



# THE GAMEiT HANDBOOK

A framework of game based learning pedagogy

Edited by: Mathias Poulsen and Ebba Køber

THE GAMEiT  
HANDBOOK



## **The GAMEiT handbook**

Published 2011

Oslo, Norway.

This book is licensed under the Creative Commons Attribution-Non-Commercial-Share Alike 2.0 UK: England & Wales License. To view a copy of this licence, visit <http://creativecommons.org/licenses/by-nc-sa/2.0/uk/> or send a letter to Creative Commons, 171 Second Street, Suite 300, San Francisco, California 94105, USA. The game images in this book is used by permission of the copyright owners and does not go under the creative commons licence.

### **List of contributors:**

Tove Ingerslev (Project Coordinator), CV2, Denmark

Mathias Poulsen, CV2, Denmark

Christos Gatzidis, The University of Bournemouth, United Kingdom

Dr Laurent Borgmann, University of Applied Sciences, Koblenz, Germany

Marcus Feßler, University of Applied Sciences, Koblenz, Germany

Thomas Berger, Institut inter.research e.V., Germany

Atle Løkken, University of Stavanger, Norway

Petter Mordt, University of Stavanger, Norway

Ebba Køber, NADE (Norwegian Association for Distance and Flexible Education), Norway

The GAMEiT project has been funded with support from the European Commission. The articles in this book reflect only the views of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained herein.

[www.projectgameit.eu](http://www.projectgameit.eu)

ISBN-13 978-82-91766-25-6

Illustrations by Zaxis, Petter Mordt

Design by Ebba Køber







# THE GAMEiT HANDBOOK





# Content **THE GAMEIT HANDBOOK**

<b>Preface</b>	9
<b>Chapter One - Introduction to game based learning</b> Author: Mathias Poulsen Play Consulting, GameIT College	15
<b>Chapter Two - Global conflicts</b> Author: Mathias Poulsen Play Consulting, GameIT College	33
<b>Chapter Three - History Lessons via Gaming; A Review of Current Approaches and the Design of a Case Study using Rome Total War</b> Author: Christos Christos Gatzidis Bournemouth University, UK	45
<b>Chapter Four - Introducing Games with a Purpose to Online and Blended Learning Environments</b> Authors: Dr. Elmar-Laurent Borgmann, Thomas Berger, Marcus Fessler University of Applied Sciences, Koblenz, Germany	63
<b>Chapter Five - Learning by producing</b> Author: Mathias Poulsen Play Consulting, GameIT College	87
<b>Chapter Six - The Medication Game - Digital Game Based Medication Calculation - Development and Design</b> Authors: Petter Mordt <sup>1</sup> , Karsten Tillerli <sup>1</sup> , Atle Løkken <sup>1</sup> & Brynjar Foss <sup>2</sup> <sup>1</sup> NettOp, Department of E-learning Development, <sup>2</sup> Department of Health Studies, University of Stavanger	105
<b>Future Perspectives</b>	125



# Preface

By Mathias Poulsen  
Play Consulting  
GameIT College

## Preface to GAMEiT handbook

Throughout history games have been an integral part of human culture, and many different types of games have been played for both leisure and more serious purposes, such as practicing war strategies or learning relevant skills and/or competences. In more recent time, digital games have effectively permeated most areas of popular culture and society in general. Digital games are no longer confined to the arcades or the darkened rooms of teenage boys, but have successfully broken (and continues to break) new ground, forcing us to keep revising what games are - and can be.

Seeing the overwhelming popularity of games, acknowledging the hours and hours of hard work and learning unfolding in the virtual worlds all across the globe all the time, it should come as no surprise, that an increasing number of researchers, game developers and educators are interested in games. Many a frustrated teacher have undoubtedly wished for her students to mobilize the same motivation in school as they do when playing their favorite video games. Others have seen and marveled at the complex learning processes sparked by a burning desire to perform well in, say, World of Warcraft.

Such is the basic logic behind the eager attempts to include games in education; "what if we could make educational learning contexts as compelling as do games?"

Despite this seemingly deceptively simple logic and the rapidly growing interest, it would also seem that we are not yet anywhere near a full-blown understanding or application of games in education. On the contrary, the uptake of games and game based learning in schools is rather slow and facing many obstacles on its way. Only few teachers have yet applied games in their teaching, and those who do are rarely given the resources to pay any attention to the enormous importance of sharing their valuable experiences. As an immediate consequence, those who considers taking the first steps may feel all alone and without substantial backing from likeminded practitioners. In addition, there is the more trivial (yet important) obstacles related to ICT and technology in general, such as an uncertainty or intimidation on part of the teachers, lack of resources (sufficiently powerful computers, relevant software/games etc.) and - most consequential, perhaps - the lack of time to explore these new teaching methods.

These observations constitute the point of departure of the GAMEiT Project, and thus also this handbook, clearly expressed by our mission statement:

"We aim to identify, collect, test and distribute good practice in game based learning. Our project will result in a game based learning pedagogy".

By gathering together different partners with very different backgrounds, we intended to not only fulfill our mission statement, but to do so while also showing the enormous diversity and multitude of different approaches to game based learning. If you should take only one lesson away from this handbook, let it be the one, that there is no one right way to practice game based learning - but rather a wide array of right ways. Games have the potential to contribute to learning and education in a multitude of ways, many of which we may have not even seen yet.

Throughout the book, we make an effort to clearly illustrate how games or elements of games can be included in educational practice, and to what end. In the following, we briefly introduce each of the chapters in the handbook, but we strongly recommend reading the entire book, as each chapter provides each own perspective on game based learning.

## **Overview of handbook**

### **Introduction to the field**

In this first chapter, we set out to provide an overview of the different ways of perceiving and approaching game based learning. This overview is primarily based on the large and constantly growing body of research, but interpreted to shed light on the implications for educational practice. We introduce some of the basic principles underlying game based learning, and we establish a typology of game based learning.

### **Exploring conflicts**

When thinking about “game based learning”, it is not uncommon to instantly start considering the genre of games specifically developed for learning purposes, often labelled “serious games” or “learning games”. These games are developed with education in mind, and the content of the games are thus most often quite closely linked to curricular demands.

### **A Case Study using Rome Total War**

In this chapter we present an argument for the use of gaming for educators to communicate information and knowledge better to a pupil audience in a history-based curriculum. This includes a run-through of important previous approaches, a detailed explanation of the methodology used in an envisaged pilot study, expected results and, finally, a set of recommendations/suggestions for future implementations of similar approaches in a classroom in other settings such as, for example, HE.”

### **Introducing Games with a Purpose to Online and Blended Learning Environments**

In this chapter we experiment with a simple, low-threshold, and low-budget version of “Games with a purpose”. We report about a pilot study, which compares the modified learning activities with the original versions of the respective regular courses.

### **Learning by producing**

In our definition of game based learning, we include the complex learning sparked by not only playing games, but also by developing them. Despite the importance of developing games to more fully understand games, this chapter is focusing on the array of important, broader and generic competences related to moving from an idea phase through to selling a final product - generally known as entrepreneurship.

### **The Medication Game**

Medication calculation is a critical topic in nurse education. Due to its importance, various learning strategies have been developed to improve the students medication calculation skills. We developed "The Medication Game" to drill basic mathematics, medical units and medication calculation to improve not only mathematical skills, but also learning motivation as well as confidence among nurse students.





# Chapter One

## Introduction to game based learning

Author:

Mathias Poulsen

Play Consulting

GamelT College

## Content – this chapter

Definition and relationships

Game literacy

Game based learning

Principles of game based learning

Games are about solving problems

Actions in context

Games provide frequent feedback

Good games create optimal challenges

Games create a safe zone

Typology of games

Dedicated learning games

Commercial titles

Game-like scenarios

Developing games

Designing the learning context

References

## Definitions and relationships

Play is an integral part of any culture, and is often seen as integral to learning as well. As such, it should come as no surprise that “game based learning” has become talk of the town in recent years. The field has undergone rapid developments lately, and we are currently seeing journals, conferences, projects, books, articles, videos, discussions, best-practices, teaching materials and games emerging all across the spectrum.

As an immediate consequence, it may prove a fairly daunting and intimidating task figuring out where to begin and how to best approach this field hailed by many as the savior of contemporary education. Having made an effort of mapping the many ways in which games can be appropriated for learning purposes, we dedicate this introductory chapter to providing an overview of the fundamental components of game based learning. By doing so, we simultaneously aim to point towards the borders and boundaries, attempting to adjust expectations and show what games can and cannot do.

### Definition and relationships

Before we embark on our endeavor to illustrate concrete ways in which game based learning may potentially enrich and strengthen learning and education, it is necessary to establish some common ground. First of all it is important to understand, that when people are talking about “games in education”, they are often talking about a wide array of things, and frequently misunderstandings spring from not appropriately making explicit our individual preconceptions. You may think one thing, whereas my ideas may be pointing in another direction altogether, thus rendering our conversation nigh on impossible. This is often overlooked, however, as there seems to be some implicit, yet erroneous, understanding that “games in education” is a relatively homogenous field, where the number of approaches is limited.

We may appropriately draw an analogy to a somewhat more familiar medium, namely books. Try for a moment to reflect upon the various ways in which you have implemented or could imagine implementing books as a resource for learning. In all likelihood you are not just thinking about one particular scenario, but a variety of such. Having had relatively unhindered access to books for centuries, we neither question books as a medium suited for learning nor try to frame books within one particular mode of use. We know “books” to be a very diverse phenomenon and we see books as a rich medium fulfilling a wide variety of purposes and even today imaginative educators are coming up with new and creative ways of using books.

We encourage you to think about games in education along similar lines.

In education, it is thus possible to include games in a multitude of different ways, not all of which is considered game based learning, neither in general nor in the framework of this book. It is beyond the scope of this project to extensively map the various

approaches to games in education, but in the following paragraph we will clarify two major distinctions: Game literacy and game based learning, respectively.

### Game literacy

Game literacy finds its origins within the traditional perception of literacy, which has later been expanded to include such areas as media and digital literacy (Buckingham, 2007). Being digitally literate is becoming ever more important as society is increasingly relying on digital media. Digital literacy begins with, but is not limited to, the ability to navigate and use digital media. For a number of years, this was seen as the primary area of focus,



Figure 1 - Game literacy at GamelT College

and most talk about ICT in education was thus preoccupied with a basic functional approach. Recently it has been widely recognized, that building upon such functional skills, developing critical analytical and reflective competences is even more crucial (Hague & Payton, 2010). The demand is widely acknowledged among researchers, decision- and policymakers, nationally as well as internationally (see (Reding, 2009). As an addition to media and digital literacy, the notion of game literacy is now becoming consolidated as its own field within both research and practice. Several researchers and theorists have been exploring game literacy in recent years, among them José P. Zagal (Zagal, 2010), David Buckingham (Buckingham & Burn, 2007), Katie Salen (Salen, 2007), Kurt Squire (Squire, 2008) and Eriz Zimmerman (Zimmerman, 2007). As video games occupy a prominent position in our culture today, it is impossible to ignore the importance of understanding video games. Game literacy encompasses the understanding of games in "isolation", deciphering what makes a game a game, as well as in a broader cultural context.

Even though game literacy or understanding games is important in its own right, it also functions as a vital prerequisite for game based learning. It is only through continuously inquiring and exploring the nature and characteristics of game we can hope to develop a clearer perception of exactly how games can be brought to facilitate learning:

Media should not be regarded merely as teaching aids or tools for learning. Education about the media should be seen as an indispensable prerequisite for education with or through the media. Likewise, if we want to use computer games or the internet or other digital media to teach, we need to equip students to understand and to critique these media: we cannot regard them simply as neutral means of delivering information, and we should not use them in a merely functional or instrumental way (Buckingham & Burn, 2007).

### **Game based learning**

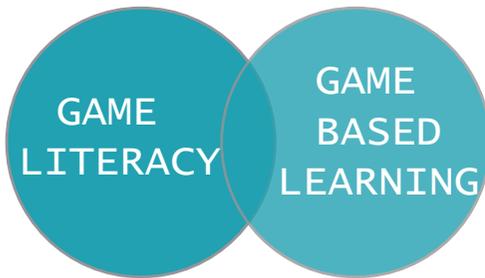
Whereas the question of game literacy is concerned with the understanding of games and their context, applying games in the perspective of game based learning is less interested in the game itself, and more in the game as facilitator of learning. As described by one of the prominent researchers in the field, James Paul Gee, games are essentially learning machines (Gee, 2004). You can hardly play a game without learning something, and most games create a safe space, where you learn what is needed in order to solve the problems and challenges brought by the game. Some even argue, that it is exactly learning to master the game that creates the immersion of the player (Koster, 2005). This is probably also the realization, that inspired people to develop game based learning in the first place; if kids are willingly working quite hard to learn

what is required to solve relatively complex problems in games, why should we not harness this effort for educational purposes?

Game based learning is thus the act of appropriating games or game mechanics, recreating the scenario-based, problem-oriented learning processes found in games in order to fulfill specific learning purposes.

By adopting this relatively broad and flexible definition, we allow ourselves a diverse approach to exploring and implementing game based learning, hereby also mirroring our claim that “games in education” represents a diverse range of scenarios.

Even though we are dedicating the remainder of this handbook to the field of game based learning, we maintain that the two approaches are often closely intertwined and overlapping, as illustrated by the model below.



### Principles of game based learning

In order to more fully grasp the potential of game based learning, we need to decipher the nature of games, deconstructing them and critically examining their inner components and mechanics. When we and others maintain the claim that games can be considered a valuable contribution to education, we do so because of the specific characteristics of games. Many commentators, researchers as well as practitioners, often choose to downplay the “games” part of game based learning to avoid the negative cultural connotations of games being – at best – stupid entertainment.

We recommend going in the opposite direction, acknowledging that games are interesting for learning purposes exactly because they are games. A good game creates a space for learning, and this potential is of particular interest when attempting to appropriate game based learning.

How is it, then, that games supposedly provide us with these “learning spaces”?

This question we cannot answer in full, but limit our attempt to showing in the following paragraphs what we consider to be the central principles of game based learning, namely:

- Solving problems
- Action in context
- Receiving feedback
- Optimal challenge
- Safe zones

“A game is nothing but a set of problems to solve”  
(Gee in (Corbett, 2010))

### Games are about solving problems

“A game is nothing but a set of problems to solve” (Gee in (Corbett, 2010))

As James Paul Gee points out, at their very core games are about solving problems.

The nature of these problems are as diverse as the often colourful imagination of game

“Unlike the simple one or two variable experiments characteristic of science classrooms, MMOGs offer multivariate problems of real complexity and of genuine social import to those solving them” (Steinkuehler & Chmiel, 2006).

designers, but whatever the shape and colour of these problems (challenges, puzzles), they are the only thing standing between the player and the goal of the game. More precisely – are there no challenges, there is no game (for a more elaborate discussion of this issue, see (Koster, 2005)). What is especially interesting in relation to game based learning, of course, is that the player must learn what is required to overcome these problems and eventually beat the game. If you play Starcraft II, you must be able to assess the attributes of all the different units in the game in order to adjust your strategies to those of your adversaries. This is very complex problem solving at a frenetic pace, and you must gradually become better to succeed. When millions of deeply involved players embark on adventurous quests in World of Warcraft, they simultaneously engage in a very complex learning system. Most challenges in WoW are so demanding, that they require not only massive collaboration, but also an almost scientific approach to solving problems (Steinkuehler & Duncan, 2008). In contrast to all too many educational courses and projects, problem solving in games are not considered something trivial or of no importance; on the contrary, as much research goes to show:

### Actions in context

Even though many in-game challenges might be captivating all by themselves, the context is most often what really imbues problem solving in games with meaning.

If we step back for a while, we are probably all aware that most things cannot be understood without being embedded in proper context, and misunderstandings are thus

prone to surface, when, for instance, quotes are used “out of context”. This somehow seems to be forgotten or neglected in many educational settings, where knowledge,

“These rich virtual worlds are what make video games such powerful contexts for learning. In game worlds, learning no longer means confronting words and symbols that are separated from the things those words and symbols refer to. [...] In virtual worlds, learners experience the concrete realities that words and symbols describe. Through these and similar experiences in multiple contexts, learners can understand complex concepts without losing the connection between abstract ideas and the real problems they can be used to solve. In other words, the virtual worlds of games are powerful because they make it possible to develop situated understanding.”  
(Shaffer, Squire, Halverson, & Gee, 2005)

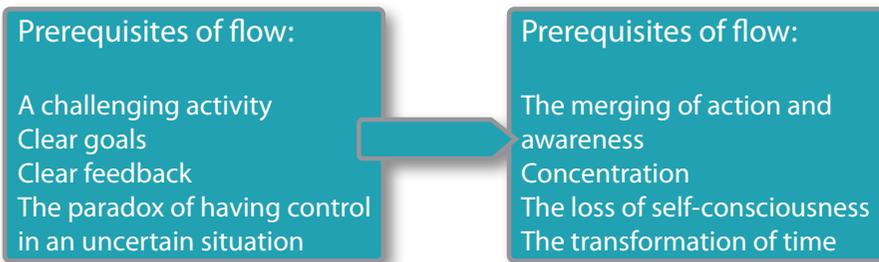
facts, skills etc. are effectively separated from their proper contexts. When we teach mathematics, chemistry, language or social sciences, we often do so in a more or less intentional isolation from where those subjects are applied outside of school. This approach has been heavily criticized by learning practitioners and theorists alike during recent years (Wenger, 1998) (for further discussion, see (Poulsen, 2011)). The problem arises because of the gap between abstract phenomena and the actual concrete application of said phenomena. In short, learning is immensely difficult if the learner is unable to see the purpose and possible uses of what is to be learned.

Games work differently. Not only do games present the player with challenges, they frame these challenges within a particular context, where solving the problems suddenly makes terrific sense. The context may consist of a variety of elements, of which the concrete fictional world of the game and the social neighborhood circumscribing the game are notable ones. Often we take on specific roles in a game (warrior, city planner, journalist, detective etc.) and acting as these characters, we solve whatever challenges we are confronted with in the game world:

This is a central principle when using games like *Global Conflicts: Palestine* to explore the complexity of the Israeli-Palestinian conflicts. The topic and the player actions are set in a concrete context, where it makes sense to the player, why game characters act in certain ways, how different issues are related etc. (see the following chapter on the *Global Conflicts* games series).

**Games provide frequent feedback**

Learning can be hard – painstakingly hard – if you have no idea how you are doing. Often students are, if not left alone with problems, then feeling frustration caused by a lack of feedback. In many cases there is a more or less outspoken mismatch between the need of feedback felt by students, and the resources teachers have for providing this feedback. At the same time, good games are fabulous at exactly this. When we encounter and solve problems within games, we regularly receive feedback measuring and evaluating our effort. Whether we are fighting perseverant enemies in outer space, building a civilization, developing new species, designing a particularly appealing home, embarking on fantastic adventures or matching diamonds, we are almost always well aware of our own progress. This feedback may be in the form of written messages, dialogue, cutscenes, points, health meters, sounds, vibration (in controllers/handheld devices) – and so on. These bits and pieces allow us to constantly gauge our performance and readjust accordingly.



**Good games create optimal challenges**

A prominent strand of learning theory is particularly concerned with the relationship between the learner and the learning goals, e.g. Vygotsky’s zone of proximal development (Vygotsky, 1978, s. 86). These principles are developed even further by Mihaly Csikszentmihalyi’s famous theory on “flow” (Csikszentmihalyi, 1990). In short, the premise described by Csikszentmihalyi is, that people are having “optimal experiences” when the challenges they encounter is closely matched with their skills and competences. The flow state is generally considered very attractive in education, as the conditions for learning seems to be eminent when one is “in flow”.

What is of particular interest here, is that games and game designers are quite adept at creating these “optimal experiences”. This is described in detail by game designers and game theorists Katie Salen and Eric Zimmerman, who also makes a distinction between

the prerequisites and the consequences of flow (Salen & Zimmerman, 2003):

As Raph Koster further argues, playing games is satisfying because of a feeling of mastery, which is obviously closely linked to flow:

Summing up, games are about solving problems within concrete contexts which provide the player with optimal challenge without the risks of solving said problems in the real world.

Fun from games arises out of mastery. It arises out of comprehension. It is the act of solving puzzles that makes games fun (Koster, 2005, s. 40) These principles are seen as central to learning with games, and James Paul Gee refers to games as operating within the learners' "regime of competence", where "the game often operates within, but at the outer edge of, the learner's resources, so that at many points the game is felt as challenging but not "undoable"" (Gee, 2007, s. 67) Linked with the previous principles, we see that games are about solving problems within concrete contexts which provide the player with optimal challenge.

### **Games create a safe zone**

Among humans and animals alike, playing is a form of "legitimate peripheral participation" (Lave & Wenger, 1991), whereby we learn to participate in society through the act of "playing to participate". Hereby is hinted at the concept of the "magic circle", first introduced by Dutch historian Johan Huizinga in his seminal work on the role of play in human culture, "Homo Ludens" (Huizinga, 1938). Huizinga argued that play is circumscribed by a magic circle, which excludes play from the regular rules of society. This is not to say, that games have no consequences - if that was the case, all talk about game based learning would obviously be futile. As pointed out by game researcher Jesper Juul (Juul, 2005), there are consequences of playing a game, but they are negotiable and not equal to doing the same outside the game. Games provide us with a safe zone, a playground, where we explore and interact with the world, learning and solving all kinds of problems without have to constantly fear the consequences of our actions.

