughout the year, so buying individual game licenses for students in specific subjects would require the game to be sold quite cheaply. The alternative is to buy more flexible school licenses not bound to specific students, which can allow for higher pricing per license but overall fewer long-term sales. Currently, the market is also limited in size as there's a finite number of schools that are viable customers with the necessary preconditions to support the use of learning games.

Appropriating an already developed game title for use in educational settings, which a couple of the interviewed developers did, is an efficient way to cut down on development costs, but introduces potential costs for purchasing the license to use the game or giving royalties to the original developer. It also limits the possibilities of what you're able to do as a developer, since some games may be constructed in a way that limits re-jiggering of game mechanics to be suitable for various educational means. Being commissioned for development projects, in essence being paid for your services as a developer rather than the end product, is a route that gives a stable income during project months, but setting up projects in sequence to ensure stable income is difficult. When educators finds good reasons to create a learning game to support their educational procedures, a laborious process of finding money to support development needs to be initiated and finalized before development can actually start. This means that projects don't start on the basis of developers and educators meeting up and starting out projects together, but rather needs being identified by educators who then find a supporting organization that can supply them with the necessary funds to pursue their ambitions and then finding suitable developers for their project. The process prevent developers being able to pitch ideas to educators and creating their own project opportunities in that way since the interim period between the birth of a learning game idea and receiving the necessary funding to execute on it can be prolonged. Shortly summarized, the money available in the market isn't stable and reliable

for developers, and few developers can build their business model around commissioned work from educators. There are a few exceptions of notable studios building a reputation in the learning games industry, but newer developers without brand recognition have a hard time finding projects.

## 5.4 SUMMARY

Development and use of learning games is a complex process. There are practical factors within the realms of formal education, social factors among teachers, and discrepancies between the traditions of education and games, economical factors, as well as theoretical considerations that obstruct acceptance towards considering learning games as viable teaching tools as well as their development, design, implementation, and their viability as a business venture (described in *Table 5.2*).

Using the model described in *Figure 5.1*, we can attribute the different types of factors explained in *Table 5.2* to different participants or goals. For example, the factor of organizational standards and structures relates to the utilitarian aspects of learning games, and are also primarily controlled by the clients wanting to use learning games. If the developer, in an attempt to make sure the learning game provides utility, focuses too much on catering to these processes the game experience and the player/student will be underrepresented, and as a result the learning game will provide less value in that area of the model. A positive example of how the factors relate to the model is how the context of a classroom and teacher-guided gaming sessions can aid a learning game. Here, the client contributes to the utilitarian aspects of the game by relieving some of the “duties” the game has to perform. By guiding the play sessions, and encouraging reflection and deliberation from their students, the game doesn’t have to be as heavy-handed in its design to ensure positive learning outcomes. The developer is able to focus on maintaining engaging gameplay (while still, of course, being aware of some utilitarian aspects and the context of the game’s use) and the client contributes to the game’s utilitarian aspects. When both experience and utility is provided for in ways like this, meaningful play sessions can occur.

