ENTRExplorer Project

Theory and Taxonomies of Serious Games

Document description	
Document name	Theory and Taxonomies of Serious Games
Abstract	This document informs shortly about the history of "learning with games", deals with "digital games", tries to deliver a definition of "serious games" and explores pedagogical concepts as well as the taxonomies of online games.
Document Identifier	Result 1
Version	0.2
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Creation Date	30/04/2011
Version Date	30/12/2011
Status	Final version
Destination	Consortium
WP number	2
Related Documents	Report on the development of multiplayer online serious games

History		
Version	**List of changes, Author(s) / Reviewers**	**Date**
0.1	First draft publication, STVG	30/04/2011
0.2	Final Version	30/12/2011

1.   Content

2.   Aim of the paper

The main objective of the project ENTRExplorer is to build a serious game for immersive entrepreneurs. The used platform will be browser based, for the possibility of very broad use on different devices (personal computers, notebooks, netbooks, smartphones ...) as well as on different operating systems.

The target group of the serious game ENTRExplorer will be people which are standing at the start of a career as an entrepreneur or are interested in founding and building up a business company, especially young people from 15 to 25. Furthermore the player out of the target group should be motivated to deal with topics around "entrepreneurship".

This paper will inform shortly about the history of "learning with games", will deal with "digital games", tries to deliver a definition of "serious games" and will explore pedagogical concepts as well as the taxonomies of online games to establish the basis of decision-making for the consortium.

We will find out, what types of games are the most important and successful games. What makes that games successful and make them that interesting. Furthermore you will find a set of relevant questions which are important to deal with in order to develop a "really good and useful serious game". There are many learning games on the market, of different quality, too many to deliver an overview over all of them, but just a few of these games are really serious and will be mentioned in this paper.

To find out the paper will build the taxonomy of online games concerning the targets of ENTRExplorer and will explore some of the existing games on the market with comparable target groups, content and aims.

December 2011

3.   Introduction[1]

Computer games are currently often used in different serious applications and especially in the terms of vocational education and training. The teaching community discovers in them new opportunities for reaching groups which are difficult to attract and to motivate for learning. Apart from that game based learning supports the personalized trainings and gives new instruments for teaching basic key competences. In the recent years this approach gains popularity in the corporate training sessions.

The governments of different EU countries, as well as the United States government are conducting a policy supporting the inclusion of game based learning and exploring the effectiveness of this approach into practice since several years. In those researches are involved universities as Massachusetts Institute of Technology, Pennsylvania State University, Carnegie Mellon, University of Southern California, Stanford University; IT University of Copenhagen; University of Birmingham etc.

In the recent years in terms of globalization and constant development of new technologies and approaches the serious game based learning finds its application in all partners countries of this project – Portugal, United Kingdom, Bulgaria in Austria, as well as in the European Union as a whole, but also almost all over the world. The expansion of that approach can be found not only in its application in different corporate or informal learning initiatives, but also in the adoption of different policies on international and national level aimed at integrating the serious game based learning approach in formal – as well as informal – education.

Despite the wider application of the game based learning approach it still meets some resistance. Some of the opponents support the idea that the effectiveness of the method can hardly be evaluated. They also think that their inclusion in corporate and formal training programmes requires a lot of resources connected not only with the provision of sufficient amount of funding, but also with recruitment of teachers and trainers possessing necessary knowledge and skills.

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[1] The introduction is based on the article of Ivanova Malinka, "Game based learning – new opportunities for the teaching community", published in CIO Magazine, issue 9, 2007, available online at http://cio.bg/1618_obuchenie_bazirano_na_igri_novi_vazmozhnosti_za_prepodavatelskata_obshtnost_2_komentara (last seen 16.08.2011)

However some of the arguments in favour of the application of serious game based learning approach are:

- Enhancing the productivity – with the correct application the game based learning method can rapidly increase the knowledge and skills of the learners (students or employees);

- Enhancing the level of appreciation of the learners' role – serious games help the learner to understand the effect from his behaviour in a concrete situation and the consequences from decisions taken by him;

- Testing competencies – serious game based learning can be a powerful tool for testing different knowledge and skills. Through the provision of real scenario the behaviour of the learners can be tested and analyzed in different real working situations. This feature of the serious game based learning approach is the key element for its inclusion in the training programmes for some of the highly risked professions in the country like in the military field or in the field of health care provision. This feature is also significant for the inclusion of serious games in the formal learning, as a tool preparing the students for their realization in a real working environment.

- Evaluation – games collect significant amount of information classified under different criteria – qualitative or quantitative – while the learners are playing. This can be used for the preparation of detailed reports for their evaluation.

- Recruitment and selection of employees – serious games can be used for testing the knowledge and skills of the potential employees through assessing the way they implement different roles or react in situations typical for the relevant position. The instrument can also be used during the initial training of the newly recruited employees.

- Training for partners and users – the game based learning approach can be used for enhancing the partners'/ users' understanding for a certain product or service.

- Best practice exchange – in the game scenario can be included virtual experts or mentors to guide the learners with advices and expertise in different situations.

Combined with other tools and services for e-learning serious games can provide the learners with a lot of choosing opportunities. They are part of the frame which not only

presents unique opportunities for specified trainings, but also gives potential for supporting the social interaction between the trainer and the learner, between the employee and the employer. As the gaming software can provide the learners with enriching educational experience in informal educational context, the integration of effective game based learning solutions in the context of formal education gives interesting challenges to the game developers, pedagogues, teachers and employers. In the context of effective, coordinated and relevant usage of the serious game based learning method it broadens the learning opportunities of the learners and the options for personalization of the learning experience. In addition this approach offers ways for integrating different learning tools (for example social software) in more understandable type of training (from the learners' perspective).

4. Types of Games

4.1. Genres of Computer-Games

There are different possibilities to distinguish computer games, one of them is to divide them up into[2]

- Casual games (are developed purely as entertainment activity , and thus the learning outcome is not intentionally foreseen)

- Advertising games (are identified as tools designed and delivered as promotion and marketing of products, services, new coming movie or TV series)

- Serious games (are especially designed to improve some learning aspects and players expect the learning process)

Another possibility to distinct computer games is[3]

- Action games (emphasis on physical challenges)

- Strategy games (emphasis on strategic, tactical and logistical challenges)

- Role-playing games (exploration, tactical and logistical challenges)

- Real world simulations (e.g. vehicle, sports, physical and tactical challenges)

- Construction and management games (economic and conceptual challenges)

- Adventure games (exploration and puzzle-solving)

- Puzzle games (logic and conceptual challenges, almost exclusively)

Furthermore it is possible to divide games from the point of view of:

- Concerning the idea (action games, adventure games, fighting games, puzzles, role-playing, simulations, sport games, strategy games...)

- Concerning the players (individual or multiplayer)

- Concerning development objective (mainstream or commercial entertainment games, commercial educational games, and research based educational games).

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[2] Susi et al, 2007.

[3] Claro, 2007.

There will be no detailed explanation of each type of game in this paper, however, all of these types can be useful when thinking about serious-games, and it just depends on the goals of the game and the target group. Some of the mentioned games are now looked at in detail, because of their complexity and relevance when thinking about serious-games.

4.2. Learning games

Learning games rises especially since computers and internet makes a lot of interesting and exciting games possible. They are in use in any devices and in any environment. Not only because of intentional learning. Another point is the possibility to motivate user to handle with topics, which are boring for them, if they had to learn that content in a traditional way or with traditional media.

So learning games is an offer for any ages and topics. Very young users learn to count and spell words, to act with a computer mouse and so on. On primary school level a lot of learning games help the user to learn more about maths, grammar and so on.

Examples:

- Edmo & Houdini:
  http://www.riverdeep.net/language_arts/edmark_lang_arts/EdmoHoudini/Edmo Houdini.html

- The grammar gorillas: http://www.funbrain.com/grammar/index.html

The aim of using a game is to foster interest and motivate the target group to handle with the topic of the learning game. The game is only the means of transportation for the pedagogical content in the game. So the concept of the game - the idea behind the game has to be adjusted to the target group. The tasks for the users, the graphics and animation and so on, have to be adjusted to the target group. The content is exchangeable.

A very helpful way to bring the appropriate target group to deal with special topics and to learn more about the content boxed in the learning game.

4.3. Role play games

Role plays gives the user the possibility to act as another person in a familiar or in a non familiar situation. The role play is mostly used without computers. Psychologists'

use it for instance with family constellations. In business seminars role plays are used to teach the user how to negotiate in proceedings. Sociologist use role plays for their research. Counsellors train their handling with their future clients with role plays and a lot more applications for role plays are in use. Sometimes role plays are used as a group dynamics tool, for instance as an icebreaker in seminars, conferences and so on.

But in any case the most important thing within all the role plays is the reaction of the acting users in the role play. So role plays are normally not designed and programmed for the use with computers.

Role playing games at the other hand are normally used to have fun or to foster creativity[4]. They are very often at the same level as party games – like charade[5] – and mostly the users only want to know more about the other users.