In this handbook, this principle is probably best illustrated in chapter 6, where we describe "The Pill Game", which is used to learn how to calculate, adjust and prescribe the right doses of medicine - without killing any patients.

explicit and carefully thought-out educational purpose and are not intended to be played primarily for amusement (Abt, 1970).

Despite its relatively old age, this definition remains widely used even today, as serious games are thought of as games with a purpose beyond pure entertainment. Whichever name we choose for these games, they share some common traits. What is probably most important is the link between the learning “content” embedded in the game and the actual process of playing the game:

When you play a learning game you need to make sure that learning and play are integrated. This means that to succeed in the game you also need to master the learning goals behind the game (Egenfeldt-Nielsen S. , 2011).

When this integration works well, the game creates a context for exploring, learning and solving problems more or less directly relevant for particular curricular subjects. We further explore this approach in the following chapter, where we introduce the Global Conflicts-games, which is a series of dedicated learning games allowing players to explore complex conflicts and issues “from the inside”.

### **Typology of games**

Whereas the term “game based learning” may seem relatively new and progressive, the idea of establishing a link between “playing” and “learning” is very old indeed. Play is as old - if not older - as humanity itself, and some of our oldest writings from ancient Greece describe the intimate relationship between playing and learning (Huang & Plass, 2009). Using games as part of training and education is a time-honored practice within especially military and business, where strategy games, combat games and business simulators have been widely applied (Egenfeldt-Nielsen S. , 2005, p. 32 ff). In the 1980's the term edutainment was made popular, and many relatively simple training games were introduced as educational tools. These remain a component of education today, though less popular and primarily limited to drill-and-practice exercises, e.g. teaching simple mathematics and fundamental grammar. In recent years, researchers and game developers alike have been working to raise the bar, and implement game based learning in more diverse ways, aiming for more complex learning scenarios.

In the following four subparagraphs, we will describe these four different interpretations of the game in game based learning:

- Dedicated learning games
- Commercial entertainment titles
- Game-like scenarios
- Developing games

### **Dedicated learning games**

Many people would probably be quick to define game based learning as something along the lines of “using learning games in class”, which would be a completely valid perception (if a bit limited, as we shall show in proceeding paragraphs). Where edutainment was the predominant breed of learning games in the 80's and 90's, researchers and developers are now increasingly talking about serious games as games with a purpose beyond pure entertainment. This change of words can mostly be attributed to a growing criticism of edutainment, which has been said to consist of earnest aesthetic, derivative game play and poor production values (Jenkins, Squire, & Tan, 2004). What this boils down to, is that many edutainment titles are simply neither good games, nor good educational material. Serious games has thus been suggested and widely adopted as a substitute, where more focus is put on creating a healthy relationship between game and learning. The term is far from new, as Clark Abt defined it back in 1970:

We are concerned with serious games in the sense that these games have an explicit and carefully thought-out educational purpose and are not intended to be played primarily for amusement (Abt, 1970).

Despite its relatively old age, this definition remains widely used even today, as serious games are thought of as games with a purpose beyond pure entertainment. Whichever name we choose for these games, they share some common traits. What is probably most important is the link between the learning “content” embedded in the game and the actual process of playing the game:

When you play a learning game you need to make sure that learning and play are integrated. This means that to succeed in the game you also need to master the learning goals behind the game (Egenfeldt-Nielsen S. , 2011).

When this integration works well, the game creates a context for exploring, learning and solving problems more or less directly relevant for particular curricular subjects.

We further explore this approach in the following chapter 2, where we introduce the Global Conflicts-games, which is a series of dedicated learning games allowing players to explore complex conflicts and issues “from the inside”.

### **Commercial titles**

If you ask Wikipedia, “Game based learning is a branch of serious games that deals with applications that have defined learning outcomes” (Wikipedia). We disagree with this definition, as we argue that game based learning cannot be limited to edutainment,

serious games or dedicated learning games in general. Applying games developed specifically for learning purposes does have obvious advantages in some cases, e.g. the content of the game may closely match curriculum goals, but these advantages does not rule out other types of games. In most cases, entertainment games targeting the commercial consumer markets are actually better learning machines, but the content is not intentionally matching educational goals. These games are often referred to as “Commercial-off-the-shelf” games (abbreviated “COTS”. For a more elaborate introduction to COTS games in education, see (Sandford, Ulicsak, Facer, & Rudd, 2006)). The overall principles with COTS games resemble those of dedicated learning games; the desired goal is for the players (=students) to engage with the game in such way to explore or solve relevant problems. As there is no explicit or pre-designed link between the game and curricular goals, it becomes even more important to pay careful attention to the educational context, in which the game is situated (see Designing the learning context).

In chapter 3, we outline this approach, using the commercial entertainment title “Rome: Total War” as an example of applying that particular game when teaching history.

### **Game-like scenarios**

In the two preceding paragraphs, we have described the use of concrete digital games in supporting students’ learning. By doing so, we are probably well aligned with the most widespread interpretation of game based learning. We are convinced, however, that game based learning extends well beyond the use of concrete games, be they digital or not. Inspired by and drawing upon the learning principles of games, it is possible to design game-like scenarios without actually using any one particular game. One of the most thorough analyses of the value of games’ characteristics in a learning perspective was done by James Paul Gee, who states that “the theory of learning in good video games is close to [...] the best theories of learning in cognitive science” (Gee, 2007). With this in mind, games themselves can be considered mere frameworks, within which the player is constrained by a number of rules (implicitly or explicitly), is tasked with certain challenges and selects certain strategies in order to overcome these challenges. As a method to increase emotional involvement with the game, it is common to create a role for the player and situate the “character” in a concrete fictional world.

We are well aware, that this line of thinking shares several traits with the currently very hyped phenomenon “gamification”, which is popularly considered to be the application of the “basic elements that make games fun and engaging to things that typically aren’t considered a game” (Gamify.com). We are consciously not using the term, as it is currently very much associated with a rather simple perception of both games and

learning, yet the overall idea that learning processes and projects can be designed as if they were games is considered a valuable one.

### **Developing games**

Even though making games may first and foremost be relegated to the domain of game literacy, the complex process of developing a game may in a certain sense be considered a valuable contribution within game based learning as well.

This can be considered from at least two highly interrelated perspectives:

To develop games can be a relatively complex process involving a wide array of skills and competencies, many of which are also highly relevant outside the realm of game development. Planning, developing, documenting and selling/communicating a game is indeed an entrepreneurial process drawing upon some of the most valued skills in society today (communication, creativity, collaboration, innovation etc.).

When searching for relevant learning games to support this or that subject matter, say mathematics or physics, oftentimes one comes to realize, that there is no such game readily available. Whereas the easiest solution would thus be to denounce the possibility of doing game based learning, another solution would be to allow for your students to develop those games themselves. Thereby a layer is added to the learning potentials described above, as this approach also requires an understanding of the subject matter to be included in the game.

This approach is described in the chapters 5 and 6, with chapter 5 elaborating on the former of the two above perspectives, and chapter 6 focusing on the latter.

### **Designing the learning context**

In a sense, the frequent discussions about game based learning may sometimes lead us astray, blurring our vision and tempting us to expect more than games will ever be able to deliver. Games are no silver bullet (Squire, 2005), and will never be able to revolutionize education all by themselves. Games are not the best teachers, even though the most optimistic commentators may like to describe them as such. They are rather to be understood as teaching tools , which is pointing directly to the invaluable importance of the teacher in any game based learning project:

Viewing games as 'teaching tools' is a useful distinction because it highlights the key role that teachers play in defining the purposes for their classroom use, in planning activities, and in providing curricular context. Games are, in this sense, used as part of planned learning experiences rather than for their own sake or for flimsily conceived

incentivisation purposes (Williamson, 2009, s. 31).

This is also why Danish researcher Thorkild Hanghøj is keen to shift the focus from game based learning to game based teaching, indicating that it is not just about learning with games, but also teaching with games (Hanghøj, 2010).

Teachers have a pivotal purpose in the design process (Sorensen & Ó Murchú, 2004) also in terms of ensuring the connection between in-game experiences and the overall out-of-game learning situation. Furthermore, it quickly becomes evident that the dialectic between playing and thus experiencing "in-game" and working with subjects from the game "out-of-game" created a valuable synergy strengthening the overall learning experience (Henriksen, 2006).

The teacher thus undoubtedly remains the cornerstone of successful game based learning, but this does not mean, that nothing changes in the classroom. On the contrary, many teachers experience quite radical changes. The students are often relatively adept at playing the games, yet the act of playing rarely automatically leads to higher levels of reflection, which is critical to harness the full potential of game based learning. Drawing on experience, knowledge and the broader perspective, the teacher collaborates with students in order to broaden the scope and frame the actions and decisions from the game within a larger picture.

## References

Abt, C. C. (1970). *Serious Games*. New York: The Viking Press.

Buckingham, D. (2007). Digital Media Literacies: rethinking media education in the age of the Internet. *Research in Comparative and International Education* , 2 (1), pp. 43-55.

Buckingham, D., & Burn, A. (2007). Game Literacy in Theory and Practice. *Journal of Educational Multimedia and Hypermedia* , pp. 323-349.

Corbett, S. (2010, September 15). *Learning by Playing: Video Games in the Classroom*. New York, USA.

Csikszentmihalyi, M. (1990). *Flow - The Psychology of Optimal Experience*. New York: Harper Perennial.

Egenfeldt-Nielsen, S. (2005). *Beyond Edutainment: Exploring the Educational Potential of Computer Games*. Copenhagen: IT-University of Copenhagen.

Egenfeldt-Nielsen, S. (2010). The Challenges to Diffusion of Educational Computer Games. *European Conference on Games Based Learning*. Copenhagen.

Egenfeldt-Nielsen, S. (2011, February). What Makes a Good Learning Game? Going beyond edutainment. Retrieved from eLearn Magazine: <http://www.elearnmag.org/subpage.cfm?section=articles&article=153-1>

Felicia, P. (2009). *Digital games in schools: A handbook for teachers*. Brussels: European Schoolnet.

Gamify.com. (n.d.). What is Gamification? Retrieved from The Gamification Encyclopedia : <http://gamification.org/wiki/Gamification>

Gatzidis, C., & Poulsen, M. (2010). Understanding the Game: An Examination of Ludoliteracy. *4th European Conference on Games-Based Learning*. Copenhagen.

Gee, J. P. (2004, April). Learning by design: Games as learning machines. *Interactive Educational Multimedia* , pp. 15-23.

Gee, J. P. (2007). *What Video Games Have to Teach Us About Learning and Literacy*. New York: Palgrave MacMillan.

- Hague, C., & Payton, S. (2010). Digital Literacy across the Curriculum handbook. Futurelab.
- Hanghøj, T. (2010). Gaming, Schooling and Knowing. European Conference on Games Based Learning. Copenhagen: [http://www.academic-conferences.org/pdfs/ECGBL\\_Keynote\\_Hanghoj.pdf](http://www.academic-conferences.org/pdfs/ECGBL_Keynote_Hanghoj.pdf).
- Henriksen, T. D. (2006). Dimensions in Educational Game-Design. Nordic Playground event.
- Huang, T.-T., & Plass, J. L. (2009). History of Play in Education. New York: Institute for Games for Learning.
- Huizinga, J. (1938). Homo Ludens.
- Jenkins, H., Squire, K., & Tan, P. (2004). "You Can't Bring That Game to School". In B. Laurel, Design research.
- Juul, J. (2005). Half-Real. MIT Press.
- Koster, R. (2005). A Theory of Fun in Game Design. Scottsdale, USA: Paraglyph Press.
- Lave, J., & Wenger, E. (1991). Situated Learning. Cambridge University Press.
- Reding, V. (2009). Commission recommendation on media literacy in the digital environment for a more competitive audiovisual and content industry and an inclusive knowledge society. Retrieved from epractice.eu: <http://www.epractice.eu/files/Commission%20Recommendation%20on%20Media%20Literacy.pdf>
- Salen, K. (2007). Gaming Literacies: A Game Design Study in Action. Journal of Educational Multimedia and Hypermedia , pp. 301-322.
- Sandford, R., Ulicsak, M., Facer, K., & Rudd, T. (2006). Teaching with Games: Using commercial off-the-shelf computer games in formal education. Futurelab.
- Shaffer, D. W. (2006). How Computer Games Help Children Learn. New York: Palgrave MacMillan.
- Squire, K. (2005). Changing the Game: What Happens When Video Games Enter the Classroom? Innovate: Journal of Online Education .
- Squire, K. (2008). Video-Game Literacy: A Literacy of Expertise. In Handbook of Research



# Chapter two

## Global conflicts

Author:

Mathias Poulsen

Play Consulting

GamelT College

## Global Conflicts

When deciding to include games in education, the first choice is frequently to look for dedicated learning games. These are called many different things, but the core idea remains the same; games developed for specific learning purposes, and thus designed to support learning within one or more subjects.

Unfortunately, channeling the potential promised by good video games into a game designed specifically for learning purposes is no easy process, and all too often the balance shifts from the game towards explicit learning content. Despite these difficult challenges, a growing number of good learning games have been developed, and we find reason to be optimistic about the future of this field.

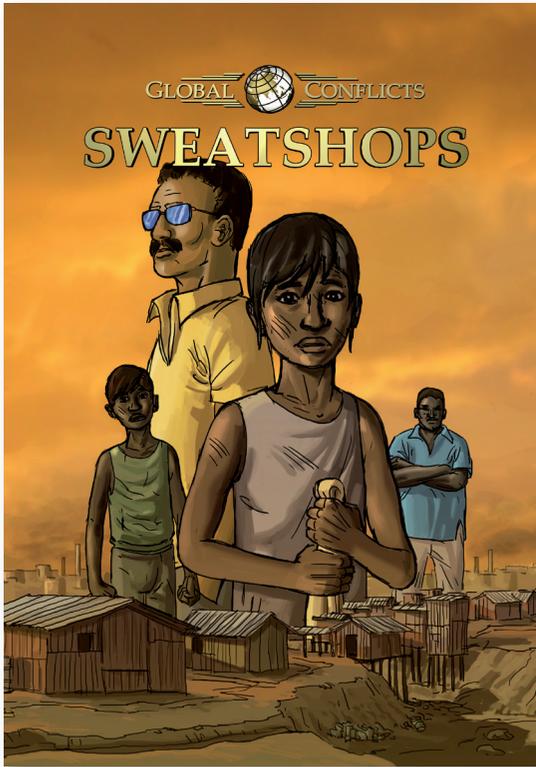
In the light of these reflections, we have selected as the first of our selected case studies the experiences we have with the Global Conflicts-series from Serious Games Interactive (go to <http://www.globalconflicts.eu/> for more information). The first game released was "Global Conflicts: Palestine", which featured a series of missions, where you were assigned the role of journalist arriving in Jerusalem. This was followed by Global Conflicts: Latin America, in which you travel around Latin America, before Global Conflicts: Child Soldiers and Global Conflicts: Sweatshops let players uncover and influence other grave, contemporary issues:

"The series allows students to explore and learn about different conflicts throughout the world and the underlying themes of democracy, human rights, globalization, terrorism, climate and poverty"

In these games, you thus take on the role of a journalist (or a representative for the International Criminal Court in later games) travelling around the world to uncover complex and often dramatic situations, issues and - surprisingly enough - conflicts. By actively exploring the virtual universe, talking to a range of persons with different interests and motivations, and trying to find the illusive truth, players weigh their options and usually feel more emotionally attached to the outcomes. Whereas reading about these issues may prove not only boring, but also irrelevant and too far removed from the lives of the students, talking to "real" people with real problems helps build a bridge, drawing the students closer.

## What's to learn?

As the games will be brought into a larger educational context, it is also possible to approach the games from a number of angles, which again leads to the possibility of covering several subjects:



- Language - the games are available in several languages, and can thus be brought in to different language subjects. When using the game in Denmark, it has primarily been played in Danish, which beyond reading and writing also includes several dimensions mentioned below such as media literacy, analysis and reflection etc. It would make perfect sense, though, e.g. playing Latin America in Spanish.
- Social sciences - all missions are situated in the framework of society, and thus supports an understanding of how societies around the world are structured, how macro- and microlevels interact, how human rights are enacted (or not) etc.
- Economy - several economical phenomena like “outsourcing” and the cost of labor are included as central topics in the game.
- History - every issue of conflict is historically rooted in one way or another, and the game also aims to account for this, and to provide a deeper understanding of these underlying circumstances.
- Geography - visiting conflicts around the world, geography is explicitly an inherent parameter to consider and examine.

- Religion - when exploring the roots of conflicts in the games, religion sometimes plays a pivotal role (most prominently in GC:Palestine), and in these situations it is thus not possible to reach any proper conclusions without relating to the way religion is interpreted by the different parties.



In addition, we see many different generic skills and competences brought into play:

- Collaboration - students are encouraged to play in pairs, but also (more informally) participate in a larger community of practice, which almost always unfolds in the classroom. It may seem chaotic, when students are talking across the classroom, yet often they merely share experiences from within the game, and are perhaps even engaging in problem solving and discussions.
- Communication - the course is aimed at showing the meaning of communication and dialogue, and students are applying different forms of communication both inside and outside of the game.
- Media literacy - media often play a part in conflicts around the world, and this a topic to consider in several missions, not least when the player herself is acting as journalist, interacting and influencing surroundings and broader society.
- Analysis & reflection - both on a concrete and on a meta-reflective level, the course encourages students to be analytical and reflective towards whatever information they encounter in and around the game and towards their own decisions, actions, and learning outcomes.
- Empathy & seeing different perspectives - a major learning potential of digital games is exactly the possibility of seeing and exploring different perspectives on important

topics. When talking to the virtual characters representing actual people, the conflicting opinions and world views are not only understood more clearly, but they also resonate with students' own world - "it's almost like talking to real people".

- Empowerment & self efficacy - the game encourages a view of the world, where the individual effort matters, and where it is thus possible for each person to make an actual difference. This is supported by the fact that the player can influence the outcomes, and is thus imbued with the feeling, that not only is it possible for someone to change the world - it is possible for them to do so.



### Considerations for teachers

When games are introduced in the classroom, it may challenge existing teaching conventions and relations. These changes may seem daunting or even intimidating to the teacher, but they are not to be feared. On the contrary, those challenges ought rather be embraced and supported, as they in most cases point towards better ways of facilitating learning.

First off, many teachers are reluctant to risk shifting "the balance of power" in the classroom. One such shift is frequently associated with the arrival of computers, digital media and video games in school. Inspired by popular commentators like Marc Prensky and others, it has been (too) common practice to almost automatically assume, that each and every child in today's so-called "digital society" are able and competent media users - consumers as well as producers. Quite often this leads to the conclusion, that children and youth are better off without us. Children do probably possess a certain youthful curiosity, allowing them to jump unafraid into the digital media landscape, but this in itself does not make them competent. When moving from simply using digital media and

on to higher taxonomical levels of reflection and inquiry most students are however in need of guidance and support.

Secondly, it may seem a bit blurry what exactly to do, when students are playing games. Knowing that most students are relatively proficient with regard to using new technology and not least games, teachers may fear becoming obsolete. Just as many students are not automatically perceiving the depth, complexity and meaning of digital media, they



are often having a hard time understanding perspective and context to issues depicted. If students are just allowed to play on their own, they will rarely be able - or willing - to critically examine all available information, just as they would rarely situate that information in a larger context, thus not seeing the big perspective. Luckily, this is what most teachers are very good at, and it therefore makes perfect sense to consider this course a collaborative project, where teachers and students contribute with what each part does best.

Finally, we still often meet the widespread perception, that games are merely for entertainment - with students as well as with teachers. Several teachers have pointed exactly to the importance of "framing the game", so students are fully aware that educational goals are still in effect.

### **Design the context**

We have already stressed, that games should not be thought of as silver bullets, but merely as teaching tools; albeit teaching tools with their own set of affordances. Games are able to convey knowledge and insights in a way, which is different from other media

by way of their interactive nature.

To harness the full potential of game based learning, it is incredibly important to look further than just the game. Even though the Global Conflicts games are dedicated learning games, they are merely “one part of the puzzle”. Any attempt to practice game based learning focusing solely on the game itself will rarely be particularly successful, as it is the entire context that makes for a valuable learning experience. Whenever we talk about fulfilling this or that learning goal, it only makes sense when considering the game in context, including other relevant tools and media. Do not expect any one game to cover every relevant aspect of a topic, but make an attempt to let games do what they do best, while drawing on e.g. written texts for further background, news clips for more recent material etc.,

### **A course overview**

We really encourage you to tailor any course specifically to the level and requirements of your students, and thus need to emphasize, that there is no one “right way” to go about this. The following suggestion is inspired by several different courses, where the Global Conflicts games have been included, and where the outcome has generally been quite satisfying:

- Introduction to the course
- Discussion of topic and prior knowledge
- Playsession
- News clip and discussion
- Playsession 2
- Student research
- Article/blogpost
- Presentation
- Concluding discussion

### 1. Introduction to the course

We may someday reach upon a situation, where games are seamlessly integrated with any educational toolbox, but we are not there yet. Many students are found to be skeptic regarding the seriousness and learning potential of games, and they are thus reluctant to perceive games as legitimate teaching tools. This should be proactively countered by illustrating how the game is but one component in larger educational framework, where an array of tools (books, online articles, social media, news clips, movies etc.) are used in dynamic interplay with the game.