**Table 5.2:** A summarization of factors influencing the use and development of learning games.

| Factors | References explaining details of the factors |
|---|---|
| Games are taxing on a school's infrastructure. Technology needs to be reliable and available, and the teachers' time to spend time setting up game sessions is severely limited. The technological infrastructure and teachers' technology literacy in schools may still be too unreliable to support wider implementation of learning games. | 3.3G<br>3.4.C<br>4.A<br>4.C |
| For a teaching tool to be considered viable for wide-spread application, it needs to be able to cater to almost all students in a classroom. Given the heterogeneity of a classroom, adhering to this requirement is difficult for games. | 3.2.B<br>4.A |
| While attitudes are generally positive towards learning games and the motivations for using them are frequently evangelized, there are still some social and political pressures against using them. For example, the learning outcomes of using games aren't certain, and neither are the negative psychological effects of gameplay. | 3.3.A<br>3.3.B<br>3.3.D<br>4.D |
| The budgets of schools prohibit experimentation with new teaching tools, as a result "safe" teaching tool alternatives are often chosen above unproven ones. Supporting a learning game development studio by selling game titles to clients in formal education can be difficult. | 4.C |
| Games primarily make their way into formal education through passionate, experienced and knowledgeable individuals, rather than resulting from broader policy changes or institutional direction. | 4.E |
| Student interest in games and their gaming literacy isn't as universal as some research may indicate. This makes it difficult to create a game that caters to all students in a classroom both in terms of engagement and learning content. | 3.2.B<br>3.3.G |
| There are no clear guidelines to designing good learning games. A game that is well-design judging by the standards of entertainment games does not necessarily facilitate good learning. | 3.3.B<br>3.3.G |
| By existing in a broader learning context with available mentors and peers lessens the pressure of a game to include all necessary aspects of a subject matter. Teachers can contextualize the game experience as needed to facilitate the learning process. | 3.2.C<br>3.3.E<br>4.I |
| Communication between developers and educators can be difficult and lead to mismanaged requirements and unreasonable expectations during a learning game project. Management of the learning and gameplay dilemmas can be particularly problematic. Co-design methods may be a way to alleviate these concerns. | 3.3.F<br>3.4.D<br>4.G<br>4.H |

In the work done under the confines of this thesis, studies where teachers and developers were interviewed and collaborated with in various ways relating to learning games were combined with literature studies. Challenges presented by previous research, for example in the Triadic Game Design model and in technology acceptance research, were coupled with results from studies to more accurately describe the nature of the concerns specific to learning game design and use in formal educational contexts. From the research, it's apparent that the problems learning games are facing often stretch far beyond what a developer alone can influence, and focusing on improving their design is certainly important but won't alone lead to games becoming used more and having an impact in formal education.

Educators' motivation and willingness to start using games in educational is increasing, and the stronger aversions that may have been more prevalent during the 90's and early 00's are nowadays more reserved. Technology expertise is slowly increasing among teachers, and technological infrastructures in many schools are also becoming more rigorous, so the conditions necessary for learning games to be viable are constantly improving. But many obstacles still remain, and most formal educational contexts are currently unable to implement learning game solutions without severe investments and organizational restructuring that are laborious enough for teachers, principals, and even developers to negate a positive return on their investment.

There are also some discrepancies in how educators are accustomed to operate and the properties of games as a medium and how engaging game experiences need to be facilitated. Becoming immersed or feeling engagement in game activities doesn't happen

instantaneously – and confining play sessions to one-hour sessions spread out over weeks and months makes certain types of game designs unsuitable for formal education on the sheer basis of play session fragmentation and time limits.

Egenfeldt-Nielsen's summarizing statement after one of his studies on the implementation of games in formal educational contexts, "are games worth it? Currently, I don't think so" (Egenfeldt-Nielsen, 2008, p. 26), echoes the outcomes of this research. There are many obstacles that make learning games both difficult to use and develop – but that's not to say that the equation will never change to produce a positive outcome. Turning to the description of the investments typically necessary in the implementation of a learning game described in *Figure 5.2*, current trends both in game development and education are constantly decreasing the significance of each of the investment-categories. The common technology- and gaming literacy among teachers is increasing, thus reducing the investment needed in getting teachers "up to speed" to be able to use learning games efficiently. Overall technological infrastructure is improving in educational institution as well, thus the necessary conditions for introducing digital games into formal education are becoming more stable. The situation for developers is also improving as progress made in the field of entertainment games and the availability of potent development tools (e.g. game engines like *Unity*) make their working processes quicker and more efficient. Thus, the variables that dictate the final return on investment for making and using learning games are shifting, and the resource drain on both educators and developers is decreasing. So while the characteristics of formal education are introducing several new challenges that make learning game development and implementation difficult and very different from entertainment game development or development of games to be used in informal contexts, the conditions are improving and the obstacles will progressively become less severe.