Role play games on Computers or video game consoles bring new possibilities to play those games and brought a lot of new ones. But all of them clearly try to entertain; none of them pretend to be a role play with a pedagogical aim or content. Using an avatar in a game to give the player a more personalized feeling not makes a role play (game) but is used in a lot of genres. If a real role play is programmed for computers, normally the computer program takes the part of the other users, so it is a simulation or a simulation game.

4.4. Simulation and strategy games

A simulation is a (reduced) copy of a part of realty. Simulations are used in different areas of business, education and research with various aims. In the field of different engineering tasks simulations help to reduce costs or risks. They allow making forecasts, to test the behaviour of technical equipment in case of accidents, fire and so on and much more[6].

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[4] MÜNTER, F.: Rollenspiele (RPG) als Methode zum Erwerb sozialer Kompetenzen in der Sozialen Arbeit, p 10.

[5] http://de.wikipedia.org/wiki/Scharade#Pantomimespiel

[6] ENGELHARDT-NOWITZKI, C./NOWITZKI, O./KRENN, B.: Praktische Anwendung der Simulation im Materialflussmanagement: Erfolgsfaktoren und Implementierungsszenarien, p 36 ff.

In the educational fields simulation allows us to act in a (sometimes reduced) and in a secure environment. The beginning of the use of simulations to learn was – as a lot of other things – in the area of military. After the Second World War the business education see the possibilities of simulation games and transferred them to train managers and politicians[7].

First the possibility to try different scenarios and bundles of decisions was the big advantage of simulations. The simulations were programmed to be as near as possible (the limitation was very often caused by the capacity of the computers) at the reality. To use the "battlefield" without risk of real losses and/or unemployment was the big benefit.

In a next step the possibility of reducing the complexity of the realty (primarily necessary because of limits of computer capacity) was seen as a further advantage in training and education. To reduce the complexity brings the possibility to use simulations in different level of education. The reduction of the costs of hard- and software and the scalability of the complexity of simulations lead to a use of simulations with target groups of different level, age and pedagogical aims.

Today not only in the field of business education simulations are used. To teach and show various target groups the behaviour and reaction of very different systems a lot of simulations were designed and programmed. Some of them at a very low level of showing the reality, others (because of increasing of the technical possibilities) at a very high level of complexity and very near at the reality.

At what level of complexity a simulation shall be realized for the usage in the education depends – amongst others - on the aims and the educational level where the simulation will be used. In any case the setting of a simulation has to consider limits of maintainable effort and gain able benefits, as to be seen in the following graphics[8].

To increase the complexity of a simulation it is necessary to increase the input in kind of resources, whereupon from a special point on the input rises a lot faster than the achieved complexness. At the other hand the benefit of using the simulation reduces from a special point on very fast. The needed time for preparation and to use the simulation rises up while the more of pedagogical output reduces.

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[7] CAPAUL, R./ULRICH, M.: Planspiele: Simulationsspiele für Unterricht und Training.

[8] BLOG: Planspiele im Einsatz für Bildung und Wirtschaft, http://planspiele.stvg.at/blog.nsf

The quality of a simulation model not necessarily corresponds with the complexity of the model. To reduce the complexity of a simulated system in a simulation game for the reason to make it more explainable raises the risk of oversimplification, but it is not automatically wrong.

In the same way a higher complexity of a simulation model do not make automatically a higher quality of the simulation or make it in any case to a better copy of reality.

So there are a lot of particularly complex correlations in a simulation games like SimCity[9]. Comparing it with fashionable online simulation games like FarmVille[10], Kapi-Regnum[11] and so on, the complexity and the plausibility of the model of SimCity looks much higher. But are any of these simulation games near the reality they try to copy?

One possibility to test this is to test if an expertise in the field of this simulation games will help to achieve a better result. So the question is, if a farmer will be better in FarmVille than a student, who plays the game the first time or if an urban planner is better in SimCity then the same student?

After playing one of that simulation games more often, any player will learn more about the model and the system behind. The quality of a model and the seriousness of the system copying the reality are to see, if it is possible to increase the results of a player by learning more about the subject of the simulation game outside of the game in the reality[12].

Even if in a simulation only one aspect of a complex system should be followed to teach that special aspect, the possibility to learn more about this single subject independently from the simulation game from any other sources to that topic must be met.

4.5. "Non-learning" games

By definition a "non-learning" game is not possible. With any playing learning in all different types happens. But the question is, what the users are learning and what do we want to teach them. The psychologist sees implicit learning mostly for that kind of

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[9] http://de.wikipedia.org/wiki/SimCity

[10] http://www.farmville.com/

[11] http://www.kapi-regnum.com

[12] BLOG: Planspiele im Einsatz für Bildung und Wirtschaft, http://planspiele.stvg.at/blog.nsf

learning we need to learn to ride a bicycle or to swim. So we have to make a difference between cognitive learning and the very acquirement of physical skills.

Learning is acquiring new or modifying existing knowledge, behaviours, skills, values, or preferences and may involve synthesizing different types of information[13].

The definition shows, that really any playing is learning. With any game the users will get new knowledge or train their skills. The result of the learning process will decrease during the increase of experience and knowledge. A learning-curve (or training- curve) shows in this context the relationship of the duration or the degree of effort invested in learning and experience with the resulting progress, considered as an exploratory discovery process[14].

The more we play, the less we learn. To learn more we have to increase the duration or the effort for the same result or we have to change the game. What we learn remains unaffected. If we train skills we have to face the same training-curve as we have the learning-curve, when we do a cognitive learning.

A lot of games seem to response to both, cognitive and physical learning, but the result does not corresponding to the definition of learning. E.g. the very old game "Pong" from 1972 and the famous "Pac-Man" from 1980.

Picture 1: Pong from 1972 (Wikipedia)
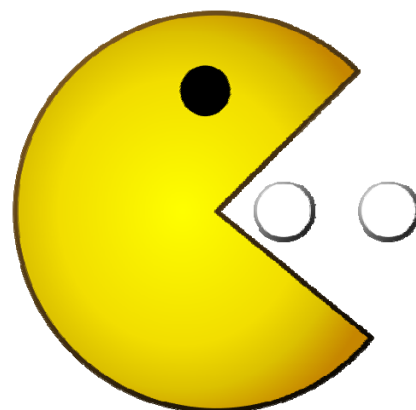
Picture 2: Pac-Man from 1980 (Wikipedia)

In both games it is necessary to train physical skills to become faster and more exact with your movement of the cursor (a symbolized racket at the one side, a smile at the other side) at the screen. But there is also to learn tactics to anticipate the movement of

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[13] http://en.wikipedia.org/wiki/Learning

[14] Heinrich, M./Greiner U Schauen, was 'rauskommt: Kompetenzförderung, Evaluation und Systemsteuerung im Bildungswesen, p 372 f.

the symbolized ball or the way the evil spirits will take. It was also an advantage to remember the recurrent way of the spirits. To notice and to remember and to use the information in your tactics are also things that are learned by playing. More of that is needed in the next generation of games: Jump' n' Run games.

One of the first and best known games of that genre is e.g. "Super Mario". More levels and more different scenarios pushes the users to learn more and to train the same skills but in different way. It is not necessary to change the game until you are not in the highest level.

The number of games offered at the market since Pong and Pac-Man rose enormously. But not only new games entered the market, a lot of new game genres are coming up during the last centuries. And a lot of that games and genres are used - in very different ways - also with pedagogical aims. Learning games are made for a lot of content and target groups.

5. Serious games

5.1. Definition of Serious Games

Serious Games are digital games not primarily or not only to amuse the user, but it is always a concrete aim of that kind of games to amuse. Serious games try to allocate information or education. A serious game tries to offer a balanced possibility for an authentic and amusing learning. Genre, technology, platform and target group are changing. At the end the user decides in his way to use the game what it means to him.[15].

To be effective, this type of games should ensure the four key characteristics of a successful game: challenge, skills exercise, competition and sense of progress (Cruz, 2008). The serious games are designed with the intention of improving specific aspects of learning and their users seek this activity based on these expectations. The serious games are used for training of emergency services, military training, organizational education, medical care and many other sectors of society. They can also be found at all educational levels and in all schools and universities all over the world. The act of playing is an essential ingredient in a serious game, since it is an important contribution to the maturation, learning and human development (Cruz, 2008).

According to Derryberr (2007), serious games are games with a purpose beyond entertainment and deal with issues related to learning, health and politics, among others. To make a good "serious game" is necessary an effective design and a theoretical understanding about learning, knowledge and fun and should be created with the help of experts in educational content (Heeter, 2011).

5.2. Distinction of Serious Games

The classification of Leyland (2006) proposes to distinguish serious games according to their primary market – e.g. military games, government games, educational games, corporate games, healthcare games as well as political, religious and art games.