### 2. Discussion of topic and prior knowledge

Upon the initial introduction, it is often recommendable to continue with a general discussion of the topic to get students focused and to establish a common frame of reference. This discussion also serves the purpose of directing the attention towards the topic, inspiring students to start thinking about what they already know. Depending on the scope of the course, it can be feasible to make short written assignments, where students summarize their current view of the selected issue(s).



### 3. Playsession

At this time, the students are tasked with playing one or two missions in the game. They are not “just” playing, however. They are working and they are seeing from the perspective of “real” journalists, being critical in their inquiry, taking notes and preparing for future journalistic work - outside the game.

While students are playing, the teacher(s) involved should act as “consultants”, observing the groups while playing, and intervening with questions and comments whenever relevant. If, for example, students are in doubt regarding specific a specific term/ phenomenon, if they’re superficially racing through the game or if they seem confused, a brief teacher intervention often proves to be the best way to help students engage more appropriately with the game.

#### **4. News clip and discussion**

One way to attempt to bridge the gap between the virtual game world and the surrounding world, is by including contemporary news clips, which serve to put the game in to a larger perspective. This could be clips directly related to the events in the game, e.g. the Israeli-Palestinian conflict, illegal immigration to USA, outsourcing in Latin America, sweatshops or child soldiers, but it may also very well be related issues from other parts of the world.

#### **5. Playsession 2**

After having discussed the first few levels and the selected news clip, students are playing another one or two levels.

#### **6. Student research**

Playing the game is but one way to explore the topics of the game, and it is important for youth to explore and understand how journalists are doing research on various subject matters.

#### **7. Article/blogpost/video material**

Having played, watched additional journalistic material and conducted a more thorough research process, students should be ready to take another step towards fully taking on the role of professional journalists. One way of doing so, would be to create a journalistic coverage of a chosen issue from the game. A traditional approach would be writing an article, which by all means remains a worthwhile effort. It could be just as interesting, though, to write blogposts, initiate discussions on Twitter, or to do a video feature to be used in, say, a news show or as a background story.

#### **8. Presentation**

Upon having played the game, having done proper research and having created a “journalistic product”, we use the opportunity to work with another dimension of students’ communicational skills - presenting to an audience. The most obvious and frequently applied method would probably be to make students present to their classmates, yet the experience becomes more authentic and challenging, if the

classroom is left behind. This does not have to require immense preparation; just by presenting to, for instance, another class, perhaps to younger students, the entire



experience and the learning outcome changes significantly. Another option could be to make video recordings of the presentations for a YouTube-channel, a blog, the school website or something similar.

## 9. Concluding discussion

As deeper learning hinges on the ability to reflect upon what you have learned, we always finish with a two-part discussion addressing two different dimensions of the course. With the first part springing directly from the core subject touched upon by the game and the overall context, we strive to cover the central topics, summarizing the content. What happened, which incidents were the most striking/touching/thought-provoking, and how does those different experiences relate to the nearer life and society of the students?

In continuation of the subject discussion, we usually take it a step further, moving on to a more meta-reflective discussion on the specific methods and tools applied, and, eventually, to the students' own assessment of their learning outcomes. This phase may seem to be of particular interest at a time, when none of us are yet fully evolved in using games as "teaching tools" and thus need to examine and re-examine the consequences of applying games. Sensible as it may sound, such an assertion would downplay the never-ceasing importance of reflecting on the way we work and learn. It is our opinion, that this process should never be left out of education.

## Perspectives

It is clear, that the Global Conflict games are by no means perfect, and many

improvements could thus be thought of. They are visually a bit dull and not quite cutting edge. This, however, is only marginally important, as graphics are not what makes a good game. Some commentators, both developers, researchers and practitioners, tend to assume that learning games must visually resemble COTS titles as closely as possible in order to convince students to play them. We disagree with this assertion (to an extent, at least), as the basic premise is skewed. Games are not primarily relevant in education because of high tech graphics, but because they allow students to explore and play with



situations and problems in relevant contexts. Additionally, the advanced COTS titles are not the alternative to learning games; books and other less interactive media are. More importantly, though, this particular example of learning games are not as good and dynamic as the best of games. For one thing, they require quite a lot of reading, which to an extent weakens the idea of the game as an alternative to reading altogether. Despite the intent of Serious Games Interactive to create serious games, which are able to commercially compete with entertainment games, it would probably not be unfair to say, that this is not entirely the case...yet. We would like to see learning games learn even more from all the fantastic entertainment games out there, because only by doing so, can we realistically hope for learning games to radically improve.

Despite these drawbacks, we have experienced very valuable situations and courses, where specific games from the series have contributed to students better understanding complex topics. It simply becomes much easier to relate to e.g. human conditions in societies much different than our own, when you are able to explore those destinies in a simulated concrete environment.

In conclusion, we certainly recommend keeping an eye on both the work of Serious Games Interactive, but also, and more importantly, the field of learning games in general. A growing number of developers, projects and institutions are working to raise the bar and improving the way learning games facilitate learning.



# Chapter three

## History Lessons via Gaming; A Review of Current Approaches and the Design of a Case Study using Rome Total War

Author: Christos Gatzidis  
Bournemouth University, UK  
cgatzidis@bournemouth.ac.uk

## 1. Abstract

Game-based learning pedagogy in education has today a considerable number of advocates but, despite the wealth of academic literature in the subject, remains for a variety of reasons a medium largely unexplored in real-world educational settings. This chapter aims to present a convincing argument for the use of gaming, and in particular that of the strategic genre, for educators to communicate information and knowledge better to a pupil audience. Previous approaches are provided with a focus on some of the most significant and notable efforts in the area. Moreover, there is a detailed explanation of the methodology used in an envisaged pilot study for this and also the expected results. Finally, a set of recommendations are presented, as well as a number of suggestions for future implementations of similar approaches in a classroom. It is hoped that, via this work, an educator can gain both the confidence but also the inspiration in using, without the need of additional development, a specific style of off-the-shelf commercial gaming title to further enhance history-oriented teaching curriculums.

## 2. Background Research

The creation of educational experiences, which are both beneficial to the learner in terms of enriching knowledge but can also be very memorable, has been made more possible the last few years due to advancing technology plus the introduction of novel methodologies. One such approach, championed by many as driving pedagogy today, is that of game-based learning, which can offer benefits such as the sharpening of problem-solving skills, incidental learning, use of an already familiar medium, sustaining motivation in learners, overcoming cultural and social boundaries, providing an enjoyable learning experience and reducing tutorial times for institutions (amongst many others). However, studies of application for the medium for certain parts of the curriculum have been very sparse. This is for a variety of reasons, not least because of the inherent idiosyncrasies certain fields have in organization and delivery.

As with other disciplines such as physics [1], [2], mathematics [3], [4], [5], [6], biology [7] and geography [8] (to name but a few), there have already been numerous approaches in the practicality of the use of, or exploring the use of, history-oriented game-based learning. It has to be noted however that these approaches are less in quantity than the ones for more traditional, science-oriented subjects. This section details and outlines some of the most significant ones and strongly encourages the reader to further investigate these.

To begin with, there have been arguments from quite a while ago in research suggesting that simulations (a distant relative of gaming) can be very conducive in teaching historical subjects. Lee [9] for example conducted an experiment with the focus firmly

on establishing the effectiveness of simulations in teaching. The subject chosen was labor conditions in the beginning of the 19th century (with peripheral and associated concepts being unions, working conditions and collective bargaining) and, via the use of simulation-based teaching, it was demonstrated that the acquiring of information was not affected in a negative way (when compared to a traditional teaching delivery approach) but also that in terms of preference and enjoyment the simulation approach was favoured over the standard one. This is just but one example of how simulations have been typically called on in the literature in order to explore history teaching and/or other curriculum subjects.

One of the most influential, widely known and perhaps more substantiated (via empirical studies) and successful approaches in this field has been the work of Squire [10]. This research effort is one that can be wholeheartedly recommended to the reader of this handbook chapter, as it is one of the better structured and specific examples of the sheer potential game-based learning has to offer in teaching history.

Via the use of an off-the-shelf game (FIRAXIS' Civilization III, shown in Figure 1), Squire presented three case studies which, apart from history-based learning, also indirectly facilitate politics and geography-oriented learning as well. While all studies present significant mileage to be had in the usage of a game such as Civilization (which has currently reached its fifth iteration since this work first emerged it has to be noted), they outline many difficulties of applying this approach to a live teaching situation (which explains in many ways the greater number of science-based oriented methodologies using gaming listed and referred to earlier in this section).



Figure 1. screenshot from Civilization III, "Screenshot (C) Take-Two Interactive Software, Inc. 1987-2011."

Direct (and indirect) follow-ups to this work include the ones by Squire and Durga [11], Squire et al [12], Squire [13], Squire [14] and Squire [15]. Out of these, it is perhaps worthwhile singleing out this one [15], as it contains a detailed, multi-faceted experiment/ case study this researcher conducted with another FIRAXIS-created game, Pirates! (shown in Figure 2), which is again strategy-oriented and also very heavy on historical (and also geographical) content.

Amongst many other topics covered in this study (conducted in a live classroom) were Carribbean maps, a background on the origins of pirates and piracy in general, the differences between the colonizational patterns of the variety of nationalities included in the game (in the game you can play as English, French, Spanish or Dutch for example), the accuracy of depiction of subjects such as swordfighting etc.



Figure 2. screenshot from Pirates!, "Screenshot (C) Take-Two Interactive Software, Inc. 1987-2011."

Another very popular and particularly well-cited approach standing next to the previous body of work in the area is the one by Egenfeldt-Nielsen [16]. This work, other than a lengthy background and discussion in the theoretical foundation of game-based learning, focuses on a case study, with a sample consisting of 72 high-school pupils, which this time uses another strategy game with a strong history-oriented focus called Europa Universalis II (shown in Figure 3). It should be noted that the game, developed by Paradox Interactive, covers during its gameplay a timeline from 1419 to 1820.

Similarly to the work of Squire, there is for this research too a variety of additional



Figure 3. screenshot from Europa Universalis II

articles peripheral to it, again very much worth investigating such as [17], [18], [19], [20] and [21]. In [18] and [19] in specific, a continuation of the original Europa Universalis effort has been attempted via the development this time of a playable prototype called Global Conflicts: Palestine (shown in Figure 4). Buch and Egenfeldt-Nielsen [19] presented, using this game which focuses on the Palestinian-Israeli conflict, a study with a sample of 51 high school students, taking place over four days.

The subject matter was covered in traditional delivery beforehand and the students were then allocated to play two missions every day for the duration of the first two days, while the rest of the time was given to summarising, further individual and group work and interviews. Both qualitative and quantitative data was collected as part of this, with very encouraging results emerging for the usage of this approach, this time with the help of custom-made software rather than off-the-shelf content. It should be noted that the development of Global Conflicts: Palestine was followed up by a variety of other titles in different settings, tackling however very similar issues (such as Global Conflicts: Latin America, Global Conflicts: Sweatshops and others, more information on which can be found at the portal website of the series [22]).

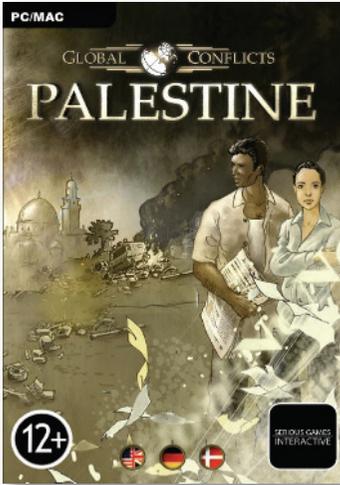


Figure 4. screenshot from Global Conflicts: Palestine

“this game which focuses on the Palestinian-Israeli conflict... It should be noted that the development of Global Conflicts: Palestine was followed up by a variety of other titles in different settings, tackling however very similar issues (such as Global Conflicts: Latin America, Global Conflicts: Sweatshops and others)”

It should be also mentioned that Egenfeldt-Nielsen is also involved in another, even more recent, effort to create game-based learning content for history curriculums. This is Serious Games Interactive’s Playing History [23] (shown in Figure 5), which focuses again on the creation of a custom-made history-teaching title (using the Unity platform) of a more episodic nature.

For example, in the first episode of Playing History there is a firm focus on a setting situated during the 14th century at Florence in Italy, where the player can navigate around a 3D interactive world and work on a variety of tasks, while at the same time taking in historical information about a given point of time at a specific location (such as, for example, the plague and its impact as a disease in Europe at the time, at least on this specific occasion).



Figure 5. screenshot from Playing History

More contemporary work in this area and subject matter, other than the cornerstone pivotal approaches of Squire and Egenfeldt-Nielsen and their associates which should be delved into further by anyone interested in implementing something similar in a classroom, includes the one by Ardito et al [24], [25] (who employed an approach of mobile technology usage on archaeological site(s) in order to enhance historical notion understanding for classes, shown in Figure 6), Kardan [26] (who describe the potential of teaching of history, culture and language via the development of game called Ohana, essentially a single-player role-playing game in the style of World of Warcraft, which is situated in a village in Hawaii) plus Sarkar and William [27] (who explored history, or as the work suggests democracy, learning via the development of a game/simulation including key content such as the US Civil Rights Bill).



Figure 6. screenshot from Ardito et al's work on mobile technology use on archaeological sites for history learning

### 3. Methodology and Expected Pilot Results

The game selected for the envisaged/proposed pilot/case study presented in this chapter is Creative Assembly's Rome Total War. Released in 2004 [28], the game (shown in Figure 7) addresses the early years of the Roman empire. There are two main elements to the game, the first taking place on a turn-based campaign map and the second (this time in real-time) in a battle-mode.

On the campaign map, the player, controlling a Roman family, can make a variety of infrastructure, population, diplomatic and political decisions (amongst many others), while on the self-explanatory battle-mode the game is advanced by beating enemies of different nationalities in the field or during city/town sieges by controlling strategically a number of different units at his/her disposal.

The game runs on either a campaign mode or in an individual historical battle mode which covers a number of actual battles where the player can assume control of one of the sides (prefaced with a fairly detailed historical piece on the background of the battle). Geographically, the game also covers the typical span of the Roman empire and its extreme fringes (Europe and North Africa). One of the main reasons the game was praised (and was particularly impressive at the time of its release) is the fact that the armies in the battle-mode could go up significantly (in numbers) than what was customary in an average strategy game at the time, often in the thousands, impacting the realism of the experience considerably.

Figure 7. screenshot from Rome Total War



There are a number of potential ways this particular game can be used in terms of both adding to and replacing traditional, straightforward, classroom-based Roman history teaching in a standard curriculum. The benefits of using it can also be numerous and variable according to the mode selected (campaign/historical battles), the depth and also the sheer playing time a cohort of students/pupils opt to go for.

First of all, to name but a few of these benefits in specific, the campaign mode, which when played in full lasts around 270 years in the game, allows control of different factions (Julii, Bruti and Scippi, there are also some more unlockable ones although the game needs to be played extensively before these become available to the player) as mentioned above. These factions have some different task-based characteristics,



characteristics which can aid in the identification of a variety of tribes/nationalities and their ethnography by a learner.

For example, the Julii faction need to focus on Germania and also the Gauls, while the Scippi faction focus on the conquer of Carthage. This not only enhances the gameplay (and replayability of the game) but also ensures that parts of the Roman history dealing with the expansion of its empire can be taught via exposure to the game.

Another very important element of Roman history that can be taught via Rome Total War is the importance, operation and inner-workings of the senate. A key element to the game, but also to the function of Rome itself, the senate in the game is responsible for ordering the faction controlled by the player to attack a city or work out more diplomatically-oriented tasks, such as for example forging alliances. For someone learning Roman history, the essence of what a senate was about and what purpose it served in those times is crucial and the game more than provides for that. The interactivity which applies to this part of the game (i.e. senate orders can be ignored for example) is also worth pointing out, as this is again something which can be used to teach history and consequences of actions/reactions to central Roman command.

Secondly, as again mentioned above, the game offers immediate and rife for historical learning and debate battle action via the historical battle mode. This covers the following events/battles; the battles of Lake Trasimene, Raphia, Telamon, River Trebia, Asculum, Carrhae, Cynoscephalae and Teutoburg Forest and also the sieges of Sparta and Gergovia. While naturally enough there is a strong focus on battle action in the normal campaign mode too, out of which historical information/learning such as differentiated troop units across nationalities, engagement tactics, contemporary weaponry and others can be derived, the historical battle mode can offer more engagement with a specific event(s).

It can also offer exposure to specific timeline events. For example, isolating one of the historical battles above, the battle of the River Trebia is placed at 218 BC with the background focus firmly on a battle where the Romans suffered a significant defeat. This involved an Carthaginian ambush and also a timed attack using a specific unit (such as the elephant unit) in a designated way after Roman troops crossed an icy river in response to a taunt move. It should be noted that the player (and/or learner) during this mode does not necessarily take the side of the Romans (for example, in the aforementioned battle the player controls Carthaginian troops by playing the role of Hannibal Barca).

The historical battles offer a unique way for an educator to focus the interactive

attention of a learner in one particular (historical) event by removing more mundane or redundant information which could obstruct the teaching. If nothing else, games like Rome Total War could do with more examples like these.

#### 4. Recommendations

The recommendation(s) for implementation in this section of the chapter are elicited not just by the expected findings of the proposed/suggested case study described in the previous section but also according to findings of other researchers that have conducted work in the area, as can be found in the Background Research section.

One possible way to add this to a classroom setting would be by using this to enhance traditional-style teaching. While there could potentially be a future view towards moving to using interactive-only content for teaching (such as Rome Total War), in the opinion of the author off-the-shelf video games created with the purpose to entertain need to supplement normal teaching delivery and not sideline it completely, as their original goal was never really to be used exclusively for education.

The case study is envisaged to take place as a one-day seminar (or broken over individual sessions over one week) in front of a small to medium class (12 students or so). This also needs to be a class with a rudimentary understanding of the basics of Roman history (i.e. exposed to traditional teaching of the subject). The instructor or educator/teacher (it could be the same person delivering the traditional teaching of the subject, subject of course to suitable expertise in video games/Rome Total War) could begin by offering a short introduction to games development and also serious games/game-based learning. The students could also be prompted to answer a simple question; have they ever attempted the reverse of what these sessions are doing, i.e. have they ever played a game which sparked them off to look up academic information about a subject on the Internet, in a documentary or in a book? As the answer to this is likely to be positive, it could be an ideal start to the day with the students (and potentially the teacher) realising the benefits to using a strategy game to teach history.

This would be followed by some play-time of Rome Total War. This would be, to begin with, in the campaign-mode with the exposure time varying, depending on whether the one-day or over-a-week model is followed. The game is to be played individually. It is unlikely that the students would make significant progress (the game is designed to be of epic proportions) but they would be encouraged to make the most of it by exploring different choices/options and functionalities provided to them during this.

Following the conclusion of play-time, there would be a discussion session focusing on

their experience with the game. More specifically, the students would be asked to discuss their impressions of a variety of issues found in the game such as the geography of Europe (and Africa), Roman factions and families, the hierarchical social structure for Roman citizens, the different nationalities/tribes found in the game, their understanding of diplomatic functions, their understanding of the religious functions in Rome and the importance attached to those, their understanding of senate central command, organisation of troop units and their equipment, architectural styles, city structures and many others.

The second part of the course, intended to last as long as the first (i.e. campaign mode), would focus on the historical battle mode. This time the students will be encouraged to first focus on the information offered by the game on the battle/siege itself and then elect a team-leader who will control the game with the rest of the group also fully participating in the decision-making. After play-time a similar approach to the one above will be followed for a discussion, this time however with a stronger emphasis on the details of the event, ranging from the year it took place, the surrounding contextual history, the military tactics deployed and the eventual outcome.

Finally, it would be of interest to conclude the day or sessions (depending again on delivery mode) by discussing what the students thought of historical accuracy in the game overall. This could include a prompt for them to identify and discuss any specific points where they might have spotted inaccuracies themselves (see next section for more information and alternatives on this) and could be very beneficial in order to assess and also enhance their critical awareness and abilities.

## 5. Conclusion

While the projected results and emerging recommendations from the proposed pilot study presented in this chapter are of interest, the author intends to conduct the experiment with a considerably larger and more ambitious scope, length of duration but also collection of quantitative data too for higher education students in the near future.

The population sample used for this aforementioned experiment is also intended to be considerably larger than what is envisaged and discussed above in Section 4. There are a variety of reasons as to why teaching history with a game like Rome Total War could be particularly intriguing and even yield different results or lead to different discussions in this situation/setting; Rome Total War has, particularly because of its great and sustained popularity as a strategy game, yielded criticism for lack of historical accuracy in a variety of smaller details.

While this is outside of the scope of this chapter, a more detailed discussion of this issue can be found here [29]. As a result of that, modded (i.e. modified) efforts have emerged attempting to address these inaccuracies and anachronisms (with the most high-profile of which being *Europa Barbarorum* [30] and *Rome Total Realism* [31]), so, for example, in a future, more expansive, case study it would be ideal to combine and contrast traditional delivery, an off-the-shelf game (*Rome Total War*) and a mod such as the aforementioned ones, all in a higher-education, University setting.