# CHAPTER 6
# CLOSING REMARKS

The critical analysis of learning games in this thesis is not intended to deter efforts to pursue games as a tool to be used in formal education, but I've come to realize that what I'm presenting can be perceived as having an overly pessimistic slant. I'd like to clearly state that the conclusion, and indeed the entire point of the entire thesis, promotes more awareness regarding learning games to prevent problems to recur, and to hopefully make future learning game endeavours start out on a more informed premise. There have certainly been successful applications of learning games in classroom environments, but they are often the fringe-cases that are driven by extraordinary circumstances that can't be expected of the average school or classroom. But, as was revealed during the interviews, it's these pioneering instances that often drive the long-term acceptance and appropriation of new educational tools, and learning games are likely to make further strides in the next few years as general technology and gaming literacy is slowly increasing in schools and society thanks to experimenters pushing the envelope.

I would also like to reiterate that I don't take the stance that it's the responsibility of the developers to devalue game elements in favour of being more accommodating for the requirements of formal education. A lot of the points I bring up may sound overly critical, or as if my research agenda is to force learning game developers to solely work on educators' terms not at all, but that is of course not the point of this thesis. The concerns and issues I bring up should be read as something that need to be taken into consideration by educators as well. In the field of IS, organizations aren't considered as static constructs that new software solutions need to be precisely moulded after – the implementation of new solutions can reveal shortcomings in organizational practices and encourage change for the better. Learning games can and should influence the organization of formal education the same way, but developers still need to be aware of the details of their clients' traditions in order to start experimenting with ways to gradually change them. As pioneering educators and developers continue to explore the place learning games can hold in formal education, both games and education will mutually influence and change each other. Back in 2008, when games didn't saturate society quite to the extent they do today, Bogost encapsulated this sentiment of mutual change well in an explanation for why learning games were becoming a somewhat stagnant proposition:

> ...the very notion of "Educational Videogames" represent a massive rejection of the customs of both videogames and education. ... If we want to have educational videogames, we are using games against the grain, and education against the grain. (Bogost, 2008, p. 161)

In this thesis, I've made the argument for a more inclusive and utilitarian approach of considering learning games, and explained some specific factors that affect learning game development and use in formal educational contexts. The conclusions and arguments made aren't particularly revolutionary either, as I perceive them as primarily being a merger and continuation of arguments made previously by researchers as well as practitioners within the subject area and further supported by outcomes of my own case studies.

For example, according to Egenfeldt-Nielsen (2008) and Bogost (2008), formal education in its current structure naturally produces obstacles that make the use of learning games in classrooms difficult. Teachers work under several conditions that put limitations on the amount of time they can spend preparing and conducting their lesson plans (e.g. the schedules for classes, amount of teacher-student time allotted for each student) (Egenfeldt-Nielsen, 2008). Furthermore, in my interviews with principals and teachers the national curriculum was frequently mentioned as it places specific requirements on what a teacher needs to cover in their lesson plan throughout a school semester. Adhering to these requirements is highly prioritized, and as using learning games is a laborious and uncertain process in many ways their use often remains limited to teachers already experienced in playing and using games.

The concept of learning games is also somewhat problematic in and of itself when examined through a theoretical lens as well. For example, Turkle (1995) and Linderoth (2009, 2012b) have posited counter-arguments against the perceived inherent learning potential of games assumed by researchers such as Gee (2003) and McGonigal (2011). The critique, ratified by other researchers as well (Egenfeldt-Nielsen, 2011; Kirriemuir & McFarlane, 2004), in essence comes down to what a game actually teaches its player, and the distinction between learning to play a game and learning transferable skills is crucial to this discussion. In my literature studies, I've never encountered any arguments stating that games are incapable of conveying information or educating their players, and that's not where the disagreement lies. What Turkle (1995) and Linderoth (2012b) point out is the importance of distinguishing between game mastery and transferable learning. For example Koster (2005), who I consider having implicitly followed the same line of reasoning, has defined games as systems that teach, but adds that they teach the skills necessary to perform well in the confines of the game itself.