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[15] Vgl.: http://de.wikipedia.org/wiki/Serious_Games

Serious games are defined a broader view and so a lot of very different solutions for a lot of different appliances existing, here is an exemplary overview[16]:

	Games for Health	Advergames	Games for Training	Games for Education	Games for Science and Research	Production	Games as Work
Government & NGO	Public Health Education & Mass Casualty Response	Political Games	Employee Training	Inform Public	Data collection / Planning	Strategic & Policy Planning	Public Diplomacy Opinion Research
Defense	Rehabilitation & Wellness	Recruitment & Propaganda	Soldier/Support Training	School/House Education	Wargames/planning	War planning & weapons research	Command & Control
Healthcare	Cybertherapy / Exergaming	Public Health Policy & Social Awareness Campaigns	Training Games for Health Professionals	Games for Patient Education and Disease Management	Vizualization & Epidemiology	Biotech manufacturing / design	Public Health Response Planning & Logistics
Marketing & Communication	Advertising Treatment	Advertising marketing with games, product placement	Product Use	Product Information	Opinion Research	Machinima	Opinion Research
Education	Inform about diseases/risks	Social Issue Games	Train teachers / Train workforce skills	Learning	Computer Science & Recruitment	P2P Learning Constructivism Documentary?	Teaching Distance Learning
Corporate	Employee Health Information & Wellness	Customer Education & Awareness	Employee Training	Continuing Education & Certification	Advertising / visualization	Strategic Planning	Command / Control
Industry	Occupational Safety	Sales / Recruitment	Employee Training	Workforce Education	Process Optimization Simulation	Nano / Biotech Design	Command / Control

Table 1: Ben Sawyer, Serious Game Taxonomy

You can find examples for all of these categories, some of them are for public use, others are not. However, the quality differs extremely, depending on point of time when published, depending on use and target group as well as depending on the content to deliver. Some examples – especially for the area of education – can be found in this document.

5.3. Educational Value of Serious Games

It is a known fact that video games are considered to be an exciting and challenging activity that represents a vital part of life for many teens. Neiburger (2007) states that "literacy has evolved beyond the definition of the ability to read and write" and now includes the ability to perfectly interpret a screen with information such as the graphics in a game or the ability to quickly decode certain symbols. The same author adds that

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[16] Ben Sawyer: Digitalmill, Inc. & Serious Games Initiative, Serious Games Taxonomy

"to be effective, the player should be able to quickly decipher the symbolism present in each game, which is equivalent to what readers do when they have to decipher the alphabetic code".

Recognition of serious video games on learning of individuals has increased over time. Ward-Crixell (2007) commented that the educational practices need to recognize and incorporate the participatory culture of today and find different ways of delivering content because nowadays the "new cultural skills include the ability to navigate through different types of media and manage different content in different types of media".

According to Len (2007) "Students of today are different" and outside school students develop numerous tasks through the use of new technologies such as messaging, mobile phones, computers, email, digital music devices and video games. In the same article, the author states that these students, who are deeply attached to technology outside school, are deprived of the same inside the classroom and increasingly express their frustration and dissatisfaction with their school experience. "These students require new learning experiences that should be parallel to the exciting and engaging digital format they use in their daily lives" and the skills displayed by so-called "successful players' leverage them to be more sociable and to develop strategic thinking and the ability leadership (Len, 2007).

Likewise, teachers and teaching practices are also changing as more and more educators today realize that electronic games are part of students' lives and that require skills such as analytical problem solving. In terms of attractiveness, games can convey a different perspective of what students get from a textbook or a trip to a museum (Cliff, 2006). On the other hand, Gee (2005) states that the increasing use of serious games also due to the existence of more young teachers who grew up with this kind of games and who recognize the value of incorporating these interactive resources on student learning.

Properly designed video games have the potential to improve student motivation, enhance educational outcomes and facilitate transfer of learned knowledge to practical application. However, teachers must have a solid understanding of the characteristics that are important in games in order to turn them into a good learning tool. Teachers will continue to work to include innovations in their teaching through games and redesign teaching practices to achieve positive results (Summit on Educational Games, 2006). The same report concludes that the main value of video games has to do with their motivational factor. The motivational factor of the games can have very important

applications in the educational process and the fact that the players are interested in a game makes them continue playing several times, removing the obstacles that are finding and improving their performance during the exercise.

Another reason why the games are considered good teaching tools due to the gradual evolution of their level of difficulty. On the other hand there is the characteristic of "no consequence", which makes the player do not feel bad about failing, unlike what happens in reality where the individual is faced with pressure to perform well the tasks. Gee (2005) explains what he calls the "principle of responsibility" that "ensures that all levels of play, overcome by player skill, only last long enough to be a challenge, but allow the player to be successful." This gives players a feeling of simultaneous pleasure and frustration that makes the motivation for completing the various stages increase.

Carey (2009) reports on his website an online study conducted on University of Berkley by Dr. Silvia Bunge that concludes that some video games help improve thinking and processing skills of children. The results also indicate that some games help children increase their Intelligence Quotient. This study, aimed at understanding the development of intelligence in children, was carried out for several years, in order to understand the factors that allow a better progress of the cognitive ability of individuals. The method of analysis was the selection of games that required specific mental functions such as planning, comparison and logical. Children practiced this activity twice a week for one hour and fifteen minutes and after a few weeks, the author of this research found that children's reasoning players increased by 32% in terms of intelligence quotient, which is equivalent to a considerable gain 13 points on this scale. Previous studies have shown that one year of attendance increases the average IQ of a child 12 points, a result that Bunge and his research team managed to overcome by conducting gaming sessions that totalled only 20 hours.

5.4. The market for serious games

Before analyzing the current market of serious games, it is important to know the history of them. Sawyer, B. (2004) presents a brief summary about the early life of this "educational entertainment": one of the first experiments took place in 1997 and was carried out by the Marines of the United States who used the software "Doom" to train their recruits, also a military context in 2002, the U.S. Army released a free game called "America's Army" in order to improve the military capabilities of its users. The U.S. government and its military forces opted for serious games for two distinct reasons. On

the one hand the costs of training were drastically reduced, since the computer games cost significantly less than a full-scale simulator. On the other hand, the use of this technology has increased the quality of experience for users, such as the games are competitive, fast and with a high degree of entertainment (Sawyer, 2004).

In another study, Sawyer (2004) discusses the characteristics of the market for "serious games" and makes a structured analysis by region. In the United States of America, scholars increasingly recognize the potential of serious games and conferences on this subject began to expand. A successful example is the annual conference "Games for Change" which has promoted the games as a social asset and institutions such as Michigan State University are starting to incorporate this logic in teaching plans to announce the launch of Masters in Design of Serious Games. In Europe, ANGILS - Association for Serious Games, a non profit organization based in the UK, has focused its efforts in promoting the growth of the market for "serious games" and it is now considered one of the few associations in Europe with focus on this activity and the related emerging technologies. The market of the old continent became fully operational in 2007 with the Serious Games Institute based in Coventry, a project with an investment of three million Euros. Regarding Latin America, this type of action is concentrated in Brazil, where a serious game was designed for educational purposes that simulates a business environment, although these market demographic capabilities have not yet been maximized and exploited to one hundred percent. Sawyer (2004) also states that all over the world began to emerge investment funds from foundations, government agencies and private investors, which shows a great incentive for the production and acquisition of such games to improve technical skills and practices who uses them.

Price Waterhouse Coopers annual report shows that the market for video games is one that has a higher global growth. Estimates indicate that in 2011 the games market will move about 49 billion U.S. dollars, with an average growth rate of 9.1% over the next five years. In contrast, it is believed that the average annual growth of all the entertainment economy is "only" 6.4%. These data were calculated taking into account consumer spending on games apart from the physical media and related accessories with them. The engine of growth of these sectors will be online gaming, the new generation consoles and advertising present in the games themselves.

For the serious games sector, the estimates more conservative presented in the report indicate that the industry moves from 200 to 400 million Euros a year. It also mentioned that these numbers tend to increase due to the emergence of several companies that

have committed to the development of such games and is expected that this bet generates in the future about 400 to 600 million additional dollars (Price Waterhouse Coopers, 2010).

6.   A pedagogical framework of game-based learning[17]

6.1. Introduction

From the earliest age on we are learning by playing games. A lot of traditional games which are played by mothers with their children help them to develop different skills. While growing up children play a lot of different games which train their balance, speed, ability as well as to advance their counting, observing, speech comprehension and command of language and a lot more mostly without to be aware about that learning.

In the wide field of learning games very often unconsciously learning (compared to deliberate and intentional learning) is used to teach the users. The way to teach with games and without the user is aware that he is learning is seen as a self-contained method of learning[18]. That pedagogical method targets the subconscious mind of the user and confirms in the game attained knowledge. The user gets ability, a skill and is able to use it or changes his mind because of the attained knowledge, without consciously learning. But it is – by definition, learning:

Learning is an intentional or an incidental […] acquisition of intellectual, physical and social knowledge and skills …[19]

The incidental learning is the second very important way to feed users of games with information and knowledge. In this case the user acts in a game and tries to solve problems formulated by the game or to reach a high score, to find information needed to go ahead in the game and so on. To achieve or fulfil those settings of a game a lot of information or activities around the straight subject of the game are necessary.