Official extensions/expansions of the game also exist, which could in turn provide alternative platforms for 'attacking' additional educational content such as *Rome Total War: Barbarian Invasion* [32] and *Rome Total War: Alexander* [33], still without needing bespoke extra software. The first of these tackles historical content dealing with the decline of the Roman empire and also includes factions such as Huns, Saxons, Franks and Goths, while the latter addresses, as is evident by the name, Macedonia and Persian empire-related content. The play modes are similar to the original game (and additional historical battles are also included).

Finally, an alternative approach that has also been contemplated is to go in the opposite direction and pick a historically-oriented strategy game that is more simplified and less elaborate (such as Cinemaware's *Defender of The Crown* [34], shown in Figure 8, set in the United Kingdom of the Middle Ages with a strong emphasis on the Saxon versus Norman struggle, albeit with a rather loose historical accuracy evident) to address its introduction in, this time, (early) primary education. In fact, the original version of this has been made available for free by the developer and runs online on a minimum spec machine, which makes this scenario even more feasible.



Figure 8. screenshot from *Defender of The Crown*, "Defender of the Crown" and Cinemaware are registered trademarks of Cinemaware.

Screenshot (C) 2011 Cinemaware. All rights reserved."

## 6. Acknowledgements

The author of this chapter would like to thank the fellow partners of the EU Leonardo Transfer of Innovation GameIT project (for more information please visit <http://projectgameit.eu/>) for the input and advice on the research presented here, as well as the European Union itself for funding it.

Moreover, the developers and researchers that granted permission for images of their work to be used in this handbook chapter are thanked, as it was crucial to be able to visually showcase these examples. Sid Meier's Civilization III and Sid Meier's Pirates! images courtesy of Firaxis Games, Inc., 2K Games, Inc. and Take-Two Interactive Software, Inc. Take-Two Interactive Software, 2K Games, Civilization and Pirates! are trademarks of Take-Two Interactive Software, Inc. in the U.S. and other countries.

Additionally, fellow colleagues at Bournemouth University, UK are thanked for their support throughout the work as are, of course, all educators that offered invaluable advice/assistance as without them it would have been impossible to ever contemplate the potential exposure of the game and/or approach to live subjects.

## 7. References

1. K. Squire, M. Barnett, J. M. Grant and T. Higginbotham, "Electromagnetism Supercharged! Learning physics with digital simulation games", Proceedings of the Sixth International Conference of the Learning Sciences, 2004, pp. 513-520.
2. J. Birchall and C. Gatzidis, "Elemental: An insight into the development and evaluation of a secondary education chemistry game using XNA", Proceedings of the Third IEEE International Conference in Games and Virtual Worlds for Serious Applications, IEEE Computer Society, Athens, Greece, 4-6 May, 2011, pp. 32-39.
3. G. Lopez-Moreto and G. Lopez, "Computer support for learning mathematics: A learning environment based on recreational learning objects", Computers And Education, Vol. 48, 2007, pp. 618-641.
4. F. Ke and B. Grabowski, "Game playing for math learning: cooperative or not?", British Journal of Educational Technology, Vol. 38, 2007, pp. 249- 259.
5. R. S. Baker, M. P. J. Habgood, S. Ainsworth and A. T. Corbett, "Modeling the Acquisition of Fluent Skill in Educational Action Games", Proceedings of User Modeling 2007, 2007, pp. 17-26.
6. M. P. J. Habgood, "The Effective Integration of Digital Games and Learning Content", PhD dissertation, 2007.
7. C. Dede, J. Clarke, D. Ketelhut, B. Nelson and C. Bowman, "Fostering motivation, learning, and transfer in multi-user virtual environments", Proceedings of the Annual Conference of American Educational Research Association (AERA), Montreal, Canada, 2005.
8. P. C. Adams, "Teaching and Learning with SimCity 2000", Journal of Geography, Vol. 97, 1998, pp. 47-55.
9. J. L. Lee, "Effectiveness of the use of simulations in a social studies classroom", ERIC Documents, 1994.
10. K. Squire, "Replaying History: Learning World History through playing Civilization", PhD dissertation, 2004.
11. K. Squire and S. Durga, "Productive gaming: The case for historiographic game play", In R. Ferdig (Ed.) The handbook of educational gaming, Hershey, PA, 2009.

12. K. D. Squire, B. DeVane and S. Durga, "Designing centers of expertise for academic learning through video games", *Theory Into Practice*, Vol. 47, 2008.
13. K. D. Squire, "From content to context: Video games as designed experiences", *Educational Researcher*, Vol. 35, 2006, pp. 19-29.
14. K. Squire, "Video games in education", *International Journal of Intelligent Simulations and Gaming*, 2003.
15. K. D. Squire, "Toward a theory of games literacy", *Telemidium*, Vol. 52, 2005, pp. 9-15.
16. S. Egenfeldt-Nielsen, "Beyond Edutainment: The Educational Potential of Computer Games", Continuum Press, 2007.
17. S. Egenfeldt-Nielsen, "Overview of research on the educational use of video games, Digital Kompetanse, 2006.
18. S. Egenfeldt-Nielsen, "Case study of Global Conflicts", Proceedings of Games@IULM conference, Milan, Italy, 2006.
19. T. Buch and S. Egenfeldt-Nielsen, "The Learning Effects of Global Conflicts", Proceedings of Media@Terra conference, Athens, Greece, 2007.
20. S. Egenfeldt-Nielsen, "Can Education and Psychology Join Forces. The Clash of Benign and Malign Learning from Computer Games", *Nordicom Review*, 2005, pp. 103-107.
21. S. Egenfeldt-Nielsen and J. H. Smith, "Playing With Fire - How do Computer Games influence the Player?", *NORDICOM*, 2004.
22. Serious Game Interactive's Global Conflicts Portal, <http://www.globalconflicts.eu/>, last accessed May 2011.
23. Serious Game Interactive's Playing History, <http://www.playinghistory.eu/pressroom/press-room>, last accessed May 2011.
24. C. Ardito and R. Lanzilotti, "'Isn't this archaeological site exciting!': a mobile system enhancing school trips", Proceedings of AVI 2008, 2008, pp. 488-489.

25. C. Ardito, M. F. Costabile, R. Lanzilotti and T. Pederson, "Making dead history come alive through mobile game-play", Proceedings of CHI Extended Abstracts 2007, 2007, pp. 2249-2254.
26. K. Kardan, "Computer role-playing games as a vehicle for teaching history, culture, and language", Proceedings of the 2006 ACM SIGGRAPH Symposium on Videogames, 2006, pp. 91-93.
27. M. S. Sarkar and J. H. William, "Digital democracy: creating an online democracy education simulation in a software engineering class", Proceedings of ACM Southeast Regional Conference 2010, 2010.
28. SEGA's Rome Total War, <http://www.totalwar.com/rome>, last accessed May 2011.
29. All Empires Online History Community's Historical Accuracy of Rome: Total War, [http://www.allempires.com/article/index.php?q=Historical\\_Accuracy\\_of\\_Rome\\_Total\\_War](http://www.allempires.com/article/index.php?q=Historical_Accuracy_of_Rome_Total_War), last accessed May 2011.
30. Europa Barbarorum, <http://rtw.heavengames.com/rtw/mods/portal/eb/index.shtml>, last accessed May 2011.
31. Rome Total War Realism, <http://www.rometotalrealism.org/index-2.html>, last accessed May 2011.
32. Gamespot's Rome Total War: Barbarian Invasion expansion pack review, <http://uk.gamespot.com/pc/strategy/rometotalwarexpansion/review.html?tag=summary%3Bread-review>, last accessed May 2011.
33. Gamespot's Rome Total War: Alexander expansion pack review, <http://uk.gamespot.com/pc/strategy/rometotalwaralexander/review.html>, last accessed May 2011.
34. Cinemaware's Defender of The Crown, [http://www.cinemaware.com/dotcremaster\\_main.asp](http://www.cinemaware.com/dotcremaster_main.asp), last accessed May 2011.



# Chapter four

## Introducing Games with a Purpose to Online and Blended Learning Environments

Authors:

Dr. Elmar-Laurent Borgmann,  
Thomas Berger,  
Marcus Fessler

### **Background and aims of the pilot study**

When teachers and trainers consider integrating Game based learning (GBL) in their courses one of the first practical decisions they need to take is whether to use existing “off-the-shelf” computer games or whether to invent and produce games which are then tailored to their specific pre-defined learning outcomes. While the first option forces the trainer/teacher to design his or her training concept around the existing games, which can be difficult if the game content does not match the desired learning outcomes, customized games often require much higher budgets which are often out of reach for trainers and teachers. The starting point for our pilot study is a third option where game based learning is introduced into an existing on-line or blended learning unit in order to enhance learner motivation through variety of learning styles. Game based elements can be introduced in the area of games (game mechanics) such as competition/comparing yourself with other players (learners) of the course and/or in the narrative of the framework story that the learning takes place in. GBL potentially promises higher motivation and intensive interaction with learning materials, higher duration of interaction with learning material, higher learner satisfaction, and better results of learners in tests, exams etc.

We experimented with a simple, low-threshold, and low-budget version of “Games with a purpose” (GWAP) where the game content consists of small scale activities which can easily be implemented on-line with little effort by most teachers who use new media. So in the blended and online courses the “purpose” would be “learning”. As a consequence, the GWAP concept has been used as the guiding principle in order to further develop collaborative online-learning activities in the area of Intercultural Communication. One specific activity was systematically integrated and tested in the existing on-line intercultural training course “Hands-on learning!” and also in a blended learning module integrated in the regular module “Intercultural Communication” at the University of Applied Sciences Koblenz. In both settings (100% online vs. blended learning) learning activities with and without the “games with a purpose” components were piloted allowing us to compare the modified learning activity with the original versions of the respective regular courses.

## The Games with a purpose (GWAP) concept

### 2.1 Definition

“Games With a Purpose” (GWAP) are described as combining “behavior, preferences, or ideas of a group of people to create novel insights” (Segaran 2007; Rafelsberger & Schar 2009). The term “GWAP” was invented by Lenore Blum a professor of the Carnegie Mellon University, and was first published on her blog<sup>2</sup>.

The idea behind GWAP was to create games where the gaming actions are used for a special purpose. GWAPs are “designed to encourage people to provide the information needed in the database” (Pearl 2010) and can be classified in the area of serious games. An example for this concept is the ESP-Game.

### 2.2 Example: The ESP Game<sup>3</sup>

The problem-solving task behind this game is to label images and graphics with meaningful text, a rather complex task for computers, even in the age of image recognition; the ESP-Game is the first realization of the GWAP approach (Ahn 2006). GWAPs is based into the human computation (Ahn 2007) concept which is an approach for using human processing power to solve problems that computers cannot yet solve. In this game, the same image is presented to two players. Then, both players individually enter words or phrases which describe the image. The individual player does not know what the other player is typing, but if both type exactly the same text, this coincidence of a word or phrase appears to be a good indication for labeling that image. The players will receive a next image to continue playing. The players’ goal is to label the largest number of images in a predefined time, getting points every time they coincide in their answers. The ESP Game was licensed by Google as “Google Image Labeler” and has been used to generate a database of images labels. When users search an image in the Google site, they type a name or label. The Google search engine uses the labels database generated by the ESP Game to improve the search results. More than 200 thousand players have already contributed with more than 50 million labels in the ESP Game (Ahn & Dabbish 2008). In addition to this game, other games have been proposed, such as Verbosity (Ahn et al 2006b) and Peekaboom (Ahn et al 2006a).

### 2.3 The concept

Luis von Ahn (Ahn 2008) has proposed three models for the development of GWAPs which can be used by the creation of new games:

- output-agreement,
- inversion-problem games and
- input agreement games.

All three versions have in common that the partners are randomly and anonymously selected.

2 See: <http://blog.gwap.com/2008/05/hellow-world.html>, 09.06.2011

3 See: <http://www.espgame.org/gwap/>, 26.04.2010

### **Output-agreement games:**

The two participants receive the same input for each game, e.g. an image, a described situation etc. Their task is to produce a meaningful output on the basis of the given input. The aim is to produce matching outputs (for this they earn points), but the players cannot communicate with or see each other and they also cannot see the other person's outputs. It is not necessary to give the answers synchronously; it is also possible to play this game asynchronously. There are no real winners or losers in the games; the motivation is to be high on the ranking list. (Ahn 2008)

Example for an input agreement game: Two players are shown a pair of images and are asked to vote for the picture their partner will prefer. (Ahn 2009) The described ESP Game based in the output-agreement model.

The FH Koblenz project team decided to use this approach as the base for the game-based-learning elements in their pilot studies.

### **Inversion-problem games:**

Players are exchanging the roles of "describer" and "guesser" each round. The describer receives an input, e.g. an image (from the platform) and generates an output. This output is send to the guesser, who should reproduce the original input. If this is successful, both earn points. (Ahn 2008)

An example for an inversion-based game is Verbosity<sup>4</sup>. Two real players are playing, one is the "describer" and one is the "guesser". The describer gets a word which needs to be guessed by the other partner. The describer can reshape the term and the guesser needs to write the right word down. In the next round the roles are inverted.

### **Input-agreement games:**

In each round both players receive an input, which can either be the same for both or different. The task for the players is to generate outputs, based on the respective inputs. These outputs are then visible for both. On the basis of the visible outputs, the players must deduce, whether the inputs were the same or different. They earn points if the determine correctly whether they had the same inputs or not. (Ahn 2008)

An example for an input-agreement game is TagATune<sup>5</sup>. Two real players listen to a song and write down keywords, the keywords are visible for each partner and every participant needs to decide if both listen to the same or to different songs.

## **Learning activity template**

### **3.1 Background**

A standardized description of a learning activity can help to update it with game based (GWAP) elements. Templates such as the "VITAE learning activity plan template" (Fessler

---

4 See: <http://www.gwap.com/gwap/gamesPreview/verbosity/>, 9.6.2011  
5 See: <http://www.gwap.com/gwap/gamesPreview/tagatune/>, 9.6.2011

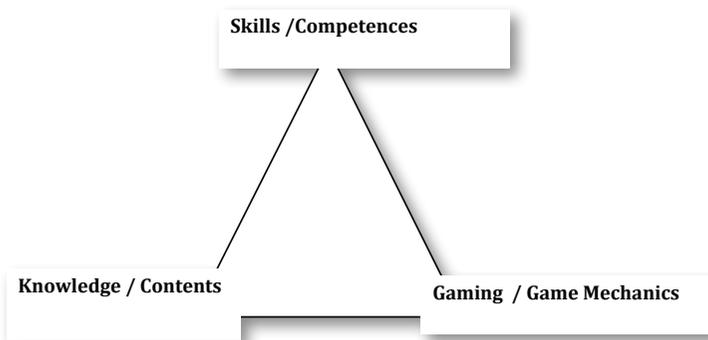
2009, pg. 88ff) allow identifying the potentials and requirements of integration of game based elements.

### 3.2 About this template

While the VITAE template allows describing general learning activities in a standardized and structured way it does not cater for the integration of game elements (GWAP) yet. For this purpose the triangular relationship between

- **Skills and Competences** a learner will gain when undergoing a certain learning activity
- **Knowledge and Contents** a learner will absorb during the learning activity
- **Game elements/mechanics** which constitute the playful nature of the learning activity is used as reference point for the new version of the VITAE learning activity template.

The following triangle is based on the figure concerning “Technology enhanced learning” (Göbel 2009 pg.: 2).



The resulting template is illustrated in the table below:

Dimensions of game-based-learning or -training	
Knowledge / Content	
Skills and Competences	
Gaming / Game mechanics	
Description of the activity:	
Short Title of the activity	

General Topic of the GBL activity	
Learning Scenario	
Learning or Training outcome	
Step-by-Step description of the activity (role of the trainer / moderator / coach)	
Optional	
Technical Requirements	

**Pilot study FH Koblenz**

The following chapter describes results of two pilot runs carried out to evaluate the game (GWAP) based version of an existing learning activity in our example in the area of Intercultural Communication. It provides an example for a low-budget, mini-game version of implementing GBL in adult, vocational and higher education.

**4.1 Chosen learning activity**

The following learning activity was identified as a potential candidate for a game based update/transformation (see table below):

Description of the activity:	
Short Title of the activity	Nonverbal Intercultural Communication (NIC)
General Topic of the GBL activity	Handling Nonverbal Communication successfully in the context of an internship abroad
Learning Scenario	You have started your internship abroad and you need to master new challenges which can be strongly influenced by intercultural aspects.

<p>Learning or Training outcome</p>	<p>Participants recognize the importance of nonverbal communication in an inter-cultural business context. They train their intercultural competencies</p>
<p>Step-by-Step description of the activity (role of the trainer / moderator / coach)</p>	<p>You are subscribed to an online intercultural awareness course in the digital platform Moodle where this module about Nonverbal Communication is introduced through five videos from different countries (e.g. Sweden and Kenya) in which speakers explain the importance and mechanics of nonverbal communication in their own languages (mostly unknown to you). As you do not understand the language you cannot rely on getting information through that channel and you are forced to start looking out for nonverbal signals in the picture.</p> <p>In the next video you watch two ladies planning their holidays together in the English language. You need to answer the following questions:</p> <ul style="list-style-type: none"> <li>• What is the role-play about?</li> <li>• What could be the actual fact behind the discussion?</li> <li>• How many different aspects of nonverbal communication could you identify in the role-play?</li> <li>• What happens to the role-play, if you turn off the sound and only have the picture?</li> </ul>
<p>Optional:</p>	
<p>Technical Requirements</p>	<p>Participants must have online access to the internet. They need to have a Flash plug-in to view the video clips used in the activity</p>

The learning activity was selected, because:

- The act of observing (as part of NIC) can be easily linked to GWAP input/output streams of information (such as output agreement)

- Observing is a repetitive activity and as such a good candidate for playful action
- Observing/NIC requires effort and concentration - hereby allowing for competitive comparison - another key element of games (see also Chaffinn 2010 pg.2)
- NIC provides room for creativity, story-telling, fantasy as important elements of gaming
- The content and material (pictures, videos) already exist or are easy to use/modify

The game element “competitive comparison” is the main key to updating and modifying a simple observation activity in a playful manner. A virtual person (“avatar”) that proposes standard answers to observation questions was introduced to provide a reference which the learners (“players”) can compare themselves with. So the learner does not play with another learner but competes with this virtual person that enters into a playful experience of success and achievement. The virtual person also serves as a metaphor for a more playful narrative of the learning activity. The learner is asked to play with “Marcus the former course participant”. So the metaphor is that the learner competes with a (virtual) person who was a student on a previous course. The game-enhanced updated description of the learning activity is illustrated in the table below.

#### 4.2 Game based update of an existing learning activity

Dimensions of game-based-learning or -training	
Knowledge / Content	Categories of Nonverbal Intercultural Communication, definitions, indicators, examples
Skills and Competences	Recognizing Nonverbal Intercultural Communication (NIC). Distinguishing between simple observation and interpretation of NIC. Developing NIC observation skills
Gaming / Game mechanics	Competitive Comparison of results with other learners and a virtual character (inspired by “Games with a purpose”)
Description of the activity:	
Short Title of the activity	Nonverbal Intercultural Communication

<p>General Topic of the GBL activity</p>	<p>Handling Nonverbal Communication successfully in the context of an internship abroad</p>
<p>Learning Scenario</p>	<p>You have started your internship abroad and you need to master new challenges which can be strongly influenced by intercultural aspects. You pick up a number of nonverbal signals which can be misunderstood, e.g. symbols / icons or gestures.</p>
<p>Learning or Training outcome</p>	<p>Participants recognize the importance of nonverbal communication in an intercultural business context. They train their intercultural competencies. They learn to observe closely without jumping to conclusions and without directly going into interpretation and are made aware of the risks of quick interpretation and judgment in intercultural contexts.</p>

Below you can find some screenshots of the nonverbal-communication module, including the game-based-learning activity.

Welcome to our blended-learning module on "**Nonverbal Communication**", which I think is best viewed in the Mozilla Browser. This module is designed to raise your awareness about Nonverbal Communication and the crucial role this form of communication plays in daily life. In this module you will find 4 activities which will help you on your learning journey.



**Nonverbal Communication consists of:**

1. KINESICS - messages sent by the body, including gestures, facial expressions, body movement, posture, gaze and gait
2. VOCALICS - vocal cues other than words including volume, rate, pitch, pausing and silence
3. PHYSICAL APPEARANCE - manipulable cues related to the body, including hairstyle, clothing, cosmetics and fragrance
4. HAPTICS - contact cues, such as frequency, intensity and type of touch
5. PROXEMICS - spatial cues including inter-personal distance, territoriality and other spacing relationships
6. CHRONEMICS - the use of time as a message system, including punctuality, amount of time spent with another and waiting time
7. ARTIFACTS - manipulable objects in the environment that may reflect messages from the designer or user, such as furniture, pets or other possessions

Image above: Screenshot from the online-activity, introduction

Would you be prepared to believe that Nonverbal Communication is the most powerful form of communication? Studies suggest that "93 percent of communication effectiveness is determined by nonverbal cues." If you are now thinking "Surely, Nonverbal Communication can't be more powerful than Verbal Communication" then you might want to read the article "Listen With your Eyes - Tips for Understanding Nonverbal Communication"

Nonverbal communication includes:

**body language (kinesics), facial expression (mimic), eye contact (occulistics), touch (haptics), body distance (proxemics), paralanguage (tone of voice, timbre, pitch etc.)**

You can perhaps control the words you say - at least - to some extent. However, are you really aware of the signals you are sending out non-verbally.