This is where the formal educational context can be beneficial, as the presence of a teacher that can help connect the gameplay to the subject matter better, encourage reflection, and direct debriefing sessions can alleviate some of these issues. The issue with considering games as inherently educational is that there's no accounting for how players interpret representations or themes in games, but with teachers guiding this process towards specific educational goal the issues may not be as severe. This is where the formal educational context provides an opportunity for learning games to excel. In informal contexts, where there aren't any structures in place to contextualize material, or assist reflection and discussion, the requirements put on the game are quite severe. The game in informal contexts needs to motivate, instruct, introduce and represent subject matter accurately within the confines of the game experience, whereas games in formal educational experiences can rely on teachers to play an active part in the play sessions and assist these processes. Understanding the benefits and new opportunities the formal educational context brings to learning games, instead of trying to figure out how values inherited from entertainment games can best be preserved in spite of introductions of learning content, is something I would claim a necessity for the field to progress. Likewise, understanding the opportunities games bring to formal educational contexts is equally important. Games aren't the saviours of education, and educators aren't the validators of games as a medium, but games can be potent teaching tools when created and used in an environment where developers and educators have a mutual understanding and respect for each other's crafts.

## 6.1 FUTURE WORK

This thesis has primarily identified common issues that complicate learning game design, development, and use. The next step, then, is to examine ways to alleviate the found issues. This can either be done through further theoretical examinations and more systematic literature review within theories fitting to describe the issues described in this thesis in more detail, or by performing further case studies, and following one learning game development or implementation process for a longer duration and document it in more detail.

Using games to educate is an endeavour with a relatively long tail (as described in chapter 3.3), and there's a healthy body of research describing the effects and results of using them. However, the development of learning games hasn't received nearly as much attention as their potential and virtues as finished products. It is difficult to find guidelines that describe how the divergent elements of educational content and gameplay can be combined in learning games and that speaks to the unique challenges faced by learning game developers. Attending to the needs of an unfamiliar audience, obliging the client's will, keeping the educational material intact while also creating a good gaming experience is a difficult craft, and created learning games fall into disuse after completion if a good balance between these different parameters can't be reached. The fields that learning games are deeply rooted in, that is to say the studies of games, information systems and software development, are fairly well understood, but there's little research that describe the ways in which they unite and create a new craft that's perhaps larger than (or at the very least different from) the sum of these separate parts. In contemporary learning game development, practitioners often resort to using guidelines from traditional software- and game development, and most of the research done on learning games have a strong connection to development practices described in these fields (Harteveld et al., 2010; Tan et al., 2012).

This is problematic, as neither field take the unique challenges that learning game developers face into account; software development is usually very focused on achieving utilitarian goals, whereas game development is more focused on experiential nature of games and storytelling – neither of which sums up the totality of what learning games need to achieve, nor cover the additional complexities that arise when utilitarian and experiential aspects need to be harmonized in one system to convey meaning. Furthermore, the practice of game development still relies on a high level of intuitiveness and alchemical practices (Hagen, 2009, 2010) – there's no consensus of what goes into making a game great – and thus it shares learning games' reliance on ad-hoc development processes.

Reliance on methods that have proven useful in game or software development may thus not be an entirely sound premise. A practical reason for considering these development processes as incommensurable with learning games is that they differ a great deal when it comes to the service they are expected to provide, the actors involved in their development, and their final context of use. Entertainment games are often birthed as a result of ambitions stemming from the developer. Many developers go by "I'll make a game that I would enjoy playing" policies and don't start out with a clear market segment in mind, while others may aim to claim openings in the market or use pre-existing licenses to attract an audience (Hagen, 2009; Rollings & Adams, 2003). Provided that the game is well executed, the first model of development will rely on the game finding its audience simply by existing since there are people with similar tastes as the developer (after all, he or she is a part of humanity). The second, more commercially centred development style will try to reach its intended audience through appropriate marketing and brand recognition. Although quite different in what they want to achieve with their development (e.g.,

monetary success, crafting a great gaming experience, sharing a vision, etc.), both types of entertainment games are created on an incentive from the developer. Contrary to this, learning games are more often birthed from an external actor's identified need in a specific area. A school, institute, or organization will approach learning game developers with a problem, and the developer is tasked with developing a game that aims to address it by informing or educating personnel, students or trainees in an engaging way. This may seem advantageous, as the developer is now informed of their audience in great detail beforehand and can tailor the game content accordingly, but the reality is that the recipients within this small audience are often extremely heterogeneous when it comes to thematic preferences, levels of gaming literacy, proficiency in different subject matters, etc. This often leads to issues with difficulty maladjustments that disrupt flow, content that isn't compelling, mismatches between product specs and technology availability, just to name a few (Kickmeier-Rust et al., 2011; Schoppek & Tulis, 2010).