By dealing with all the information and activities the user of a game learns more about that information and activities. That incidental learning happens all day for anyone of us. Whenever we are looking for something e.g. in Google we find a lot of "wrong" hits. We had to handle with some of them to find the "right" hit. So we do learn incidental

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[17] The information under that topic is based on the research of Ivanov Ivan, "Interactive learning methods", available at http://www.ivanpivanov.com/uploads/sources/55_Interaktivni-metodi-za-obuchenie.pdf (last seen 17.08.2011)

[18] Cp. Klippel, F.: Spieltheoretische und pädagogische Grundlagen des Lernspieleinsatzes, p 60 ff.

[19] http://de.wikipedia.org/wiki/Lernen

about things, we do not want to or need at that moment. In a lot of games the core content is systematically located in that "hidden" area of a game.

As the third aspect in learning (beside the intentional learning and the incidental learning) there is the implicit learning.

Implicit learning is learning of complex information in an incidental manner, without awareness of what has been learned. It may require a certain minimal amount of attention and may depend on intentional and working memory mechanisms[20].

So we do not only learn what we want to learn, there are – depending on the way of learning – always additional information's and impressions we do handle during the learning process. That makes us learning about that that additional content. So we always learn a lot more, as we "need" to solve a special problem. That is used in many games with the intention to transport information (not only in pronounced learning games) by implemented content, which is incidental learned by the user.

And very often that incidental learned content is also learned implicit, that means the user did not recognize that he learned about that content. At the one hand, that is the goal of different marketing strategies. But it is also an often used and successfully strategy for learning aims. To communicate very complex information it would be necessary to transport a large quantity of information to assure, that the context of the complex information would be understood by the learning person.

With help of targeted implicit learning strategies in different types of games it is possible to achieve a high understanding about complex context of information, without the necessary for the users to learn all the facts and information around the whole topic[21].

The conception of any game with a learning aim has to pay attention all types of learning. To address intentional and incidental opens the way to transport more content to the receptors of the users, without to overload the learning people or to be boring for them.

To address the receptors for implicit learning of the users give them the possibility to understand even very complex context of information and to keep it in mind for a long time.

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[20] http://en.wikipedia.org/wiki/Implicit_learning

[21] Cp. Kriz, W.: Lernziel: Systemkompetenz. Planspiele als Trainingsmethode, p 76 ff.

6.2. Pedagogical framework

The idea about interactive learning methods is not new to the education on global scale. Since David Kolb in his works "The experiential learning model" (1976 – 1984) develops the learning theory as a cyclic process consisting of:

- Concrete experience;
- Observation and reflection;
- Forming abstract concepts;
- Testing in new situations.
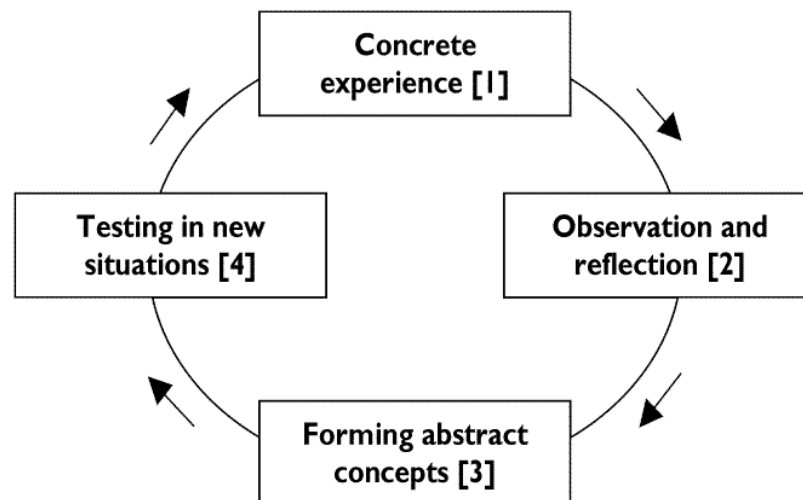
Picture 3: Kolb's Cycle of Learning

Kolb gives fundamental meaning of the experience and its critical analysis. The passing through the different stages of the cycle is leading to new experience, reflection, conceptualization etc. The learning can start at every stage of the cycle, but the experiential approach is dominating.

Robert Gagne categorizes in his "Taxonomy of Learning"[22] learning into five major types of learning capabilities: intellectual skills, cognitive strategies, verbal information, attitude, and motor skills. This model is used to design – based on Kolb's cycle of learning – content in order to get a great and effective learning experience.
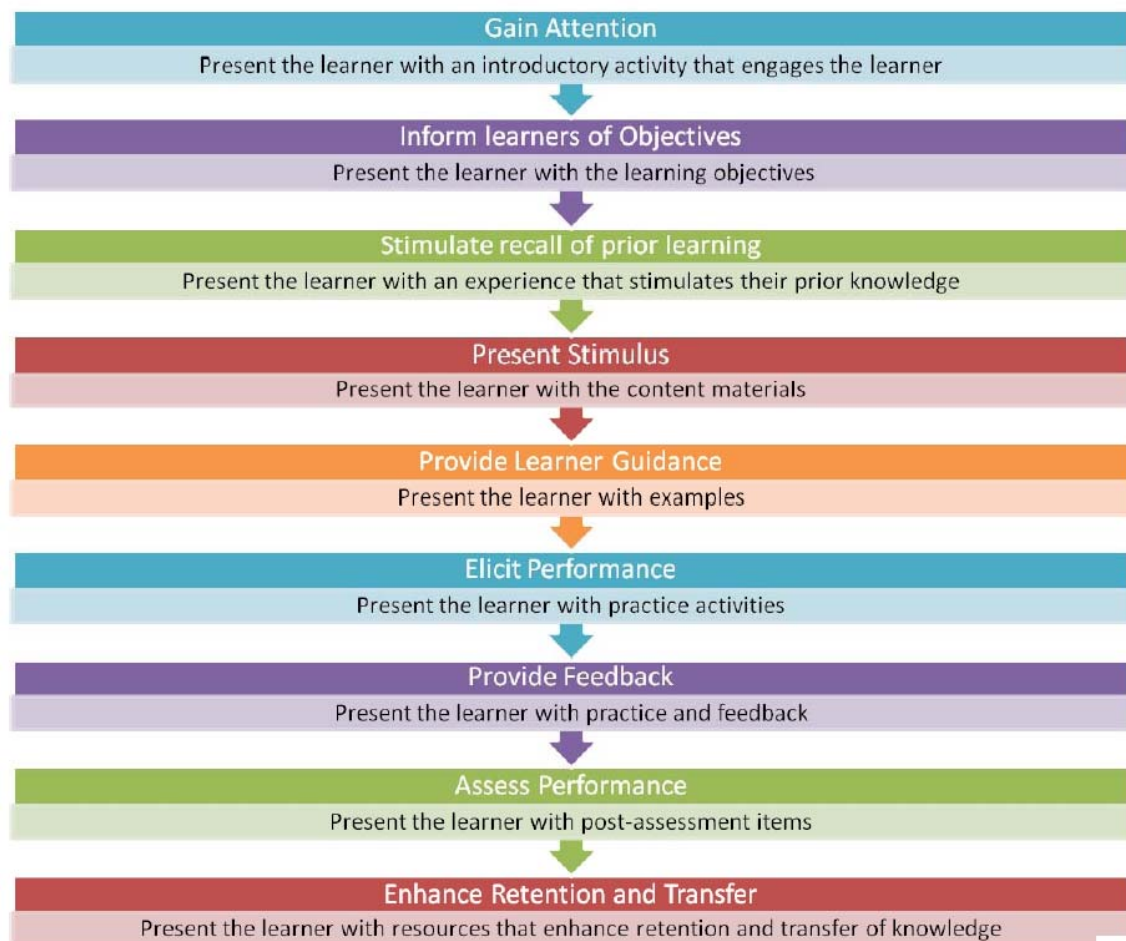
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[22] See http://arcmit01.uncw.edu/erg1602/Glossary.html, last seen on 29.12.2011.
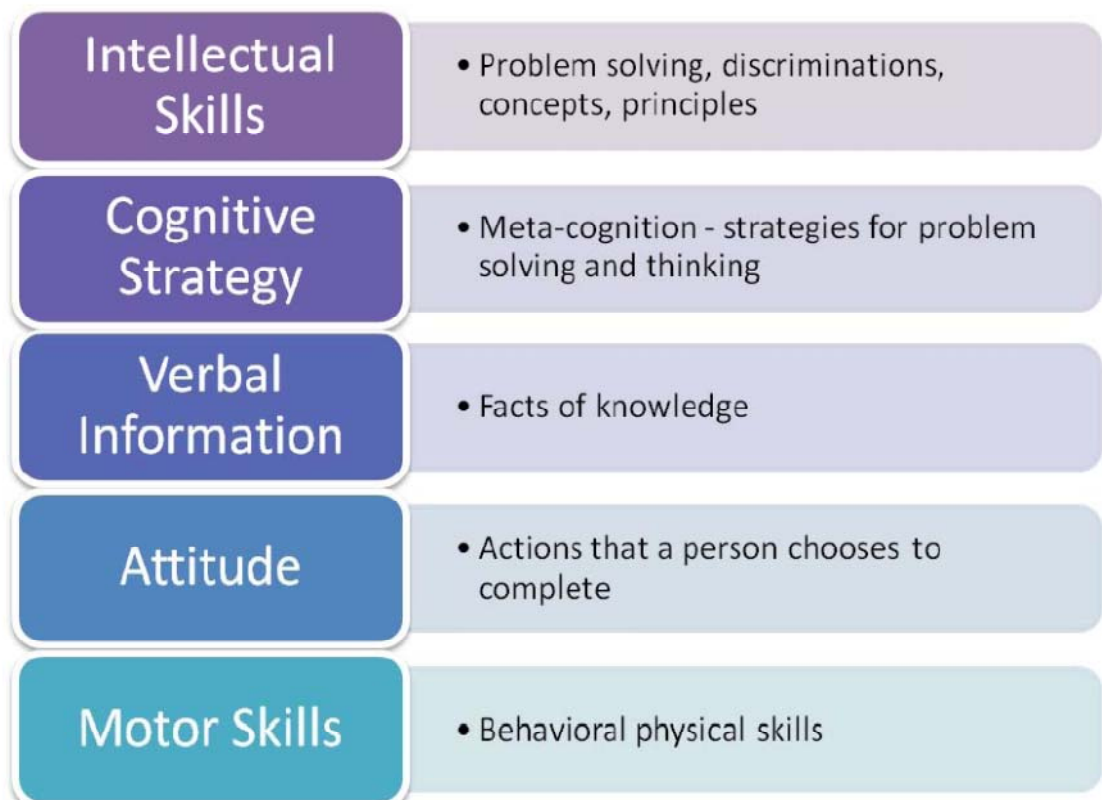
Picture 4: Robert Gagne's Taxonomy of Learning