...and apparently, we are sending out these signals all the time!

### Your Tasks:

**Task 1 "Warm-up":** Please have a look at the introduction video clips below. The content of all clips is the same, but in different languages. Listen to the videos and take time to have a look at the gestures (or lack of gestures) used by the speakers.

Take a few notes of which aspects of Nonverbal Communication are obvious ... see how it differs between different cultures and personalities. Do you recognize all three languages and cultures?

**Task 2 "Online activity":** Let's play a game! Please take part in "What do you see?" and follow the instructions.

This is a game you will be playing against one of our former participant of this course, Marcus, so see if you can beat him in it! If you click on "submit questionnaire" on the last screen, your answers will be sent to the moderator.

**Task 3 "What different kinds of Nonverbal Communication can you spot?"**

Watch the one-minute video clip and see what kinds of Nonverbal Communication you can spot. Look for Kinesics, Mimic, Occlustics, Haptics, Proxemics and paralanguage. Please take some notes so that we can talk about the nonverbal communication in this video in our next face-to-face meeting next Tuesday.

**Task 4 "From virtual to real - the next level of the game": After playing against Marcus, let's get to the next level of the module and observe people in the real world around you.**

- a) Please carefully observe the situation when two foreigners greet each other, e.g. two foreign students at the railway station or in the university cafeteria. Do not wait until you happen to see such a situation but actively look out for it over the next three days
- b) Make sure you choose a situation where both partners seem foreign
- c) Describe the situation in great detail, adding information like age, culture, status, and gender of the persons who greet each other
- d) Post your results as a new discussion topic in the forum: "Observing an intercultural greeting situation"

We will collect and evaluate the results and provide some feedback on your observations.

Have fun and good luck with this online module! BTW, there is no harm in getting in touch with the people you observe and letting them know what you are doing. Who knows, perhaps you will make some new intercultural friendships?

Image above: Screenshot from the online-activity, task for the participants

### What do you see? Task 2

Training your observation skills

On the following screens you will see some graphics followed by two questions each. In total there are five questions to answer.



... please keep in mind, you are playing against Marcus, the former course participant in this game!

Page 1 of 11

Before the game starts, we would like to give you an example of the kind of tasks you need to complete:



Please describe the image above

Marcus' answer: On the left side I can see the back of a hand and two spread fingers. The forefinger and the middle finger are pointed. The other fingers are not visible or are folded. On the right I see a similar drawing but the other way round. I see the inner part of a hand with the little finger, ring finger and thumb folded.

Please have a look at the following video and count how many nonverbal signals you can recognise, describe them in short and add your observations in the text box below.

Note: CODES OF NONVERBAL SIGNALS:

1. KINESICS - messages sent by the body, including gestures, facial expressions, body movement, posture, gaze and gait
2. VOCALICS - vocal cues other than words including volume, rate, pitch, pausing and silence
3. PHYSICAL APPEARANCE - manipulable cues related to the body, including hairstyle, clothing, cosmetics and fragrance
4. HAPTICS - contact cues, such as frequency, intensity and type of touch
5. PROXEMICS - spatial cues including inter-personal distance, territoriality and other spacing relationships
6. CHRONEMICS - the use of time as a message system, including punctuality, amount of time spent with another and waiting time
7. ARTIFACTS - manipulable objects in the environment that may reflect messages from the designer or user, such as furniture, pets or other possessions

Images above: Screenshot from the online-activity, part of the game-based-learning activity

### 4.3 Time schedule of the Pilot Study

The pilot study followed the following schedule:

Action	Deadline
Conceptual Design	1. July 2010
Implementation	10. July 2010
Pilot run 1 (as a module addition to the "Hands-on learning!" 100% online-course)	took place from 13. -22.09.2010
Evaluation / Result Analysis	until 31. August 2010
Revision / Improvement of the course	until 30. September 2010
Pilot run 2 (as a blended learning course with two groups of students of the FH Koblenz)	5. October 2010 - 13. December 2010
Evaluation / Result Analysis	until March 2011

#### 4.4 Evaluation

In order to evaluate the learning experience of students in the different groups open questions were asked at the end of the learning activity:

1. Please tell us five things you have learned in this module
2. Tell us what you liked most in this module
3. What would you recommend to change if we wanted to improve this module?

In order to interpret the open questions answers were allocated to categories and clustered. The chosen categories cover the wide variety of answers given by students.

#### 4.5 Evaluation of Pilot One

##### 4.5.1 Description of pilot one

The evaluated course module was embedded in an existing, ongoing online-course administrated by the university for students who spend a period of their studies abroad (studying or doing an internship). The whole course consists of 10 different modules with similar workloads. The evaluated module was one out of the ten modules which are offered on the online course.

In order to clearly evaluate the impact of the "games with a purpose" components of the new module, the participants of the online module were divided in four different test groups with around 25 participants in each of the groups. Groups 1 and 2 were given the existing classic online-course module "non-verbal communication" without game components, which had been used many times before. In contrast, groups 3 and 4 were given the new game-based learning adaptations of the same module "non-verbal communication". The duration of all four course module was nine days and they took place in parallel in order to create comparable conditions which would help in the comparison of results.

##### 4.5.2 Evaluation process

The evaluation with identical questions was done in all four groups (1 to 4) of the online course, for the questions, see chapter 4.3.

##### 4.5.3 Database

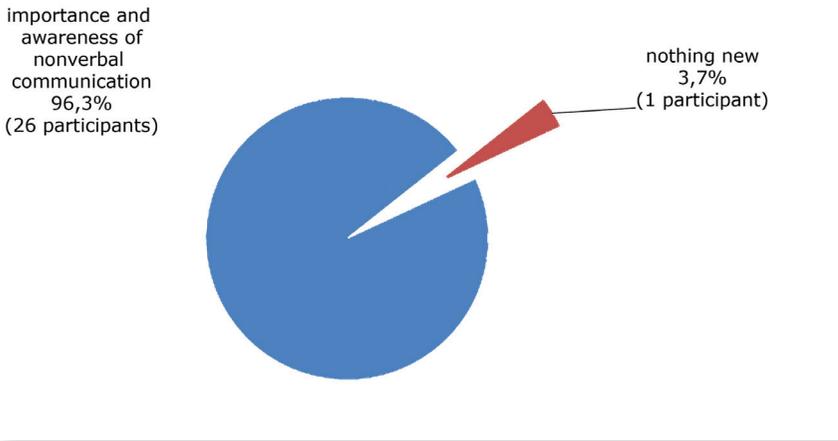
In groups 1 and 2 with a total of 52 participants, 22 participants gave feedback (42%)  
In groups 3 and 4 also with a total of 52 participants, 27 participants gave feedback (52%)

##### 4.5.4 Question 1: Please tell us five things you have learned in this module

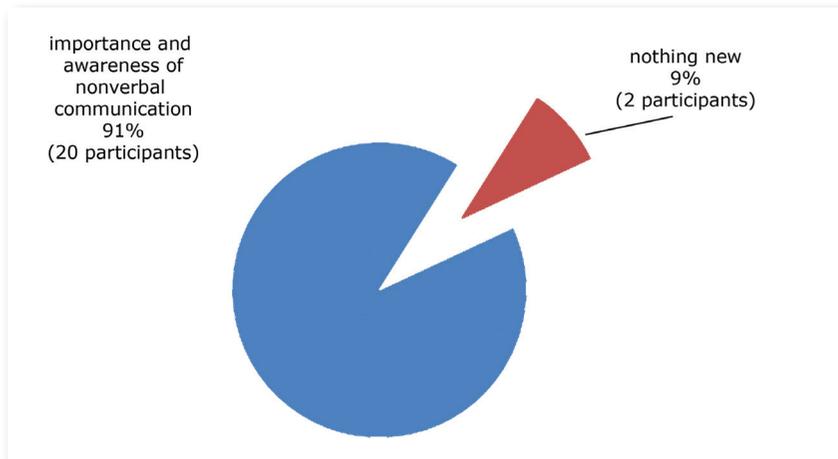
Chosen categories:

- Nothing new
- importance and awareness of nonverbal communication

Groups 1 and 2



Groups 3 and 4

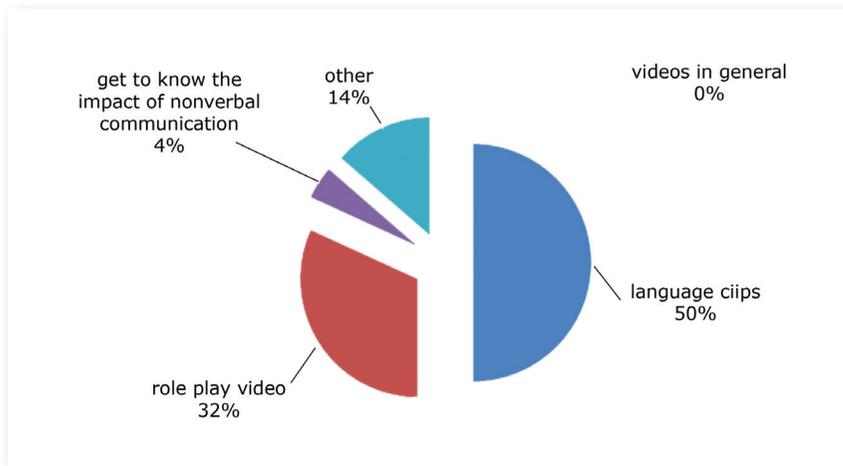


There was no huge difference between the answers of groups 1,2 and groups 3,4. The overwhelming majority of students had the impression that they had gained some new insights into the importance and awareness of nonverbal communication. However, in the test groups with game components the percentage of students who thought they had not learned anything new was about a half of those in the conventional contrast group (3.7% instead of 9%)

#### 4.5.5 Question 2: Please tell us what you liked most in this module

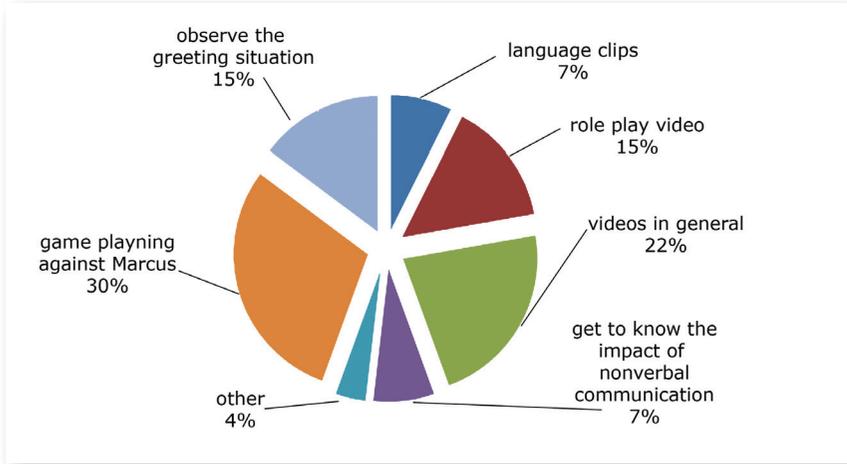
Chosen categories:

- language clips
- roleplay video
- get to know the impact of nonverbal communication
- videos in general
- game playing against Marcus
- observe the greeting situation
- other



Groups 1 and 2

Groups 3 and 4



#### 4.5.6 Quantity of communication

The average number of words per participant for description and interpretation in groups 1 and 2 together was 358 words and the amount in groups 3 and 4 was 416 words. As the rest of the module was absolutely identical this difference would suggest that the “games with a purpose” components motivated students to spend more time with the tasks and compose more complex and more detailed answers.

#### 4.5.7 Discussion of the Results of Questions one and two

The Analysis of the the the answers to question one suggest that the module reached the intended learning coutcomes. Most of the 10% of learners who stated that they had learned nothing new in this module specified, however, that they had gained this knowl- edge and the competencies in question before they even took the course. So they did not suggest that the module is not worth doing but rather that they had done a similar course before and had already gained insights into nonverbal intercultural communica- tion in previous training courses.

The most important factor of a successful online-module is the motivation of the partici- pants. Motivation in face-to-face sessions can often be estimated relatively accurately by experienced teachers during the classes, but in online-courses this can be much more difficult. Factors, which can describe or measure the motivation of online-courses, could be:

- the active use of the different types of media offered to the participants in the module and
- the amount of communication the participants initiate with other participants or with the online teacher

Offering different digital media for students to get involved in different tasks can have a positive effect on the level of motivation the participants show during the course. In the answers to question 2: "Please tell us what you liked most in this module" all types of tasks were mentioned. This wide distribution shows that we seem to have found a good mixture of the use of new media. However, one result of 30% for the task "game playing against Marcus" statistically stands out from all the other tasks. This was the game based learning component which had been added to the course for groups 3 and 4 as compared to the courses of groups 1 and 2.

The amount and intensity of communication can also be seen as an indicator of the motivation displayed by of group of online-learners. On the course which involved game-based learning the level of communication was increased by about 58 words per participant which means an increase of 16% if we compare the totals of groups 1 and 2 and the totals of groups 3 and 4.

However, we would see this as a weak indicator, because we have no data of the different workloads of the comparison groups. We tried to implement courses with the same amount of workload, but how much time the participants really needed to fulfill the tasks was very difficult to measure.

#### **4.5.8 Conclusion**

The use of game-based-learning elements in online learning activities seems to have a positive effect on the motivation of the majority of participants, which in turn leads to an easier and more involved accomplishment of the desired learning outcomes. The game-based learning elements do, however, not need to be technically complex or very sophisticated. The element of competition, even if the "opponent" is a virtual participant, seems to do the trick and seems to motivate the learners to put in more time and energy to complete their tasks than they would on a conventional course.

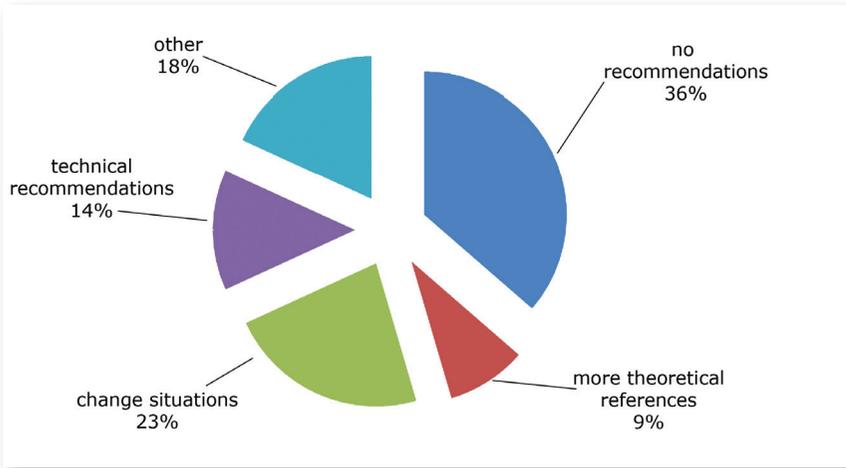
Nevertheless we were particularly interested in students' suggestions for modification of the learning materials so that pilot two could already benefit from solving problems identified in pilot one.

#### **4.5.9 Question 3: What would you recommend us to change if we want to improve this module next time?**

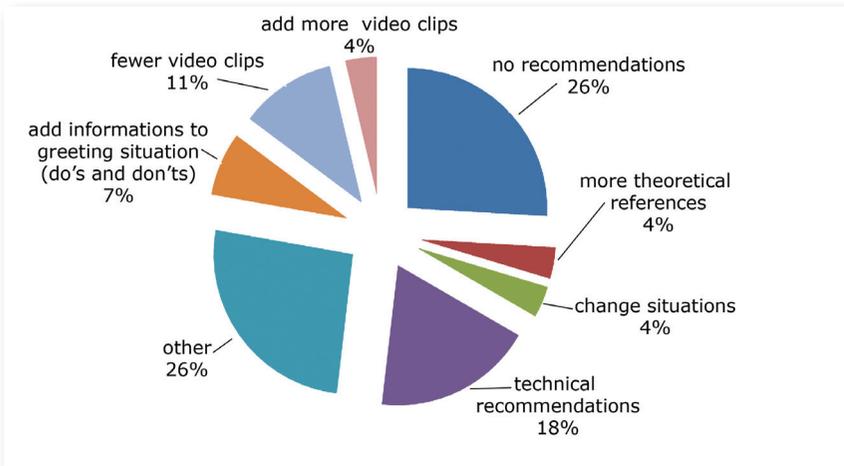
Chosen categories:

- no recommendations
- more theoretical references
- add info to greeting situation (dos and don'ts)
- change situations

- technical recommendations
- fewer video clips
- add more video clips
- other



Groups 1 and 2



Groups 3 and 4

#### 4.5.10 Discussion of the results of question 3

Most of the recommendations given by the participants have - as a consequence - already been implemented in the pilot run two, e.g. the number of language video clips was reduced for the second test run and some small technical problems were resolved. Furthermore the second pilot allowed us to test a different learning environment, this time a blended learning mode.

### 4.6 Evaluation Results Pilot Run Two

#### 4.6.1 Description of pilot course two

The online game based module was placed in an existing blended learning course at RheinAhrCampus, FH Koblenz, in order to find out whether the findings above could be verified with a group of participants who meet once every week but have to fulfill online assignments in between the face to face meetings.

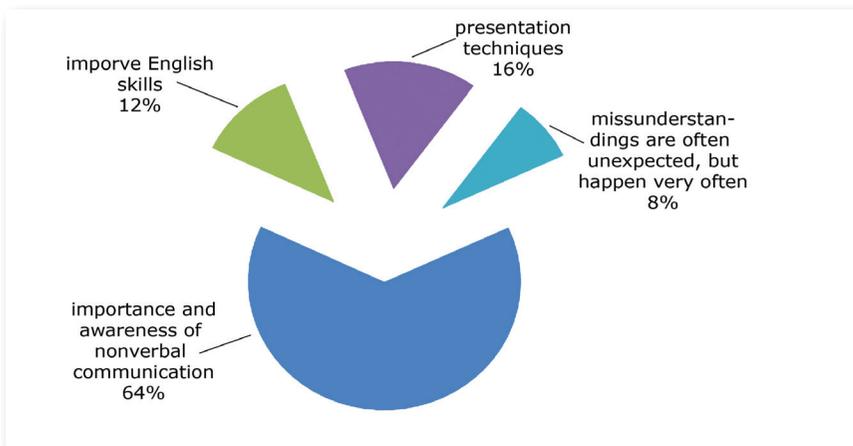
#### 4.6.2 Evaluation process

The evaluation with the same questions was done in two blended learning groups of the online course, for the questions, see chapter 4.3.

#### 4.6.3 Database

In groups 1 and 2 with a total of 26 participants together, all participants have given feedback at the end of the module. In the blended learning setting it was easier to include all participants in the evaluation because we had regular face to face meetings once a week.

#### 4.6.4 Question 1: Please tell us five things you have learned in this module



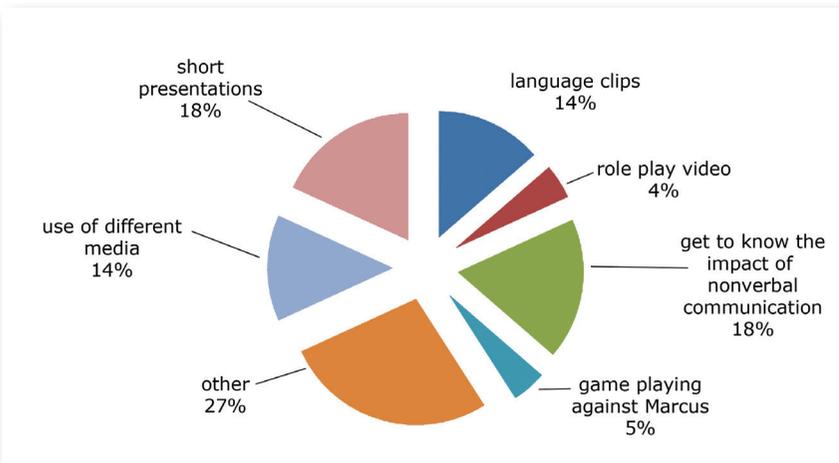
In contrast to the online pilot courses 1 to 4 in the evaluation of the blended learning courses we observe a bigger variety of responses and the participants thought that they

had also improved their English skills (as the module was run in English) and their presentation techniques in this module. There were, however, no participants on the blended learning courses who thought they had not learned anything new in the module.