This is not to say that creating entertainment games is an effortless process and that learning games or serious games are somehow more 'real' or taxing on its developers; there are just some clear differences in the development processes between the genres, and even differences on what grounds many development projects begin. As a result, learning games developers have increasingly been relying on ad-hoc solutions as the work-for-hire present them with too wide and inconsistent an array of changing parameters to establish firm standards and methods. The educational aspects of learning games is of course also a major distinguishing factor from entertainment games, as it leads to developers having to work with subject areas that may be unfamiliar to them and perhaps previously unexplored in games. The learning game developer needs to interpret the intricacies of the subject matter as explained by the knowledgeable expert and/or client, and translate it to game mechanics that trains, educates or encourages particular behaviours/activities depending on what type of game it is. This is a hard balance to maintain, and the entertainment aspects of a learning game often suffer as a result of overemphasis of the educational ones, or vice versa (Egenfeldt-Nielsen, 2010; Engström et al., 2011; Prensky, 2001).

It is important that we scrutinize traits and peculiarities such as these and clearly define how the ideas from other fields converge in learning games and create new challenges not found in the other crafts. With that as a foundation, a more realistic discourse can hopefully be held that include the processes of designing and developing as well as implementing and using learning games.

To this end, further theoretical studies could provide some mapping between the revealed factors to more applicable ways of solving them – or at least models and theories that can be translated and appropriated so that they are applicable to learning games. For example, the UTAUT model can be applied more extensively to understand how the facilitating conditions, teacher characteristics, and expectancies affect educators' and students' acceptance and intention of use when it comes to learning games. Another example that this thesis hasn't really dealt with either is also how student perceptions of games and individual students' learning characteristics influence learning game design and outcomes. The issue of audience heterogeneity has been briefly explored, but then primarily in regards to how it complicates game design on the basis of flow theory. But, students also have individual learning styles, some respond well to auditory input, some are more visual, and they also have widely differing preferences for what type of challenges they enjoy tackling. Here, research in adaptive games, for instance by Kickmeier-Rust et al. (2008; 2009; 2011), is making important strides, and research that assess learning types, player skill, and subject matter knowledge and adapt the gameplay accordingly can play an important role in making learning games more useful. While these particular theories and areas of research might not be the specific goals of my further research, it exemplifies how

some of the identified obstacles can be alleviated through further understanding of the concepts relevant to learning game use and implementation.

The other more direct approach where implementation and development is studied through more detailed and involved case studies than in the research presented in this thesis could provide valuable as well. However, the logistics involved in establishing and maintaining such a case study can be complex, and research would be reliant on the continuous efforts of included developers and/or educators. Both of these types of cases are difficult to work with for several practical reasons. For example, educators, as previously described, can't partake in experiments with learning games at any given moment and are restricted by curriculum requirements and the structure of a school year. The selection of cases to follow more closely is an important consideration as well. This initial research has through selection as well as serendipity managed to include a wide variety of developers, and is somewhat representational of the multi-faceted learning game development industry. Selecting fewer cases, or even an individual case, can likely produce results that would only be relevant to a small amount of actors that use similar processes and has a similar culture as the examined case.

Whichever route the remainder of my PhD research takes, the end purpose will be to clarify challenges in the different areas of the learning games utility and experience model and offer suggestions for solutions. Design solutions, new development practices, organizational restructurings, or usage models can be valuable to support learning games as tools for teachers in formal educational contexts. Studies in serious games, games, information systems, and instructional technology have covered aspects of all these areas. But, findings within these disciplines don't necessarily translate to learning games, and particularly important not to learning games in formal educational contexts, so whichever route further research will take the formal context will remain the pivotal point.

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