Furthermore Robert Gagne developed the model Conditions of Learning Theory[23] in order to be able to use the model for designing learning content.

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[23] http://arcmit01.uncw.edu/erg1602/Glossary.html, last seen on 30.12.2011,

Picture 5: Robert Gagne's Conditions of Learning Theory

The didactic theory knows many other theoretical researches based on the necessity of active involvement of the students as a tool for enhancing the level of adoption the information, as shown before.

What is relevant about all those theories and the current research is that all of them are highlighting the need of the student's active participation in the learning process which can be also provided with the involvement of serious games.

Famous are researches which prove that a person can adopt different amount of information for the same amount of time (retention rate):

- when listening – 10%

- when watching – 20%

- both listening and watching – 40 – 50%

- when actively participating – 80 - 90%.

All those theories have been adopted by the professionals in the field of pedagogy and led to the establishment in the scientific circles of the following principles for the organization of learning in interactive regime:

- The training must be based on the experience and the context which make the student willing and ready to learn;

- The training must enable the extrapolation (application in different fields);

- The training must be learner -centred;

- Interactivity – it defines the effectiveness of the learning process and is a fundamental mechanism for adoption of different knowledge and for development of cognitive skills;

- The students must be active in their own learning and to take active participation in the learning process of other students;

- The students must be included in as many research activities as possible;

- The creativity of the students must be awarded. They should be given different options and a variety of interaction models;

- The interactivity requires also interdisciplinary approach;

- The students should be given the opportunity to receive relevant and constructive feedback.

As it can be seen by the examples of the application of serious games in different domains, all those principles can be fully or partly addressed with the inclusion of the game based learning in formal or informal education. That's why among the different interactive learning methods the situational methods are the ones with the biggest perspectives.

Generally the situational methods are used for the imitation of professional or organizational activity for learning purposes. They are developed in the practice of the Jesuit schools in 18 century and after the World War II have been disseminated world widely in the management training programmes developed by the Universities of Harvard and Yale's. They have a significant place in the educational process and are used for illustration, obtaining feedback, forming of knowledge and skills, testing and evaluation.

According to the theory the situational methods can be divided to:

Case studies – a description of a situation which is as close as possible to a real situation. Described are as many facts as possible. Not all of them are necessary for finding a solution and decision taking. The student must learn to differentiate the relevant from the irrelevant information, to analyze the situation and to develop suggestions. There isn't a single right decision, but different alternative options which have different advantages and disadvantages.

Simulations – the participants implement a certain activity in conditions which are as close to the real situation as possible. The method is useful when the implementation of some activities needs practice, but the practice is not possible in a real situation. The method allows the learners to apply the theoretical knowledge they have gained. The simulation can be just part of the activity, but it must be as close to the real situation as possible.

Serious game – a type of simulation which requires active participation and allows the application of the theoretical knowledge gained. It is an imitation of a real activity in an artificial situation. The participants implement different roles or are in the role of active spectators (jury). Its purpose is to form skills and habits for real actions.

The practice in the field shows that the time effectiveness of the serious games is 4 – 5 times higher than the traditional methods. It doesn't bother the participants (as the role play for example) and is found as funny and attractive. Through the moments of entertainment the process of team forming is very easy. Enabled is also the establishment of open atmosphere for mutual attention. The serious games are considered as a suitable method for less communicative students or for students who doesn't know each other. Among the other advantages of the application of serious games for learning defined by the professionals are:

- Enhancing the interest of the students;

- Raising the student's awareness about the roles necessary for the implementation of a certain activity and the relationship between them;

- Developing the student's independence;

- Forming basic social skills;

- Can be used as a tool for knowledge transfer between the students.

When those principles are forewarned is possible the occurrence of errors which are mainly connected with the neglecting of the educational aims of the game.

6.3. Game-Based-Learning – may learning be fun?

Today's learning approach is constructivism. This means, that self-monitoring plays an important role and experiences are included into learning. Furthermore situational elements, the role of the active learner regarding interaction are considered to be important. Next to formal education informal education plays a much more important role. Meanwhile competencies, especially decision-making and responsibility as well as problem-solving, are more important than qualification itself (regarding certificates, educational achievements).

There are some challenges to meet a future-oriented development of competencies:

- Increasing complexity of the demand of competencies cannot be met by "learning on stock" but through more continuity in the development of competencies.

- Continuity means, that learning content must be divided into small sections, more modular, up to incremental to interlock work / school / life with learning.

- The learning goals must be development of skills resp. competencies. Not knowledge is that important, but problem-solving as well as decision-making skills.

- Decision-making competency is linked with a certain context, which means, that the application of knowledge on a concrete situation develops competencies.

- It must be possible for the learner to test / try his knowledge and to experience risks, without putting the risk into effect.

These challenges could be met by digital (serious) games. Important conditions for informal learning are:

- Self-controlled

- Based on experiences

- Situational

- Interactive

and[24]:

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[24] from http://www.marcprensky.com/writing/prensky%20-%20Digital%20Game-Based%20Learning-Ch5.pdf, last seen 30.12.2011

- Games are a form of fun. That gives us enjoyment and pleasure.

- Games are a form of play. That gives us intense and passionate involvement.

- Games have rules. That gives us structure.

- Games have goals. That gives us motivation.

- Games are interactive. That gives us doing.

- Games are adaptive. That gives us flow.

- Games have outcomes and feedback. That gives us learning.

- Games have win states. That gives us ego gratification.

- Games have conflict/competition/challenge/opposition. That gives us adrenaline.

- Games have problem solving. That sparks our creativity.

- Games have interaction. That gives us social groups.

- Games have representation and story. That gives us emotion.

Conclusion: Learning has to be fun! We learn voluntarily because we have fun regarding the topic, the design or the implementation of the game.

7.   Promote learning with serious games

7.1. Pedagogical taxonomies of a serious game

To offer a serious game some variables have to be fixed. Genre, technology, platform and target group are not selected automatically by the decision to make a serious game. To define the "serious taxonomies" of a serious game, it is necessary to cope with several issues and to answer a lot of questions:

- Will the serious game be used in formal and / or informal education (Dissemination!)?

- Who is the target group? Who shall play the game?

- What is the background of the player (age, language, experience, prior knowledge, preferred learning styles etc.)

- What are the learning goals?

  o **Personal skills** (vision, drive & persistence, initiative, commitment, control, risk tolerance, resilience, self determination)

  o **Interpersonal skills** (communication, listening, teamwork, leadership and motivation, conflict resolution, personal relations, negotiation, ethics)

  o **Critical and creative** thinking skills (creative thinking, problem solving, opportunity identification)

  o **Practical Skills** (goal setting, planning and organizing, decision making, knowledge

    - Business knowledge

    - Entrepreneurial knowledge

    - Opportunity-specific knowledge

    - Venture-specific knowledge

- Is there a learning curve – easy to learn at the start and increasing?