**4.6.5 Question 2: Please tell us what you liked most in this module**

Chosen categories:

- language clips
- roleplay video
- get to know the impact of nonverbal communication
- videos in general
- game playing against Marcus
- observe the greeting situation
- other

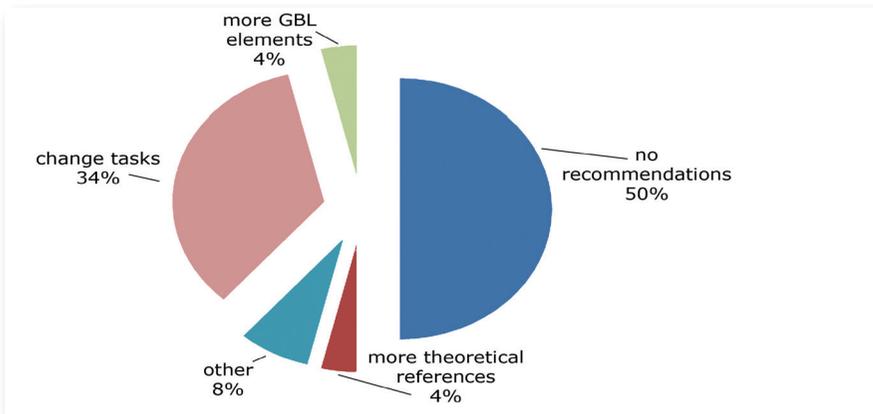


**Conclusions:**

While on the blended learning courses the module with game based components seems to produce a high learning satisfaction in the participants (nobody said that they had not learned anything new) only 5% of the participants explicitly linked this satisfaction to the “game playing against Marcus” component. Like in the conclusions of pilot run one concerning this question it seems obvious, that the variety of media in itself is the key to learner satisfaction. 14% of the participants expressed that the “use of different media” raises their level of motivation, which in turn leads to a higher learning outcome. However, within the different media categories the contents can make big differences as in the case for two activities in the same medium video: “language clips” (14%) and “role play video” (4%).

#### 4.6.6 Question 3: What would you recommend us to change if we want to improve this module next time?

- Chosen categories:
- no recommendations
- more theoretical references
- change situations
- technical recommendations
- other
- fewer video clips
- add more video clips
- change tasks
- more GBL elements



#### Conclusions:

The biggest group of participants (50%) gave no recommendations for change: Most of the participants where the answer is allocated to the category "no recommendations" are happy with the course module and saw it as a genuine enrichment of their regular classroom lectures. Compared to the 100% online-module, in this blended-learning environment there were no technical recommendations (in contrast to 14% in the online-module). We assume that all technical problems were solved and technical questions were answered in the classroom. However, the contents of the tasks were not discussed in class which was unusual for the participants and perhaps resulted in an issue about the clarity of task-setting (34%). Some participants on the blended learning course would have preferred to go through the tasks as a group rather than as an individual.

## 5. Conclusion

Game based learning can be implemented on a micro-, low-budget level by looking at existing learning activities from a different, more game-oriented perspective. Such a fresh look helps improve learning activities as it helps trainers identify hitherto unexploited potential of the materials. It adds to the variety of learning tasks and diversity of media used and thus adds to the motivation of students especially in on-line environments, when interaction of trainers with learners is limited. The template introduced and the sample application of it as described in this chapter could enable trainers who are interested in a game based update of their existing (online) learning activities, to start right away. The authors would be grateful if readers shared their experiences in the process - as the authors are happy to share theirs - so please feel free to get in touch:

Marcus Feßler, [fessler@inter-research.de](mailto:fessler@inter-research.de)

Thomas Berger, [berger@inter-research.de](mailto:berger@inter-research.de)

Laurent Borgmann, [borgmann@rheinahr-campus.de](mailto:borgmann@rheinahr-campus.de)

## 6. Sources

Chaffinn, A., Barnes, T.,

Lessons from a course on serious games research and prototyping in FDG '10:  
Proceedings of the Fifth International Conference on the Foundations of Digital Games,  
2010

Fessler, M.,

Moderated collaborative online learning - guided course development on the basis of an  
e-learning pattern template, in Mentoring For 21st Century Skills  
It's All About The Learning,  
University of Salford, UK,  
2009

Göbel, S., Rodrigues C., Mehm F., Steinmetz R.

Narrative Game-based Learning Objects for Story-based Digital Educational Games,  
in Proceedings of the 1st International Open Workshop on Intelligent Personalization and  
Adaptation in Digital Educational Games,  
2009

Pearl, L., Steyvers, M.,

Identifying Emotions, Intentions, and Attitudes in Text Using a Game with a Purpose,  
in Proceeding CAAGET '10 Proceedings of the NAACL HLT 2010  
Workshop on Computational Approaches to Analysis and Generation of Emotion in Text,  
2010

Rafelsberger, W. and Scharl, A.,

Games with a Purpose for Social Networking Platforms,  
in 21st ACM Conference on Hypertext and Hypermedia,  
Association for Computing Machinery, Torino, Italy, p.193-197  
2009

von Ahn, L.,

Games with a purpose,  
IEEE Computer Magazine, 39(6):96-98, 2006.  
2006

von Ahn, L., Dabbish, L.,

Designing games with a purpose  
in Communications of the ACM, Volume 51 Issue 8,  
2008

von Ahn, L., Law, E.,  
Input-Agreement: A New Mechanism for Collecting Data Using Human Computation Games,  
in CHI '09 Proceedings of the 27th international conference on Human factors in computing systems,  
2009

Further Links:

<http://www.gwap.com/>

<http://www.purposegames.com/>

A page where you can create and play online-games (Flash-based), such as:

“Find and click the capitals of Europe on a Map ”



# Chapter five



## Learning by producing

Author: Mathias Poulsen  
Play Consulting  
GameIT College

## Learning by producing

As we mentioned in the introductory chapter, we do not limit our perception of game based learning to using pre-fabricated, dedicated learning games. On the contrary, we argue that game based learning ought to be far more inclusive and represent a wider array of different approaches than has traditionally been the case. One such approach lies in the process of actually developing video games, which we consider to be an integral part of our game based learning definition.

The aim of this chapter is to provide an understanding of the link between developing games and fulfilling relevant learning goals. We do so by first explicitly describing skills and competences required to successfully develop a game. This is followed by a complete overview of the entire process from start to finish, where we show how the actual skills and competencies are put in concrete use.

Throughout the chapter we shall not delve deep into the technical aspects of game development, as it is beyond the scope of this handbook. In addition, a detailed technical account would not only run the immediate risk of rapidly becoming obsolete, but would also indicate that there is one way to go about developing games in education. This is obviously not the case, and though we will provide some basic pointers towards concrete tools and services, the process can definitely be tailored in a variety of ways to meet particular wishes, demands and resources.



As examples and illustrations, we use games developed by students at GameIT College and the game company ClearCut Games (which also consist of current GameIT students).

### The learning goals

One might appropriately ask if developing games is not only relevant for courses and educational contexts dedicated to game development? We are fully aware that many educators would probably not consider it worth the effort, as it in most cases require some extra work to get started with game development.

Why, then, is it that we would not hesitate to recommend educators across the board to seriously consider including “game development” in their daily work? What is that can be gained from such an approach?

Revisiting our initial distinction between “game literacy” and “game based learning”, it appears to us that we may also look at developing games through this very same lens.

Developing games in education is just one of the latest additions in a longstanding tradition, where students are taught to *produce* different kinds of media in order to more fully grasp the nature of said medium. The obvious and most firmly rooted example would be writing, which is unanimously considered an indispensable core skill even today. Over the years the array of media included in schools have been expanded to include all kinds of written media, auditory and visual media, digital media (e.g. websites) and now also games (Buckingham & Burn, 2007). The basic premise of working with any of these Making games thus becomes a cornerstone of working with students’ game literacy and an elaborate understanding of games. In the face of the media types can be better understood by the distinction between reading and writing:

“[...] game-playing is like “reading” and game-making is like “writing” in that they must be introduced to learners hand-in-hand from a young age. One learns to read better and more critically by learning creative writing and, conversely learns to write better and more creatively by reading and analyzing the symbolism in books and genres. It does a disservice to the aim of any literacy education (game literacy included) to overlook the mutually constitutive relationship between reading and writing” (Caperton, 2010).

Making games thus becomes a cornerstone of working with students’ game literacy and an elaborate understanding of games. In the face of the changes happening across the contemporary cultural landscape, such a more comprehensive and deep literacy of games is becoming increasingly important.

This is all very important, but not our primary focus in this project. Rather than developing games in order to further game literacy, we develop games in order to further a number of generic, highly valued skills and competencies. Based on both research and extensive practice experiences, we have identified and exposed a number of highly relevant skills and competencies related to making games, both inside and across multiple subjects and disciplines:

- Using digital tools
- Collaboration
- Analysis & reflection
- Creative thinking
- Planning & documentation
- Communicational skills
- Innovation & entrepreneurship

It is important to note, however, that this list is not exhaustive and many other areas could possibly be covered – all depending on the specific approach chosen.

That developing any kind of digital game requires the use of specific digital tools, which are in most cases run by a computer, probably seems all self-explanatory. This resonates perfectly with the rapidly increasing importance of being able to use a wide selection of digital tools in a variety of settings and creative ways. Few tasks in society today are carried out without the aid of a more or less diverse set of tools, and this is identified as one of today's key competences by OECD.

When working with students, we are frequently stressing, that developing games is in most cases carried out as an inherently collaborative process, where individuals with different backgrounds and specialties take on different roles (e.g. game designer, level designer, 2d/3d artist, programmer, audio designer etc.) and collaborate closely, each contributing with what they do best. Again, this closely resembles the key competences pointed out by OECD.

In order to become a good game developer, analytical skills are required to identify and isolate the core components that make up the game. This must be combined with strong reflective skills to continually assess and evaluate the project, thereby practicing "reflection-in-action" and becoming what is labeled the "reflective practitioner" by Donald Schön.

Most games start with brainstorming sessions to generate a sufficiently strong an idea, which is revisited and revised in a relatively long iterative process, where students draw upon and improve their creative skills.

From the initial planning and scheduling to the ongoing documentation and the final evaluation, students are using a variety of tools to control the process (e.g. GANTT & SCRUM).

Most game developers are frequently required to tell other people (e.g. clients, publishers, a wider audience) about their work, and thus they are required to practice and improve their communicational skills.

The entire process is as described so far is closely mirroring many contemporary perceptions of innovation and entrepreneurship, which again is included as central to many strategies, nationally as well as internationally.

Another take on identifying “knowledge and skills” required to develop games is formulated by American game designer and theorist, Katie Salen:

“Game design as a domain of professional practice involves a rich array of knowledge and skills. Knowing how to put together a successful game involves system-based thinking, iterative critical problem solving, art and aesthetics, writing and storytelling, interactive design, game logic and rules, and programming skills [...] And each of these involves a melding of technological, social, communicational, and artistic concerns, in the framework of a form of scientific thinking in the broad sense of the term (e.g., hypothesis and theory testing, reflection and revision based on evidence, etc.)”(Salen 2007, p. 305).

By allowing students to actually design and develop games, it thus becomes possible to fuse in one creative process a number of highly relevant skills and competencies - technological, social, communicational, and artistic - which are in great demand in society today.

In the following, we aim to elaborate on each of the above dimensions illustrated with experiences from several concrete projects, where students have been developing games as part of fulfilling curricular goals.

### **The process**

In the following paragraphs we wish to illustrate how an exemplary educational game development project could be planned and executed. These guidelines are distilled from

several different projects, and it will probably not always be feasible or even possible to include all the elements. That is no reason to worry, however, but solely an occasion to reflect on the desired learning goals and pick the components based on this.

Picking the components or phases is part of the initial planning and coordination, which is obviously required before including students. As is always the case in education, planning a project like this is to a large extent about carefully balancing the amount of scaffolding applied. In our experience, the best results are achieved with a relatively flexible structure within which students are allowed a high degree of autonomy.

“The Creative Partnerships programme fosters innovative, long-term partnerships between schools and creative professionals, including artists, performers, architects, multimedia developers and scientists. These partnerships inspire young people, teachers and creative professionals to challenge how they work and experiment with new ideas. Young people develop the skills they need to perform well not only in exams and extra-curricular activities, but also in the workplace and wider society.”  
(read more at <http://www.creative-partnerships.com>)

Depending on the level and the specific students, the relationship between structure and autonomy is of course a variable, which can be endlessly fine tuned.

### **Involve external partner**

We have had tremendously positive experiences with including external companies and organizations in our work. Instead of merely asking students to develop whichever game they would themselves prefer, we try to allow these external partners to act as customers with specific needs and wishes. This creates a situation not unlike that of many game developers working with partners and customers.

The relation to the external partner is in part what creates the context of the overall project, and this context is experienced as more authentic and ultimately more relevant by students when compared to “regular” school projects:

“It’s cool that we’re working with a real company. That makes it more like out in real life, where you won’t just be allowed to be working any game you like, but where you work for someone. It’s cool to get the feeling, that you are actually doing this for someone else”  
(student at GameIT College).

In addition to creating this “sense of importance”, the wishes expressed by the partner serve to focus the project, creating a narrower and more precise aim. Instead of having to start carving out a purpose for the project and defining everything from the bottom, much is given with the customer’s specification requirement.

We have worked with a number of museums and other tourist organizations, who generally ask for “increased awareness” and “involvement” among their (potential) target groups. Those organizations are typically primarily applying relatively traditional communication channels, but are eager to explore the potential of games. This push resonates with the conviction, that good games are able to promote a stronger sense of engagement and involvement than, say, printed material or static websites.

This choice of partners has mostly been a pragmatic one, and we strongly encourage a creative approach to this part of the process. Possible partners could be everything from



Fig.1 Assigning tasks and planning process.

museums, libraries, and amusement parks to all kinds of private companies. In more general terms, we are inspired by many different initiatives, which aim to break down the longstanding walls between the classroom and surrounding society. One example is the English project “Creative Partnerships”:

### Brief students

When the initial setup with the external partner(s) is in place, it is time to brief the

students. This is a very important component, as it points the students in a specific direction. The clearer the brief, the better groundwork is laid for the remainder of the project.

Just developing any one game is a very imprecise assignment, which is likely to cause more confusion than actual development. When adding a number of constraints and demands to the brief, the task becomes much more focused.

Which challenge(s) has the partner identified, and what is required of the students' games? Which platforms are to be used, how is the target group defined and what are the success criteria?

This initial session also serves to establish a good relationship between the partner and the students, and it is a good idea to facilitate discussion, either with all the students or in teams, clearing up some of the immediate questions and possible misunderstandings.

### **Plan the process**

Immediately after having received the brief, students begin planning the entire process in accordance with demands, milestones and deadlines provided. To create the needed overview, some kind of activity plan should be developed, explicitly illustrating how the separate phases are covered and how to respect the different milestones and final deadlines.

The importance of project management and planning is often mentioned as one of the keys to successful game development, as professional developer Derek Paxton argues: "Good project management definitely makes the difference between a game that doesn't hit all of its marks and the one that does" (<http://www.rockpapershotgun.com/2011/06/01/spell-it-out-stardock-on-fallen-enchantress/#more-60875>)

Another part of this phase includes the assignment of specific tasks to each of the individual team members, i.e. who is doing what throughout the course of the project. By describing and assigning areas of special responsibility, we attempt to ensure a feeling of ownership over those particular areas. At the same time we encourage the teams to actively share and discuss their individual work, so every team member is fully aware of not only their own progress, but also the overall progress of the project.

Planning a large project is difficult, and more often than not it is necessary to continually revise the plans. This is not considered a problem, but rather the inevitable consequence of working with agile software development. Not everything can be predicted, and thus the ability to adapt oneself and the product under development to a changed set of circumstances is pivotal - in any kind of project.

Whereas students in many “regular” school projects may have a hard time grasping why planning is actually very relevant and meaningful, most teams in game development projects reach upon similar conclusions about the importance of planning: “Next time we will pay more attention to the planning, so we will not suddenly be surprised about how little time we have left”.

### **Understand target audience**

Different people have different preferences in many aspects of life, and no matter whether you are developing physical products, communication campaigns or digital services - including games - it is considered important to understand your target audience or end user.

Many game developers have a more or less exact picture in their heads about is going to play the finished game. Some have an actual persona manifesting the ideal player, while others target specific segments based on, for example, age groups, gender and a number of additional demographics.

One point of critique which often surfaces is leveled at game designers who tend to develop for a mirror image of themselves. We often meet this logic with students, who would initially prefer to develop games based (solely) on their own preferences. We find it relevant to challenge this approach, and illuminate how it is possible to understand and develop for target audiences dissimilar from oneself.

Target audience is 10-18 years of age. The museum would really like to attract more young people to visit, as they find it to be a big problem, that youth today no next to nothing about the history of Djursland. Young people are not really interest in the stories about Djursland and they find them neither exciting nor entertaining. In addition, this target audience is used to today's technology, playing small flash-games on the internet, using Facebook, Messenger etc. We therefore assume, that they would be curious about trying a computer game and also experiencing history through the game.

In these projects, however, the target group is in most cases defined by the external partner along with the initial brief. This leaves the students with a more or less well defined group, which they should investigate further. Several methods exist, which are relatively simple and accessible, and students can work with online surveys, focus groups,

interviews, observation and available third-party research. In one particular project with Djurslands Museum, students experienced the requested target audience this way:

## Ideas



Fig.2 "The english invasion" game from students at GameIT College

Many students believe themselves to be immensely creative and good at coming up with solid and original ideas. This is, more often than not, not exactly the case. Opposed to the somewhat romantic notion of imaginative inventors and their "heureka-moments", ideas very rarely just appear out of the blue. On the contrary, most great ideas are the result of a prolonged process of brainstorming, revising, discussing, refining and so on.

We always try to promote this latter approach to ideas, and we encourage students to stay on their ideas for longer periods of time before finally selecting. When an idea is chosen as superior in regard to the customer's brief, students initiate an iterative process applying different techniques (brainstorm, association, problem trees etc.).

The following is an example of how a team came up with an idea, and then iteratively elaborated upon this to refine the overall concept of the game:

"We started out with just security cameras to avoid. Then we discussed, if we should have a guard to walk around, and how he should walk? Should he turn slowly or just turn around? The idea with both the guard and then laser traps was to slow down the player, or else he would just rush through the level. The laser traps, which are invisible until you get very close, makes the players paranoid and forces them to sneak

When generating ideas, we strive to help students focus on the customer's brief in order to secure the optimal alignment between the final idea and these requirements (target audience, specific problems, platforms etc.).

### Consider business models

If we go back a decade or so, most approaches to making money on video games were pretty similar, and was limited to getting your game to the market either yourself or with the help of a publisher, and revenue was generated by retail sales of a game in a box. Today, the picture is much less clear and equivocal, as we see a wide array of different approaches to making money on video games:

- Physical retail sales (sales from super markets, electronic stores, regular game shops etc.)
- Digital retail sales (sales from digital distribution platforms like Steam, Direct2Drive etc.)
- Subscription based (games financed by paid subscriptions, often on a monthly basis).
- Advertisement based (games financed by advertising, in-game, on websites etc.)
- Freemium/Free-to-play (initially free games, yet with the more or less mandatory opportunity of buying virtual goods & additional services)

Whether working with developing games or any other product or service, it is recommendable to further the understanding of a business perspective, and how possible revenue could be generated.

This part may not always be entirely relevant if working with a customer, as they would in many cases not want to make money directly on the game, but rather on collateral effects such as increased awareness or solving specific problems.

### Create a pitch

When the groups have finally settled on and refined their idea, they should be allowed to deliver an initial pitch to the customer. This is an attempt to avoid misunderstandings and undesired detours, but also, and perhaps primarily, to maintain the good relationship between the students and the partner(s), who are ideally going to meet several times throughout the project and collaborate relatively extensively.

We use the concept of "elevator pitch", whereby the teams are to describe the "unique selling points" of their idea, and provide the customer with an early insight about the nature of the game.

As an important result of this, students start practicing their communicational skills and their ability to clearly and precisely describe an idea or a concept in a convincing manner.

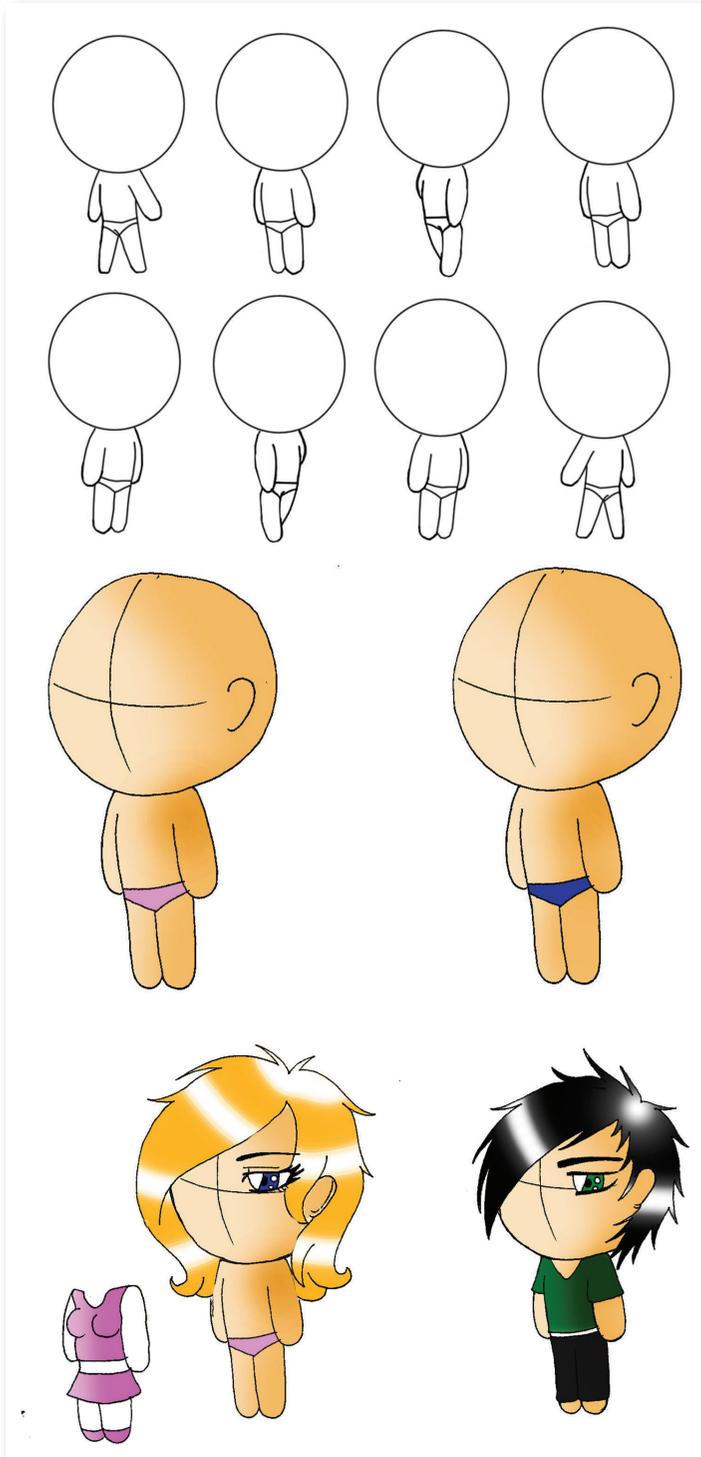


Fig.3 "Creative development."  
Credit: GameIT College

## Design document

After delivering the initial pitch, students start working on much more elaborate description and visualization of the game; the game design document. A game design document (GDD) is traditionally considered a pivotal element in the game development process. In short, the GDD is the document outlining the major design principles of the game to align the development team towards the same goal, or as veteran game designer Brenda Brathwaite explains:

“While there is no set way to write a design document, all design docs have one thing in common - they tell a programmer or an artist everything they need to know to create your game” (Brathwaite, 2008).