- Is there clear progression?

- Is there appropriate feedback?

- Are there opportunities for collaboration and group world?

- Is there assessment and follow-up?

- How does the game content, that is, the factual knowledge, experiences, mechanics and activities, relate to the learning goals?

- How integral is the content to the game content to the game mechanics, processes, experience of playing as well as the art assets or copy, and is its acquisition required in order to progress?

- Will the game engage the learners – is it immersive?

- Will the game engage the learners – is it immersive?

- Does the game have a learning curve (i.e. do the players improve through repeated play), appropriate feedback, clear progression etc.?

- What level of fidelity is appropriate?

- How can the game be embedded and assessed?

- What other practices will support learning, either in the game such as reflection, or externally as discussion?

- What retention rate, i.e. how long will the players remember the learning, will the game have?

"We often falsely assume, that the game itself will be powerful enough to cause change or learning that the outcomes will be used automatically for decision making. This is seldom the case." (Mayer and Bekebrede 2006).

7.2. With serious games to learning success

Apprentices improve their decision-making competency. Sales-people test their skills in sales-conversations, potential managers take the role as an international project manager, and potential entrepreneurs learn which challenges they will face and which competencies they will need to overcome them.

The potential of serious games is great. Digital computer games with a pedagogical additional value could be used in almost all learning contexts. Target group are single persons as well as groups of people, depending on the learning goals. Through serious games it is possible to reach high motivation of the learners, which could not be met by other training measures. Serious Games enable self-controlled, active and playfully learning.

- Free choice of learning place

- Flexible time-management

- Choice of learning time

- Choice of learning speed

- Autonomous learning in the game context

- Self-controlled learning

Science and pedagogical praxis have stated that virtual (digital) games are a useful method of learning. Responsible therefore are some characteristics which are somehow special. The learner acts active and self-determined, the learner is responsible for his results and controls the process autonomous.

A virtual setting of learning – as serious games – implies an unbiased, self-explorative learning attitude. It is important to identify, to understand and to apply knowledge, skills, opinions, qualifications and competencies. Through this kind of learning it is possible to strengthen qualities like autonomy, flexibility, self-confidence, sense of responsibility, problem-solving, systemic-thinking or willingness for cooperation.

7.3. Critical factors for success with serious-games

Serious games shall enhance reflexive learning in a playful way. The level of motivation is constant, autonomy and zest for action is combined. Therefore the retention rate of learning process is effective for a longer period of time and the results can be transferred in daily life of school or work.

Serious games have to be embedded in a didactical system. Therefore the reflexion-phase after the game is very important. It need a critical view what went good and what went wrong, what have been learned, what could be done better, how to solve it the next time and hot others did it. The goal is to enhance a self-reflexive attitude, because through individual reflexion self-controlled learning will be successful. The effect of learning is strengthened through a didactical structure of self-monitoring and self-reflection.

The transfer of the trained content should be accompanied by a coaching-based master plan in which the learner deals with certain issues of the game once more. The learner reflects and is able to apply the trained in daily life. This allows sustainable learning.

But also requirements like quality and functionality as well as an attractive design is important. In general you need the balance between pedagogical demands and good implemented technical solutions.
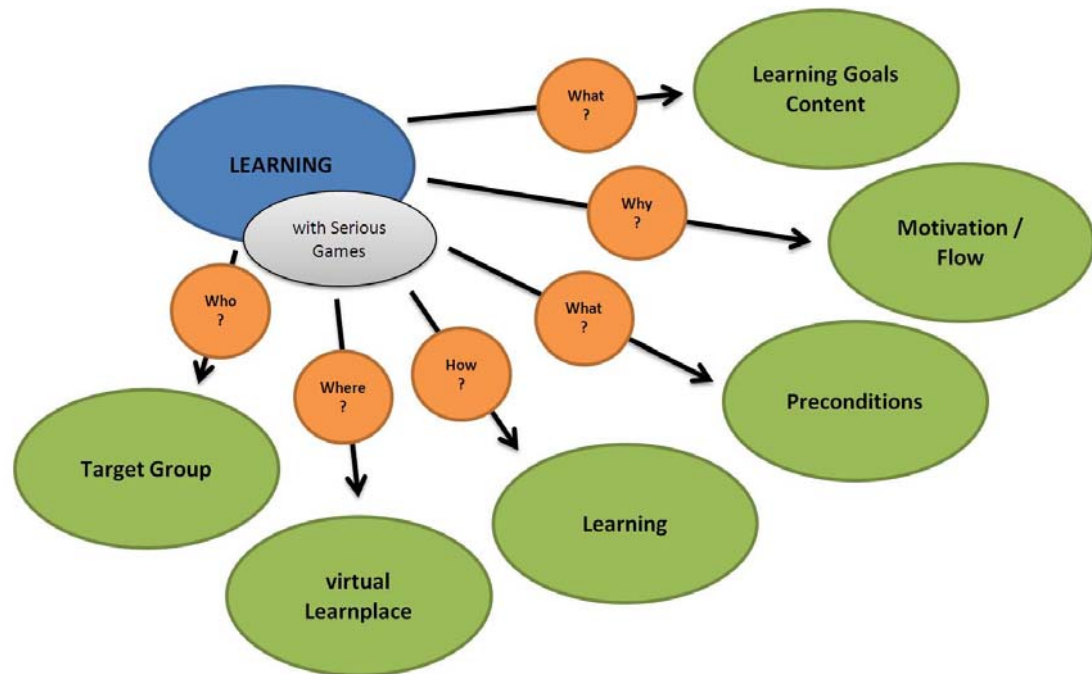
Picture 6: Learning with serious games

Within the digital game it is necessary to support different styles of learning. Some learners prefer visual styles, some are more auditory. It is an art to combine different types of media, like text, pictures, videos, audio, different types of communication (written or spoken text, a narrator, sms, mms, e-mails etc.) to meet the needs and demands of the defined target group. One important aspect is the own experience of gaming. Each person does not only learns in a different way, each person plays a game in a different way. Therefore it is necessary, that everybody will deal in his own individual way with the digital game. This has to be recognised through the phase of conception and planning the game.

To transport pedagogical content to a target group with the help of a game different methods are used. In this chapter we will see the most widely spread methods. To divide the games in categories by the used method is not always possible, because in a lot of games on the market there is a mix of methods[25] used to reach the aims of the provider.

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[25] YENTELS: DJLife is a mix of adventures game, simulation and learning game, where the game motivates to deal with content.

8.   User/target groups of serious games

It is just not possible to define just the one target group for games or serious games. It is the much more the category, the topic as well as the target or goal of the game or serious game itself, which define the target or audience group.

Primarily people should be addressed, which are concerned by the topic or who are or should be interested in the topic. Basically a serious game should be designed to attract all possible (serious) gamers, to be able to spread the topic as far as possible.

As seen on page 16 there are several categories of serious games (Games for Health, Advergames, Games for Training, Games for Education, Games for Science and Research, Games for Production and Games as Work). Within these categories there is a wide variety of possible branches these serious game categories can be used (Governmental, NGO, Healthcare, Marketing & Communication, Education, Corporate, Industry ...). When looking at this matrix on page 16 of this document, there is a first impression, how many topics can be addressed an how many goals and targets are possible. As many goals and targets are thinkable, as many target or audience groups can be possible.

To define the target or audience group is one of the most necessary decisions when doing the conceptual design of an idea for a serious game, because it influences very much the needed methods and taxonomies of learning to be able to especially attract the defined target or audience group. Furthermore it is then possible to think "with the brain" or to "see with the eyes" of the target or audience group and to create an immersive serious game.

In case of project ENTRExplorer the target or audience group were chosen to be young people between 15 and 25 years old, who are thinking about being an entrepreneur should be interested in thinking about entrepreneurs or who should be made familiar with the topic itself in formal or informal education. However, it is not enough to try to do everything to attract this target group, it is also necessary to think about attracting these people (e.g. opinion leaders), who have an influence on the target group of the serious game itself.

All further decisions regarding the conceptual design (content, storytelling, multiplayer, graphics and sound, communication within the game, feedback ...) of the game as well as distribution, marketing and promotion around the game to spread it as wide as possible within the target or audience group are dependent on their characteristics.

9.   Case studies and examples

9.1. Case studies (delivered by Bulgarian Development Agency)

9.1.1.   Virtual simulation of physics laboratory exercises

Name: Virtual guide for physics laboratory exercises for 8th grade in the Bulgarian high schools

Type: Virtual simulation

Target audience: 8th grade students in Bulgarian high schools

Content: Virtual simulation and guidelines for implementing physics laboratory exercises

Developed by: Vocational School of Economics "Prof. Dr. Dimitar Tabakov", Sliven

Background

The experiments have a leading role in teaching physics. The reality, observed during the implementation of the laboratory exercises, the direct contact with the settings, the measuring instruments and tools, the opportunity for repeating the measurement aimed at verification of the achieved results create powerful stream of feelings and information. Those feelings form cognitive abilities in students and build physical way of thinking through revealing the causal relationships between the abstract objects of the theory and the images from the reality.

The virtual application is developed by the teachers in the Vocational School of Economics and is completely consistent with the compulsory educational themes and the age and knowledge of the students. The developers of the virtual simulation believe that it is part of a bigger project, covering all physics laboratory exercises in the secondary education.

Overview

Virtual guide for physics laboratory exercises for 8th grade in the Bulgarian high schools is a virtual simulation realized in 2007 in the Vocational School of Economics in Sliven. It is developed by physics teachers and is aimed enhancing the quality of the education under the subject trough proper implementation of laboratory exercises which provoke the interest of the students to the experimental activities. The virtual guide consists of

eight laboratory exercises which completely cover the compulsory school program for physics laboratory exercise in 8th grade. The virtual guide for every single laboratory exercise helps the student to prepare himself for the implementation of the exercise without using any other sources. It contains the necessary information divided in two levels: basic information and referent information. It also contains methodical guidance which is appropriate for self – study in home or in school and with pace consistent with the personal style of every student. That fact allows the usage of the virtual guide not only in class exercises, but also in individual or distance learning forms. The multi-media virtual simulation of the laboratory exercises influences as many senses as possible which lead to enhancing the levels of retention the information and to reducing the time necessary for the adoption of the theoretical knowledge and higher quality implementation of the real experiment.

Evaluation

At the end of each laboratory exercise are included one or two tests from the relevant material. Those tests are developed in accordance with the requirements for final exams in the field and use the same criteria for evaluation of the results. Every test consists of 10 close questions with four possible answers. Each correct answer gives one point. The test is successfully completed when the final result is at least 30% of the maximal amount of points. The programme allows to be estimated the total time necessary for each student to complete the test. After submitting the results each student receives information about the right and wrong answers, as well as a grade corresponding to his results.

Another example of the application of the game based learning methods but in the frames mobile game based learning (m – Learning) in the formal learning can be found in the National Gymnasium of Natural Sciences and Mathematics "Academician Lyubomir Chakalov" where two e-Learning platforms are used. Both platforms have relatively close functionality and are used for development of an educational course, delivery of interactive tasks, assessment and feedback. The first one is Moodle system which is used in a lot of Bulgarian universities. The other platform – UNITE (Unified eLearning Environment for the school) is developed under Sixth Framework Programme project and can be used trough PDA devices or mobile phones.

M - Learning system is also established in another formal educational institution – Plovdiv University "Paisii Hilendarski". The M - Learning digital environment known as

PeU 2.0 - a Web-based learning environment that gives the possibility for cooperative creation of learning materials, creation of e-learning courses and adaptive personalized learning.

In order to provide m-learning elements, software modules are developed and experimented, which provide access to the standard PeU 2.0 e-learning services using mobile devices and WAP interface for mobile phones and pocket PCs. The prototype of the m-learning system, based on PeU 2.0, and realizing mobile services modules, is called MobilePeU 1.0. The main m-learning possibilities provided by Mobile PeU 1.0 are:

- Authorized access;
- WAP text interface integrated with different media;
- WAP calendar and WAP news;
- WAP query for student's grades;
- WAP presentation of the PeU 2.0 possibilities;
- WAP query for the available programs and courses;
- WAP query for the students and teachers belonging to the user's group, etc.

MobilePeU1.0 can be viewed as a prototype of the Plovdiv University M-Campus – a mobile information system offering data in a wide range – for candidate students, for available rooms in hostels, etc. The M-Campus system is developed as a mobile web application based on .NET technologies (ASP.NET Mobile Designer) for creation of Web-based program systems for mobile phones, personal digital assistants and pagers (Microsoft Visual Studio 2003 E MS SQL SERVER 2000).

M-Campus's subsystem "Queries for candidate students" offers m-services for the candidate students of the University of Plovdiv. Using it and his/her mobile phone, any candidate student can access the http address of the system's web page and check the dates of the candidate student's exams and other actual information about them (if the exam results are published and what is his/her grade for a specific exam).

The presented concrete solutions in the e-learning environment (PeU 2.0) aim at accumulation of positive experience in the m-learning field. Similar trend was shown as a result of a research on theme "The Influence of Usage of e – Learning on the

Students' Expectations about m – Learning"[26], held in 2005 in Ruse University and University of Trento (Italy). The research results revealed that highest interest to use m – Learning is shown by those students that have used several learning platforms. The lowest interest is registered among students which haven't used e – Learning platforms. Moreover, compared to another research held in Ruse University in 2004, the readiness of the students to use m – Learning has increased with 7% estimating at 81.6% of the respondents.

The m-applications in learning that are in process of development and experimenting is related to "generation" of games with cognitive nature. Analogous to the habitual for the user/ learner manner of ordering games from SMS-centre, requests for learning tasks with attractive elements are realized.   Another interesting application that brings dynamics to m-learning is the evaluation approach – automatic generation of short messages for the teacher (when the learner finishes his/ her work on the test) and for the learner (when the grading process is finished). Another application in development is generation (suggestion) of test problems from studied e-courses under the form of short messages.

A direction for subsequent research is the possibility to design and create generators of suitable learning tasks with game elements in the form of short messages (or mobile games which "return" results). Experiments from this type are conducted for the case of lexical acquisition of an English-minimum study dictionary. The automated processing of short messages used in the learning process with linguistic technologies and tools is another interesting research direction.

Serious games as part of the non-formal and informal learning in Bulgaria

The usage of serious games as part of the formal learning in Bulgaria is the most common application of the serous games. According to the definition of the European Commission for informal learning[27] it results from daily activities related to work, family life or leisure. It is not structured and usually does not lead to certification. In most cases, it is unintentional on the part of the learner. That makes almost every game

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[26] Full text of the research is available online at
http://elconf06.dei.uc.pt/pdfs/paper20.pdf

[27] Validation of non-formal and informal learning, official web site of the EC, available at http://ec.europa.eu/education/lifelong-learning-policy/doc52_en.htm (last seen 12.08.2011)

appropriate and used for the purposes of informal learning. No mater if it is a strategic military game available online with open domain (for example the Imperia online game based on strategic military and economic models, available at www.imperiaonline.org) or it is specially developed for educational and entertainment purposes (for example the game conQUIZtador - a strategic online game based on answering questions on different themes, available at http://www.conquiztador.bg/), the game can be considered as part of the informal learning.

This broad envelopment of the serious games for informal learning predetermines the variety of scenarios and options available. What is typical about them as part of the learning process is that the learning outcomes are usually not evaluated. They come as supporting result from playing the game. A plus in that direction is that in fact to the increasing motivation of the individuals (because they like the game and are not obliged to participate in it), they are more likely to spend bigger amount of time playing. Another typical character is that the most of the games are completely or partly free for their users – most of them are commissioned with non-commercial purposes or are financed by displaying ads and other advertising messages on their pages or by other European, governmental or private sources.

A good example in that field is the project "School financial games – the games of NeZnayko[28]", realized with the financial support of the national programme "The school – area of the students", module "Development of extracurricular activities"[29]

9.1.2. Financial game

Name: "School financial games – the games of NeZnayko"

Type: Serious game

Target audience: Children between 9 and 15 years old

Content: Serious game aimed at enhancing the financial culture of the children and the attraction of their parents to the school life trough participation in competition games

Developed and commissioned by: Educational Center "NeZnayko" and "Intermedia" Foundation

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[28] NeZnayko – quibble, on Bulgarian meat funny expression for person who doesn't know something

[29] Official web site of the project http://ou163.intermedia-bg.com/proekt.htm

Overview

The aim of the project is to enhance the financial culture of the children and the attraction of their parents to the school life trough participation in competition games. In gaming situations the children become aware of the specific financial terminology, develop analytical skills, acquire skills for work in teams, and develop loyalty, responsibility and entrepreneurial spirit. In background research held by the developers of the project showed that in the Bulgarian schools it isn't paid enough attention to acquiring of the available economic information and basic financial culture necessary to the young people in the dynamic developing market economy. The financing game offers funny and easy way for establishing practical habits and skills, necessary for achieving financial prosperity. They also build skills and habits for managing and generating money. The game raises the children' awareness of the basic financial terms and makes them create alternative financial opportunities and search and use cost effective proposals. It is based on real case studies which give the players the opportunity to exercise and feel the development and the consequences of real entrepreneurial possibilities. The financial game offers also opportunities further exploration of other fields like "Banking", "Insurance Funds" and "Stock Exchange".

The game is held on several stages as on the first stage is formed groups which participate in ten competitions. The best students form representative teams which promote the game among the other students and their parents. On the next stage are formed ten competitions with the involvement of parents as the best teams are included in a championship tournament for the "NeZnayko" cup. The project ends with national online competition with different financial case studies. This competition is open to all Bulgarian students and schools after registration in the web based platform.