Despite some recent critique of long and overly comprehensive design documents (see (Cook, 2011) and (Kelly, 2011)) the practice of using GDD's remain a widespread one.



Fig.4 Cado by Clearcutgames. Sold for 099\$ on Apples App Store.

- In projects like these, GDD's serve a twofold purpose.
- First off, GGD's are used as game developers do; to create a common vision for the team, and move towards a common goal, ideally steering clear of internal misunderstandings and arguments.
- Secondly, GDD's, being a concrete document, function as one of the obvious ways to document and assess the work of the students as required in most educational projects.



Fig.5 ClearCut Games developing Cado (credits: ClearCut Games)

### Develop the game

If developing a full-fledged game is considered a high priority, this phase quickly becomes very comprehensive. It is very important to adjust the expectations and ambitions of your students, so the challenges remain at the outer edge of their "regime of competence" without becoming impossible (as described in the introductory chapter). Many students are eager to build games similar to those they themselves play, but in most cases such an endeavor would inevitably lead to



Fig.6 Screenshot from Cado

To maintain a high degree of authenticity and proximity to the actual game development business, we apply professional tools throughout the development process. At the moment, this means creating assets with Photoshop and 3D Studio Max, which are all implemented and turned into an actual game using the Unity3D game engine.

The collaboration in the teams often lead to a certain degree of specialization, where students assign each other tasks according to their particular interests, thus respecting and promoting the strengths of the individual.

We have maintained a somewhat close connection with the teams throughout the process, providing technical assistance and creative sparring when needed. In addition, we find it important to keep the external partner closely tied to the project, and, if possible, to facilitate meetings between the partner(s) and the teams one or more times during actual development.

Info box: Alternatives: depending on the level and students' technical skills, it may be appropriate to adjust the level of ambitiousness regarding the tools deployed.

### Sell the product

Now, ideally the game is all done, and it is time to convince the customer of the virtues of the game. The last period of time before deadline is almost certain to have been a stressed and busy one, and (not unlike real-life game development) many groups are



Fig. 7 - Game developers at GameIT College “selling” their game to the customer, Djurslands Museum (credits: Haakon Rønnow Petersen)

probably not as far as they had hoped for. Even so, the deadline is reached, and the teams must attempt to “sell” their game to the customer (the external partner). As with all parts of this process, we try to turn this into something more than “just” another presentation or exam. All too often when students are tasked with doing presentations in school, they are relatively disinterested, and lack impetus to invest real effort in it. This, in most cases, strange radically when they are presented with a much more authentic and meaningful situation, where there is actually something at stake: “Usually, I am not nervous before an exam, but when it is like this, where we actually need to sell something, to convince someone to pick us. This gives me a completely different feeling that we have to succeed in this. When compared to the usual exam, this is a sales situation and completely different.”

If there is no external partner involved, the act of selling - or at least promoting - the games developed can be carried out in a different manner. Think about, for instance, designing a marketing campaign for the game across different media.

### **Post mortem**

In the world of game developers, the post mortem is a very popular way of looking back and reflecting upon finished projects (i.e. games). This is clearly seen when browsing the popular game site Gamasutra (<http://www.gamasutra.com/features/postmortem/>), or the largest conference for game developers, Game Developers Conference (<http://www.gdcvault.com/free/gdc-11>).

The post mortem serves the purpose of facing ones failures or less successful results, but in a positive and forward looking manner. By explicitly identifying and describing core components of the process, it becomes easier to improve upon the  
Post mortems can be done in numerous ways, yet some pointers exist (see <http://www.gdmag.com/postmort.htm>).

When used in education, good post mortems resonate with our desire to evaluate and reflect upon the process, but in a way more closely resembling the way “real” professionals work.

### **Perspectives**

It is clear to us that this particular approach to game based learning is a terribly valuable one, but also one which we have not yet fully explored. Rather, we feel like we have mostly just scratched the surface. We see a need for more elaborate studies and a wider array on concrete projects to build much more solid empirical experience. In a society increasingly interested in innovation and entrepreneurship, allowing students

to go through the entire pipeline from initial brief to sale, evolution and reflection is absolutely one feasible way to satisfy this interest.

What is also worth noting, and becoming increasingly clear to us, is that this way of working shares many characteristics with good games and, more specifically, what David Williamson Shaffer labels epistemic games (Shaffer, 2006):

“Epistemic games are games that let players learn to work and, thus, to think as innovative professionals. Epistemic games are games that let students develop the epistemic frames of innovation. Epistemic games are fun, but they are fun because they are about innovation and mastery of complex domains. Epistemic games are about knowledge, but they are about knowledge in action—about making knowledge, applying knowledge, and sharing knowledge. Epistemic games are rigorous, motivating, and complex because that’s what characterizes the practices of innovation



Fig.8 David Williamson Shaffer, Epistemic

Inspired by the work of Shaffer and others, we aim to further explore the possibilities of designing game design courses even more along the lines of the learning space created by good games.



# Chapter six



## The Medication Game Digital Game Based Medication Calculation – Development and Design

Author:

Petter Mordt<sup>1</sup>,  
Karsten Tillerli<sup>1</sup>,  
Atle Løkken<sup>1</sup>  
& Brynjar Foss<sup>2</sup>

<sup>1</sup>NettOp, Department of E-learning Development,

<sup>2</sup>Department of Health Studies,  
University of Stavanger

## 1.0 Introduction

Medication-related activities are everyday tasks for nurses, and involve a complex combination of skill and judgement, including; medication administration, medication safety as well as medication and mathematical calculations (Sulosaari et al., 2011). Medication errors are frequent, and may be the most common type of medical error (Barker et al., 2002; Sulosaari et al., 2011). The risk of a patient experiencing a medication related error and related adverse events seem to be significant (Sulosaari et al., 2011). Obviously, medication errors can have significant consequences for hospitalization, duration of stay, additional sickness as well as decreased patient satisfaction (see (Sulosaari et al., 2011) and references therein).

Medication comes in a variety of forms and it is crucial for nurses to be able to precisely calculate and convert dosages, and often under pressure to respond quickly. Although medication calculation and numeracy skills are only one of several steps in medication-related activities, it is an essential one with potentially critical outcomes for patients (Brown, 2002). It seem to be common that educational establishments experience high failure rates on the medication calculation exam, which is a major cause for concern for the students, the education providers and the health services alike. This appears to be a global issue in the nursing education sector, suggesting that perhaps traditional methods of teaching are not adequate or do not translate well for this aspect of nursing training. A supplementary learning strategy that is increasingly being considered in higher education is digital game based learning (DGBL). The core property of a game is learning. The player needs to learn the game to achieve its goal. Learning can however only be achieved if the player finds the game engaging. If not, the player will be bored and quit playing. Raph Koster, Chief Creative Officer for Sony Online Entertainment, explains this as "the theory of fun" for games: "Fun from games arises out of mastery. It arises out of comprehension. It is the act of solving puzzles that makes games fun" (Koster, 2005). It is therefore reasonable to explore DGBL regarding learning resources for medication calculation to increase comprehension and success rate on the exam. Therefore, to improve the students' mathematical skills relevant for medication calculation, but also to improve students self confidence and enjoyment of learning, we are developing a digital game based solution on the subject, 'The Medication Game'.

## 2.0 Pedagogical background

Medication errors include a wide array of sub-categories including time of medication, omissions, misreading, misunderstanding, concentration and dose miscalculations (Barker et al., 2002; Benner et al., 2002; Deans, 2005). Via first hand experiences as well as experience based on national meetings and international literature, it seems evident that the numeracy skills of nursing students and nurses are relatively poor (Brown, 2002; Jukes and Gilchrist, 2006; Oldridge et al., 2004), and different teaching strategies have been used to try to improve the nursing students' numeracy skills for medication calculation (Allen and Pappas, 1999; Johnson and Johnson, 2002; Rice and Bell, 2005; Wright, 2009a, b). Interestingly, repeated mathematical drilling has shown to improve nursing student ability to solve drug dosage calculations (Adams and Duffield, 1991). Thus, for health care professionals (including nurses) to be able to handle and administer medication correctly and safely, mathematical skills are critical (Jukes and Gilchrist, 2006; Oldridge et al., 2004). This is further underlined in the Norwegian curriculum for nurse education, set by the Ministry of Education and Research, emphasizing that the nursing students must pass their exam in medication calculation "without errors".

Among various learning strategies, digital game based learning (DGBL) has over the past decade clearly introduced itself as a supplement to more traditional didactic methods. This is among various subjects also seen in health education, and in addition to increasing knowledge, games also enhance enjoyment during learning and may improve long-term retention of information (Blakely et al., 2009). Various studies have characterized the effects of mathematical games, both when it comes to increasing motivation and enjoyment, but also regarding learning. Even though there seems to be overall support for the idea that games can improve learning, this is not unambiguous (Kim and Chang, 2010). Still, games seem to have a great educational potential, most likely as a supplement to other learning strategies, to improve numerical and mathematical skills. Firstly, game playing has been shown to be more effective than drills in promoting mathematical performance, and interestingly, cooperative game playing seem to be even more effective (Ke and Grabowski, 2007). Secondly, both electronic learning environments and computer based mathematical drill games seem to positively affect student attitudes towards mathematics (Ke, 2008; Lopez-Morteo and López, 2007).

All together, based on the challenges of poor numerical skills of nursing students, the importance of nurses to master mathematics in medication calculation as well as the great potential of games as supplemental strategy for learning basic mathematics, we are developing a game that has three main goals, to drill; i) basic mathematics, ii) medical units and iii) simple medication calculation.

### **3.0 Game design**

Game design always starts with a basic idea, and one that often is a modification of an existing concept (Bates, 2004). In addition to a good idea - one must also take a standpoint about a range of fundamental elements, which will become deciding factors for how the finished product will be, and thus influencing the ultimate success of the end result. This applies to any game, regardless of if it is a large scale online role playing game or a simple browser game.

One of the most important deciding factors one must consider is target audience (Rollings and Adams, 2003). It is important to realize that it is nearly impossible to make a game that absolutely everyone will like, therefore as a developer, one must identify who the game is being made for and thereafter make appropriate decisions considering the needs and wants of this target group. Other important design and strategy considerations include challenges and rewards - which will be inherent to the concept of the game. Without these elements, the probability of the player losing interest and abandoning playing the game is much higher (Koster, 2005). These are some of the main focus points for our design and strategy considerations under the development of 'The Medication Game'.

### **3.1 The game platform/software**

The front-end of the game is being developed in Adobe® Flash Professional® and run in Adobe® Flash Player® as a browser based application, rather than standalone software. For the back-end a Microsoft® server in correlation with Tomcat® and Sun Java® is being used. Since this game is to be used in the Norwegian education sector and also store data connected to students, we are implementing an electronic identity authentication in the game (FEIDE).

### **3.2 The Target Audience**

The target audience for the game is baccalaureate nursing students. The majority of these students are female. According to the Entertainment Software Association (Essential facts about the computer and game industry, 2011) this group consists of individuals who are not typically game players (i.e. people who play computer games frequently or whom are gaming enthusiasts). In addition, negative attitudes to computers and computer anxiety is seen among these students (Glaister, 2007). In contrast to games produced exclusively for their entertainment value, the nursing students are not going to be playing 'The Medication Game' necessarily because they want to entertain themselves, but because they want to learn or drill something. The background and motivation is therefore quite different to that of the entertainment industry. With these factors in mind a game that is not; time consuming, do not need

special preparation and need no instructions or background reading for the player, i.e. typical disadvantageous factors of gaming (Blakely et al., 2009), would be beneficial. In this way, players should be encouraged to open it up and play it anytime they have a spare moment, or between other activities, and thus any possible irritation about initializing play would be minimized.

Another area which is important in all gaming experiences and which can greatly affect the user impression is the graphic design. Our aim is to keep the design of the game as clear and intuitive as possible (figure 1).

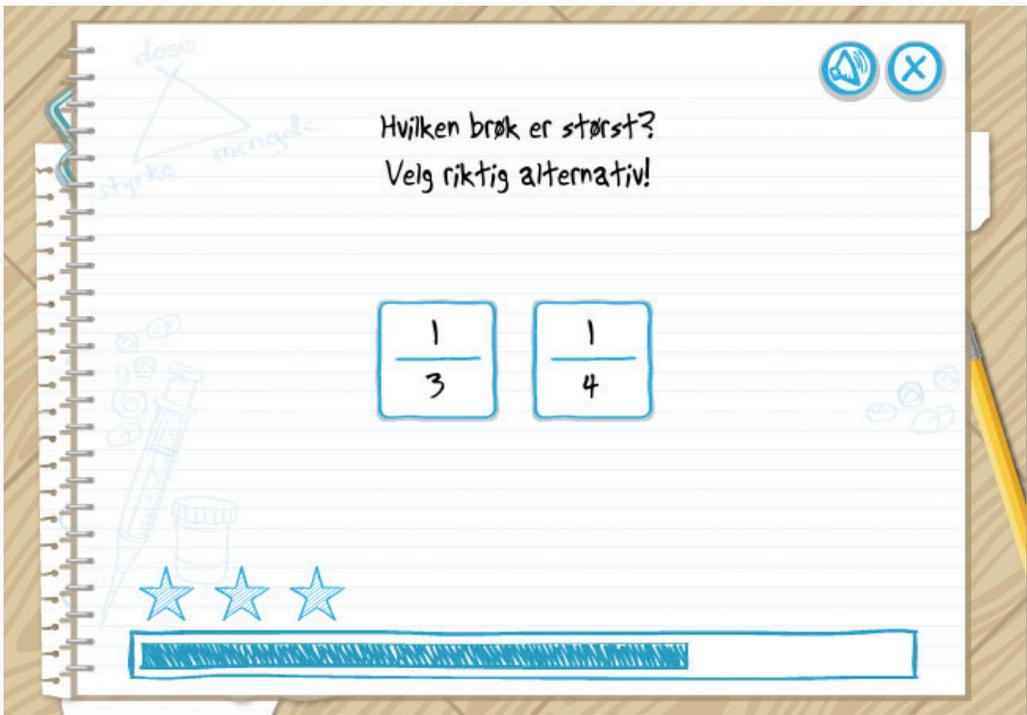


Figure 1: Graphic design. ("Hvilken brøk er størst? Velg riktig alternativ!" - Which fraction is bigger? Make your choice!)

The game should be easy to understand, even for players who have not played a computer game before. This resonates also in the construction of each task or puzzle in the game, where almost all assignments can be completed with just one simple click of the mouse.

### 3.3 The Concept of the Game

The concept of the game is to make a concise and simple game that nursing students can use as training or drilling tool in the subject area of medication calculation. The

game is not intended for teaching the curriculum directly, but rather to train students in fundamental mathematics and drug calculations. We found there was already a similar concept in existence, in the game Big Brain Academy®, developed by Nintendo® for the Nintendo DS™ in 2006, in which players can hone their cognitive skills in different areas of expertise, including mathematics, memory and logic. We took inspiration from the basic structure of this existing example, since it is already tried and tested and apparently successful in its aims.



Figure 2: Game structure. ("Treningsoppgaver" - Training exercises, "Test deg selv" - Test yourself, "Eksamensoppgaver" - Exam questions)

The structure of our game is divided into three parts; a training section, a test yourself section, and a section of exam questions (figure 2).

In the training section the players become acquainted with different types of tasks, and also have the opportunity to train specifically on areas they might find particularly difficult. In the self testing section however, the student receives two random tasks each drawn from of a total of three categories, receiving a collective point score upon completion. This makes it easy for the students to measure their progress, and compare results with other students. Students can test themselves as often as they want, however,

only the highest score from each day is being saved. Thus, progression achieved within a very limited length of time is not necessarily representative of the player's actual improvement in the subject, compared with progression over a longer time frame. The total amounts of tasks represented in this test are chosen as a direct result of the observations made regarding the target audience (see chapter 3.2). We don't want the test to take too much time, so this section comprises no more than six tasks.

The last part of the game, the exam questions, is conceived to give students examples of previous exam questions so that they gain some understanding of a real exam. These questions are not interactive so that the players do not focus too much on this section, which would undermined the whole point of the game, which is to train on mastering the basics first, before applying this knowledge to problems as might be represented in an exam (Wright, 2005).



Figure 3: Task categories. ("Tallforståelse" – Numeracy, "Omregning" – Conversion, "Anvendt legemiddelregning" - Practical medication calculation)

### 3.4 The Tasks

The tasks in the game are divided into three categories (figure 3).

These three categories are again split into under categories, so that the players can

easily identify their weak points within each different type of problem. The first category, numeracy, trains the player in basic mathematics. The second category, conversion, deals with conversion between different units. The final category aims to guide the player from basic numeracy and mathematics towards more practical medication calculation. This way of organizing the game is in accordance with an effective teaching strategy in medication calculation consisting of a three stage approach to the subject, being; mathematical concepts, drug calculation and practicing these in a clinical setting (Wright, 2005). The part of the game described here thus deals with at least the first two approaches described in this study.

At least two types of tasks for each different problem area are constructed; a mathematical and an artistic depiction. According to the multiple intelligence theory all individuals possess numerous mental representations and intellectual languages, but differ in the forms of these representations (Veenema and Gardner, 1996). We therefore use different approaches to the tasks that appeal to different learning styles, hence varying the way tasks are presented in the game.

Each task is technically built in the same way, whereby the players have 60 seconds to answer as many problems as they can manage, with a score awarded afterwards. In other words, there is no maximum limit to total points a player can score, apart from the physical limitation on how fast one can click. To ensure that the players do not guess their way to a high score by randomly clicking answers, minus points are awarded for wrong answers, and total points deducted for a minus score is greater than the points awarded for a right answer.

The tasks are constructed so that answers can be generated by the game itself, in such a way that numbers, units and order of possible combinations are randomized. This gives the game a greater re-playability which is crucial for a training and drill tool. The player thus receives new challenges by being presented with new problems, even though the problems themselves are built up in the same way each time.

### **3.5 The Time Factor**

By giving a relative short time limit to solve each task, i.e. 60 seconds, the challenge of the game increase. Challenge is one important part of game play and can make or break a game (Rollings and Adams, 2003). In addition, a short time limit forces the player to make intuitive decisions of what a right answer might be. This point has been named as a weakness for students in previous exams. Students fail to answer correctly at times when they instantly should have recognized that the option they were presented with was wrong. Students also experience stress under a normal exam and the time limitation may act as an element of added pressure to prepare the students for the

exam. Furthermore, stressful events, e.g. high workload, are possibly one of the most important human factors that causes medical errors (Deans, 2005), thus it is imperative that students also train to handle stressful events.

After testing the prototype game on students, it became clear that for some students the time pressure disrupted the experience, not necessarily for the sake of the game but for the sake of their own learning. Therefore players are given a choice between playing with the one minute time limit, or without. When the players activate the game without time limitation, they can use as much or as little time they want to complete as many tasks as they choose. However, in the self test section, the time limit is always fixed to 60 seconds.

### 3.6 Sound

Sound effects are connected to each task to provide player feedback, most of all when a player answers a problem. In addition, to help set a certain mood, music for the different components to the game are included; such as the introduction, menu and the tasks themselves. In the latter, a motif that heightened the tension by increasing in speed is used, thus underlining the element of pressure in that part of the game. At the same time the music is designed not to catch too much attention in order avoid being overly distracting or irritating. Never the less we placed a sound button in the game for the players to choose whether or not they want the music on or off. The feedback from the students about this is divided. Some like to have the sound on, others don't. The most important point is that they have the possibility to choose.

### 3.7 Reward

Rewards are one of the most fundamental aspects of game playing (Salen and Zimmerman, 2004). Achieving, winning or gaining something one didn't have before is what makes the game fun to play and worth spending time on. A game developer must be aware of which types of reward to be used and at what time it is appropriate. In 'The Medication Game' the basic reward is a point score, awarded at the end of each training task or self test assignment. The score does not tell more than just how many points the player has attained, and there is no way of knowing whether the score is good or bad since the player has no reference. Therefore a visualization of the scores to give the students an idea how they perform is included in the game. In the training tasks we use stars, whereby zero stars is the worst, and seven stars the best score a player can achieve (figure 4 - next page).

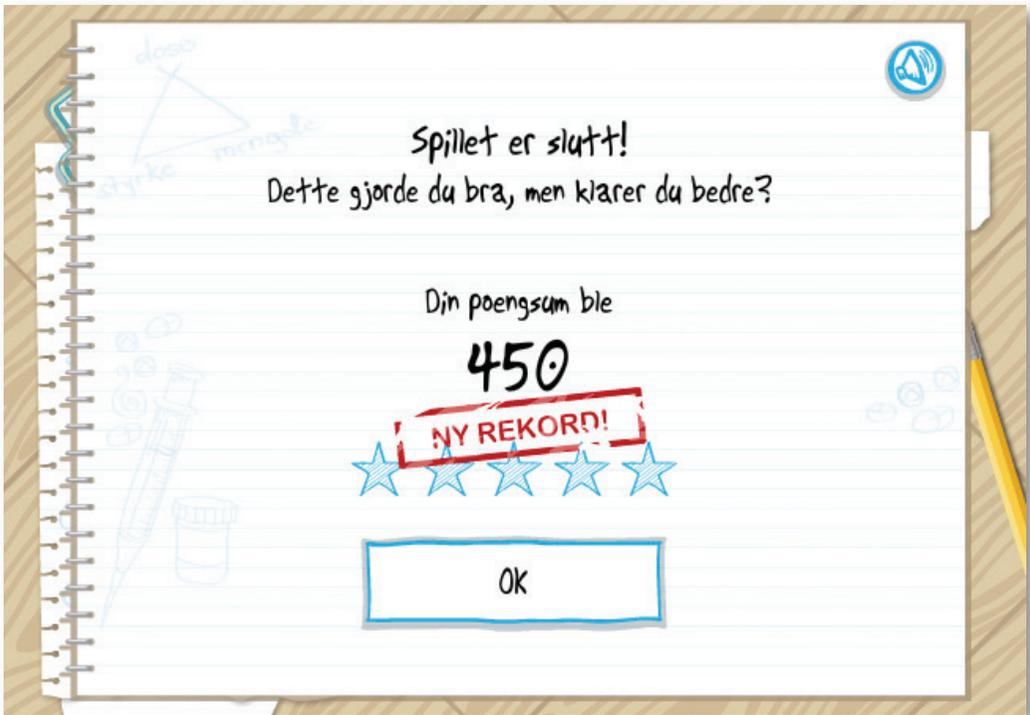


Figure 4: Game rewards. ("Spillet er slutt! Dette gjorde du bra, men klarer du bedre?" – Game over! You did well, but can you do even better?, "Din poengsum ble 450" – Your total score was 450, "Ny rekord" – New personal record!)

The stars also appear during the game playing, so that students can see how they are doing as they play. In the test yourself section, however, the end score is shown in a more attractive graph where each category is represented, so students can see how they perform for each different type of task, i.e. numeracy, conversion and practical medication calculation (figure 5, next page).

The advantages of using score is that it is easily comparable - both in regards to individual learning and how each players perform compared to the others. In the training tasks, the player's highest score is saved, so that the player has an incentive to play again and perhaps improve their score. In the self test section of the game, all scoring data are recorded so that the player's progressions are logged on a graph giving a representation of their progress over time.

The element of competition is an important part of game playing, but can be a double edged sword. On the one hand, for many people, competition can be experienced as a motivating and including factor. On the other hand, some individuals with already low confidence may experience competition as threatening (Blakely et al., 2009) and thus



Figure 5: Score graph. ("Ditt beste resultat hittil er 1523 poeng!" – Your best score so far is 1523 points!, "Bra" – Good, "Veldig bra" – Very good, "Tallforståelse" – Numeracy, "Anvendt legemiddelregning" – Practical medication calculation, "Omregning" – Conversion, "Start ny test" – Take a new test, "Resultater" – Results)

detrimental to their desire to play further, and perhaps mean that they dare not even try to take part for fear that they will come out worse off than others. Considering this dichotomy, the scores from the training sections can therefore not be seen or compared with the other players. On the other hand, the results from the self test section are logged, by nick names only, directly into a high score rank along with other players scores. This rank can be viewed by all players, however, only the top 50 scores are revealed of all players, so as not to be demoralizing for players with lower scores.

#### 4.0 Organisation and process

During our developmental phases of the game we have attained experience valuable for our further and continuing development of this and possibly other games and, in addition, experience that might be valuable for others as well. In this section we focus primarily on organisational challenges faced during development of the game playing methodology.

#### 4.1. Project Background & Organisation

Based on the pedagogical background (chapter 2.0) with a focus on game play methodology, we are developing 'The Medication Game' in two phases. In phase one (as described in chapter 3.0) we specifically address medication calculation related tasks. In our continuing and second phase of development, we include medication management tasks as well. As we write, only the first phase of the game is finished.

NettOp, the department for e-learning development at the University of Stavanger (UiS), is responsible for project management, technical development and graphic design and illustration. NettOp is a resource centre for the development of digital learning materials, which has a wide range of expertise including; technical development (programming), film, graphic design and illustration, pedagogic design and project management.

In our game development, the project group comprises e-learning specialists from NettOp (UiS) as well as participants from Department of Health Studies (UiS) and Department of Health and Nursing Sciences at the University of Agder (UiA). In addition to this core group, certain phases of the project require additional help from academics from the two involved universities.

The disciplines of medication calculation and management include elements of both science (mathematics) and nursing. Generally in Norwegian nursing education, lecturers in this subject are experienced nurses, however, doctors and biologists (as at UiS) also

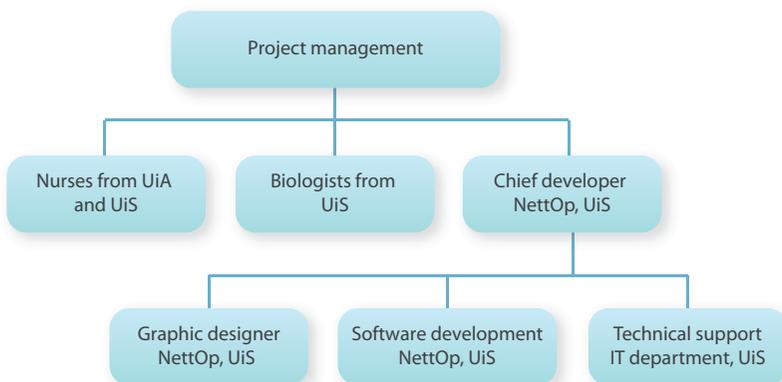


Figure 6: Project organization.

teach medication calculation. Both nursing specialists and other lecturers are invaluable when it comes to developing a game in medication calculation and management. Thus, both of these specialist groups are included in the project group, which comprise (figure 6):

- Two nurses from UiA and two from UiS.
- Two biologists from UiS.
- Four members of NettOp: two programmers, one graphic designer and a project manager.

## 4.2 Challenges

Despite the resounding agreement of all group members that it is high time to explore new angles of didactic approach for this subject matter, it cannot be denied that the idea to develop a digital game based solution was first introduced by developers at NettOp. Taking into account the notion of what a game is (or can be) varied in the beginning greatly among the project group members, each approaching the task differently. Interestingly, it seemed to be the nursing specialists who initially had to step out of their 'comfort zone' due to low or lack of experience with DGBL methods and probably because they had to leave most of the didactic development in the hands of technical personnel. This created some tension in the early phase of the project. However, the enthusiasm and commitment in making something new that potentially can improve exam results was great. Various didactic approaches have been tested to improve the worldwide problem of high failure rates in medication calculation (Allen and Pappas, 1999; Johnson and Johnson, 2002; Rice and Bell, 2005). Such techniques include more classroom teaching hours on the subject, one-to-one follow up and more organized group work and study groups, for example. Our approach is to try something completely different, and the interest for this approach among both the national and international nursing community is evident. Both the need and the desire for an alternative learning method seem apparent.

One example that demonstrates the difference in understanding the concept of a game was the discussion surrounding the name of the game. The nursing specialists were occupied with the idea that the name should resonate academically. At least this was the consensus among the nurses at the time. One of the realists in the group suggested the name 'PilleSpillet' (directly translated 'the pill game', in English 'The Medication Game'), which was supported by both the developers and the project manager. The nursing specialists saw the name misleading since the game is not just about pills, but all kinds of medication. Other project participants were more concerned that the name of the game should be 'catchy', and something that students could easily relate to. 'PilleSpillet' was therefore kept as the title of the game.

The fact that there is a variable knowledge about gaming across the group makes it challenging to establish a common ground of terminology and understanding of the challenges in the developmental work. This revealed itself when we, for example, not always got concrete answers to specific questions posed to the nursing specialists in the group. Similarly, some of the tasks that the nursing specialists were to perform (for example writing text for the different assignments and test questions within the game) bore signs that there were misunderstandings about the project 'brief' and the premise of the game. Perhaps these misunderstandings could be due to a lack of clear guidance and explanation about what was required, or maybe that we did not ensure that all members of the group had full comprehension of e-learning related terminology. However, we found that the simplest way to solve these problems was to sketch out visual examples of the game with functioning programmed demo elements. It was much easier for the project group as a whole to then be able to discuss and follow developments, and to see a relation between what they had been asked to deliver in plain text and what the end result would be. This was calming a lot of preliminary concerns, enlightening participants and enabling them to feel like they could really get a grasp of the scope of the project and its possibilities. It gave all members of the group a new perspective on both medication calculation and the principles of DGBL aids.

### 4.3 Experiences

Upon reflection, it is important that early on in the development phase teams allow adequate time for discussion (and perhaps hold workshops) about how games function, to explore the notion of what games can be. This should be seen within a pedagogical and didactical context, to encourage comprehension of the mechanics of the concept, and how it can function as an academic tool. Allocating sufficient time to explore what games are and looking at existing examples is a wise idea, as well as discussing game related terminology. The aim should be to assure common knowledge regarding DGBL.

Our project is based on the expertise of the project organisation, and their colleagues at UiS and UiA. Although subject matter specialists hold first hand information on the nursing students' problem areas regarding medication calculation, it seems wise to consult mathematicians with educational research competence to assure the quality of the mathematical and pedagogical aspects of the game.

The students are not invited to participate directly in the development of the game. However, they gave input through questionnaires before the development started, during pretest and after the first version of the game were finished. Although several inputs from students through these questionnaires is implemented in later versions of the game,

it might be sensible to include students in the whole evolution of the game development - in the development group.

Creating a game in an educational context can be challenging. To succeed, it is imperative that the lecturer is able to precisely express the didactic challenges of the subject matter, and trust the implementation to the game designers and technical developers. This trust correspondingly implies a responsibility in the hands of the technical developers not only to understand the subject matter, but in fact also to empathize with the lecturer. In this respect, the success of the game development equally relies on the lecturer's ability to relinquish control and the developers' capacity for empathy - two human factors that may not be obvious for the development of a digital game.

## 5.0 Summary

Medication-related activities involve various medication competence areas including medication calculation. However, numeracy skills of nursing students seem to be relatively poor worldwide, and different methods have been developed to increase the nurse student numeracy skills for medication calculation. Among various learning strategies DGBL can be a supplement to more traditional didactic methods. 'The Medication Game' aims to drill basic mathematics, medical units and simple medication calculation with the goal to improve students' mathematical skills, learning motivation as well as confidence.

'The Medication Game' is being developed using Adobe® Flash Professional® and run in Adobe® Flash Player® as a browser based application. The design of the game is created in a simple, clear and intuitive fashion to attract all students including those with less or no game experience. The structure of the game is divided into three parts; a training section, a test yourself section, and a section about exam questions. The training section is further dealt into three categories; numeracy, conversions and simple practical medication calculation. Due to these categories and under categories, the players can easily identify problem areas of particular interests or needs. Game sound, time and rewards are used to increase the excitement of the game and competition feeling. In addition, the rewards and score log also gives the students an overview of learning outcomes and progress.

The game is developed in collaboration between different institutions. Due to be a highly heterogenic group of persons, with different game and pedagogical experience, one of the challenges during game development was the common understanding of what the

game should become. Therefore it is important to have trust in the game developers to create the best possible medication game, based on the input from the medication professionals.

In our next phase - phase two - of the development of this game, we will expand the game to also include medication management. This part of the game will drill students' medication administration procedures with the ultimate goal to improve a range of aspects in students' medication management skills. The game's beta version is expected to be finished in the autumn of 2011, with final completion estimated in spring 2012.

### **Acknowledgement**

'The Medication Game' project is financially supported by the Norway Opening Universities ([www.nuv.no](http://www.nuv.no)). The translation by Joanne Therese Kleppe is highly appreciated.

## 6.0 References

- Adams, A., and Duffield, C. (1991). The value of drills in developing and maintaining numeracy skills in an undergraduate nursing programme. *Nurse Education Today* 11, 213-219.
- Allen, S., and Pappas, A. (1999). Enhancing math competency of baccalaureate students. *Journal of professional nursing : official journal of the American Association of Colleges of Nursing* 15, 123-129.
- Barker, K.N., Flynn, E.A., Pepper, G.A., Bates, D.W., and Mikeal, R.L. (2002). Medication Errors Observed in 36 Health Care Facilities. *Archives of Internal Medicine* 162, 1897-1903.
- Bates, B. (2004). *Game Design*, 2 edn (Boston, MA, Thomson Course Technology).
- Benner, P., Sheets, V., Uris, P., Malloch, K., Schwed, K., and Jamison, D. (2002). Individual, practise, and system causes of errors in nursing. *Journal of Nursing Administration* 32, 509-523.
- Blakely, G., Skirton, H., Cooper, S., Allum, P., and Nelmes, P. (2009). Educational gaming in the health sciences: systematic review. *Journal of Advanced Nursing* 65, 259-269.
- Brown, D.L. (2002). Does 1 + 1 Still Equal 2?: A Study of the Mathematic Competencies of Associate Degree Nursing Students. *Nurse Educator* 27, 132-135.
- Deans, C. (2005). Medication errors and professional practice of registered nurses. *Collegian: Journal of the royal college of nursing Australia* 12, 29-33.
- Glaister, K. (2007). The presence of mathematics and computer anxiety in nursing students and their effects on medication dosage calculations. *Nurse Education Today* 27, 341-347
- Johnson, S.A.P.R.N., and Johnson, L.J.P. (2002). The 4 Cs: A Model for Teaching Dosage Calculation. *Nurse Educator* March/April 27, 79-83.
- Jukes, L., and Gilchrist, M. (2006). Concerns about numeracy skills of nursing students. *Nurse Education in Practice* 6, 192-198.
- Ke, F. (2008). A case study of computer gaming for math: Engaged learning from gameplay? *Computers & Education* 51, 1609-1620.

Ke, F., and Grabowski, B. (2007). Gameplaying for maths learning: cooperative or not? *British Journal of Educational Technology* 38, 249-259.

Kim, S., and Chang, M. (2010). Computer games for the math achievement of diverse students. *Educational Technology & Society* 13, 224-232

Koster, R. (2005). *A theory of fun for game design* (Scottsdale, AZ, Paraglyph Press).

Lopez-Morteo, G., and López, G. (2007). Computer support for learning mathematics: A learning environment based on recreational learning objects. *Computers & Education* 48, 618-641.

Oldridge, G.J., Gray, K.M., McDermott, L.M., and Kirkpatrick, C.M.J. (2004). Pilot study to determine the ability of health-care professionals to undertake drug dose calculations. *Internal Medicine Journal* 34, 316-319.

Rice, J.N., and Bell, M.L. (2005). Using Dimensional Analysis to Improve Drug Dosage Calculation Ability. *Journal of Nursing Education* 44, 315.

Rollings, A., and Adams, E. (2003). *On Game Design* (Indianapolis, IN, New Riders Publishing).

Salen, K., and Zimmerman, E. (2004). *Rules of Play: Game Design Fundamentals* (Cambridge, MA, Massachusetts Institute of Technology Press).

Sulosaari, V., Suhonen, R., and Leino-Kilpi, H. (2011). An integrative review of the literature on registered nurses' medication competence. *Journal of Clinical Nursing* 20, 464-478

Veenema, S., and Gardner, H. (1996). Multimedia and multiple intelligences. *The American Prospect* November 1, 69-75.

Wright, K. (2005). An exploration into the most effective way to teach drug calculation skills to nursing students. *Nurse Education Today* 25, 430-436.

Wright, K. (2009a). Resources to help solve drug calculation problems. *British Journal of Nursing* 18, 878-883.

Wright, K. (2009b). Supporting the development of calculating skills in nurses. *British Journal of Nursing* 18, 399-402.





# Future perspectives

Author: Mathias Poulsen  
Play Consulting  
GameIT College

## Future perspectives

We have been very pleased to further explore the field of game based learning throughout this project, and we hope to contribute to moving the field forward, if only by the slightest. When looking back at the project in its entirety, we are convinced, that we have uncovered the ground we set out to do, doing experiments in practice and gathering these together to form the foundation of a game based learning pedagogy. Even so, much work remains ahead of us before we can realistically hope for game based learning to become common everyday practice among educators alongside more familiar media. As long as this is the case, we are eager to explore feasible approaches in future projects.

By the time of writing, we have identified four areas of particular interest, which we will focus on in the time to come:

- Supplementary teacher training
- Game literacy
- Dedicated learning games
- Education as a game

In the following, we will elaborate a bit more on these four dimensions, yet we ought also underline, that not only are they deeply interrelated, but also depending on other important areas, which would be outside the scope of this short discussion.

### Supplementary teacher training

Whereas game based learning is often preoccupied with the learning of students, we are very keen to maintain the teacher as pivotal to any real educational change. As an immediate consequence, we must be willing to re-examine and challenge the ways in which we support the necessary, constant development of teachers. It is becoming increasingly clear to us, that just as traditional classroom instructional teaching must be challenged and supplemented by other, more interactive forms, so do we need to revise the supplementary training practice. Just offering a seminar or short course simply isn't sufficient and clearly not enough to fundamentally change anything. Despite the divergence in target audience, it seems almost paradoxical to maintain the old ways of teaching teachers when teaching about new ways of teaching students. How can we provide a better framework for supporting teachers in their ongoing need to learn and develop?

### Game literacy

As described in the introductory chapter, game based learning is considered one of two possible approaches to including games in education. The other component, game

literacy, is no less important, however, and should actually be thought of as a prerequisite of game based learning. If games are to be considered interesting and valuable in a learning perspective, it should be precisely because they are games. This again presupposes a more intimate understanding of games, because how could we possibly harness the learning potential of games, if we do not understand the nature of games?

### **Dedicated learning games**

As we have shown, dedicated learning games are no easy fix and many challenges are facing this particular approach to game based learning. While the genre may seem like a low-barrier entry to the field of game based learning due to the relevant content of dedicated learning games, it can still prove quite a challenge to find games with relevant content, which are actually also good games. Oftentimes, learning games are more closely related to text books or quizzes than to the popular commercial titles played by millions and millions across the world. These so-called "games" are far from harnessing the full potential of game based learning, and thus more and better learning games are obviously needed. We would love to work with both identifying the core elements of good games as a foundation for good learning games (which should first and foremost be good games), just as we are eager to work with actual development.

### **Education as a game**

Using the somewhat clunky term "gamification", a large number of game developers, advertisers, researchers and educators have been recently discussing the potential of applying game elements in services or contexts, which are not traditionally considered games. Whereas a disproportionate part of the initial attempts at "gamifying" have centered on merely adding points and achievements to existing services, we sincerely believe that there is more to learn from games than just applying these extrinsic motivators. It is the basic premise of game based learning, that games build on characteristics, which make them facilitate learning more effectively than most conventional teaching. The question is - can we "extract" those characteristics and build an educational framework along the same principles as games? Can we make education more oriented towards solving concrete, meaningful problems that are at the edge of students' regime of competence, allowing a relative autonomy in choice of tools and approaches and encouraging creative collaboration?





# THE GAMEiT HANDBOOK

## A framework of game based learning pedagogy

Throughout history games have been an integral part of human culture, and many different types of games have been played for both leisure and more serious purposes, such as practicing management strategies or learning relevant skills and competences.

In more recent times, digital games have effectively permeated most areas of popular culture and society in general. Digital games are no longer confined to arcades or the darkened rooms of teenage boys, but have successfully broken new ground, forcing us to keep revising what games are - and can be.

Throughout the book, we make an effort to clearly illustrate how games or elements of games can be included in educational practice, and to what end.

The GAMEiT handbook is one of the outcomes of an EU-project with the following Mission Statement: "We aim to identify, collect, test, and distribute good practice in game based learning (GBL). Our project will result in a framework of game based learning pedagogy."

Project Website: <http://www.projectgameit.eu>

Project Partners: CV2 (Denmark), ZAXIS (Denmark), NADE (Norway), University of Stavanger (Norway), University of Bournemouth (UK), University of Applied Sciences Koblenz (Germany)