Background

As part of the preparation activities were developed school clubs "NeZnayko" which involve students from 3rd to 8th grade in the Bulgarian schools. Special attention was paid to the training of teachers who lead the games under the project. For their specialized and continuing training is build a special web based platform for distance learning. Trough this platform all of them have uninterrupted access to supporting material, guidelines for usage of different terms, test etc.

Another part of the project background was devoted to its popularization. Those activities include the development of web site, a promotional disk and conferences for discussing the results and the achievement of the project.

Evaluation

By the time of preparation of this research the project activities and the influence of those games on their users have still not been evaluated.

Apart from that example there are still many other non-formal and mostly in-formal opportunities for accessing learning content trough serious games. Among them can be listed:

- "I'm online" – serious game for safer internet (http://online.dechica.com). It is a Bulgarian web based computer game commissioned in 2009 by team of teachers, artists and students. Its aim is to check if the children are aware of the dangers in internet and if they can handle different situations, so they can avoid virtual or real violence. The game is targeted at the younger internet users and aims to present the basic rules for safety in the world-wide network. Full information about the game and its modules in the website of the network of the innovating teachers "Teacher.bg" - http://www.teacher.bg/Article/Details/230.

- Go around the world for 15 minutes – this is an online interactive quiz developed and commissioned by National Geographic – Bulgaria. It allows the users to check and broaden their geographical knowledge of Bulgaria and the world. The game consists of six stages as each of them has four rounds. Each round includes about 10 questions covering different field in geography. The answering of the questions must not exceed 15 minutes. At the end of the game the participant receive detailed report with the given by him correct. The game is with open domain and available at http://www.nationalgeographic.bg/?cid=62&grp=3.

- Knowledge Bank[30] – This is the first example of the application of the serious game based learning methodology in Bulgaria started in June 2006 and was called "Knowledge Bank". The project was developed in cooperation between one of the Bulgarian mobile operators – Mobiltel Bulgaria Ltd and the foreign language courses provider European Center for Education and Qualification, owner of the trade mark "Europe Schools" ("Uchilishta Evropa"). The project is aimed at everyone who wants to obtain online access to a wide variety of resources for enhancing his personal and professional qualification. The project uses a preliminary set network of

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[30] Demo version of the game is available at http://www.resursi.info/demo/Prop_Adj.swf

Resource centers for language, professional and consumer knowledge which can be used by all users with no regard of their location trough specially developed devices. The resources in these centers are divided in 15 categories in dependence of the age, the professional needs and the requirements of the customers. They include audio, video and multimedia products, interactive games, exercises and tests. Important components are the sections for language, professional and specialized trainings, as well as sections for preparation for obtaining a certificate. Available are also materials connected with some more specific areas of knowledge like intercultural communication (also in business context), business English courses, educational games etc.

Serous games as part of the in-company training programmes

The game based learning approach finds one of its wider applications in the in-house training procedures. One of the reasons for that wide application can be found in the bigger flexibility of the in-house training programmes. They are bound with legislatively defined and difficult to change curriculums and are limited only by the available recourses and the imagination of the trainers. This turns the serious game based learning a suitable approach used for variety of reasons like testing competencies, evaluation the skills of the employees, developing new knowledge and skills using examples and case studies inspired by real working situations and even during the selection and recruitment process for new employees.

Compared with the global scale, however, the application of the serious game based learning approach in Bulgaria can still be evaluated as relevantly limited. One of the major holdbacks that can be defined in that field is the required modification of the traditional methods which imposes enhancement of the attention to the details of the training content and especially on the way the achieved results are going to be measured. Important are also the obstacles connected with the technical aspects of the serious game based learning, including the availability of devices with proper parameters, the differences in the supported by these devices formats and the wide variety of wireless standards and their incompatibility even in small groups. These facts are even more strengthened by the cultural characteristics of the nation and of the traditional enterprises where the technical innovations are accepted slower and with a little delay in comparison with the West-European countries or USA. on a global scale

there are a lot of examples of mobile game based learning applications aimed at different industrial sectors. Some of them include[31]:

- "LearningBeans" – game developed by PIXELearning. It allows the trainees to pass trough a detailed scenario of a producing cycle, including sales, marketing, human resources, finance, production, distribution and export planning. The aim of the game is to allow the employees to understand better the two-way relationships between all business aspects.
- British Gas has designed a funny game in order to illustrate the importance of the communication, diagnostic and solving customers' problems.
- "Better Business game" – simulative game of British Telecom aimed at social and business environment management. The gamer is in the role of corporate CEO and the scenario includes business dilemmas in the field of industry,
- "The Site Safety Game" – a mini game which demonstrates how 3D technologies can be used for training in the industry. The gamer is in the role of safety inspector who should identify and define the potential dangers.
- "The Monkey Wrench Game" – game developed to teach engineers how to use 3D CAT software.

The Bulgarian enterprises are trying to adopt those best practices which in the recent years can be seen by the broadening examples for development and application of different e-learning methodologies in their in-house training programmes. Among the variety of programmes deserved to be outlined the application and development of a virtual simulation learning platform aimed at increasing the effectiveness of the provision of tourist services. According to national strategies for economic development the tourism is recognized as one of sectors that will have a major impact for the continuous development of the national economy in the future. A manifestation of those priorities is the EU funded project initiative **Learn foreign language anytime and anywhere with LinguaNet".** The system is developed by Bulgarian specialist from

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[31] The examples are based on the article of Malinka Ivanova "Mobile game based learning – new opportunities for the trainers' community", published in CIO Magazine on September 25, 2007, available online at http://cio.bg/1618_obuchenie_bazirano_na_igri__novi_vazmozhnosti_za_prepodava telskata_obshtnost.0

International College – Albena, Ruse University "Angel Kanchev", The Association of foreign language teachers in Bulgaria, the company "Global Solutions" and their partners from Greece, Spain and Portugal. The idea of the project is to develop an m-Learning system that will allow the employees in the sphere of tourism to learn the language of their guests without leaving their work places. The content of the system is developed to meet the needs of the managerial staff and the service staff of hotels and restaurants but may also be helpful to the foreign language teachers. The developed under this project m – Learning platform is available at http://flagman.ecs.ru.acad.bg/index.php?site_step=1.

A subject of interest in accordance with the ENTRExplorer project is one other example for the application of the serious game based learning approach – The interactive digital trainings me-Learning[32].

9.1.3. Interactive digital trainings me – Learning with JobTiger Ltd

Name: Interactive digital trainings me – Learning

Type: Simulation learning techniques

Target audience: Top and middle level managers in Bulgarian enterprises

Content: Virtual simulation games developed in three directions – Change Management, Project Management, and Performance Management

Commissioned by: JobTiger Ltd

Background

The complex of simulation educational techniques me – Learning opens a new dimension for the development of the managerial skills of the top and middle management in the Bulgarian enterprises. Me – Learning (management e – Learning) is the title of the series of digital training programmes connected with organizational management. The "me–Learning" training programmes are built over a joint methodological and technological system, called ALEAS – Adaptive Learning Systems. That toolset recognizes the individual leadership style and behavior of the participants and measure their performance in the case studies on certain criteria, as well as the

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[32] Full description of the methodology and the modules can be found at http://www.jobtiger.bg/statia/interaktivni-elektronni-obucheniya-me-learning-s-jobtiger-ood-176-2

level of adoption of the information in the additional materials. Thanks to that instrument the effectiveness of the learning process has been significantly increased.

ALEAS gives the participants the opportunity to define the speed they learn by themselves. This reduces the resistance of the participants to the learning process, caused by overloading with a lot of information for a very short time.

Overview

The three basic directions offered by JobTiger Ltd on Bulgarian market are Change Management, Project Management and Performance Management. The case studies included in the modules are based on real examples, given by National Geographic and Sanoma Magazines International.

Change Management Training Programme

The Change Management Training Programme presents the basic elements in the change management process and highlights the problems and the situations deprived by the change in the affirmed organizational processes, as well as the possible solutions and approaches. The basic training method in the Change Management programme is the simulation. The participants play a role under which they should change the negative tendencies in the company, identify and use improperly used to that moment resources, change wrongly established managerial and operational practices. The participants have the opportunity to take decisions connected with the organizational structure, adoption of team-building strategies and motivation of employees. They can discharge or promote employees as well as to decide to hire or not external experts. All decisions must be taken by the learners themselves and are connected with their role of leaders of the change in the company.

At every moment of the training the programme gives thorough feedback about the available company resources, the time and the resources used for the realization of a certain strategy, as well as the possible reactions of the top managers and owners of the company. The programme renders an account of the individual leadership model of each participant and connects it with the taken decisions and their impact on the company in the process of change.

Project Management Training Programme

The Project Management Training Programme presents the current and modern practices and theories about the activities, the managerial planning, the organizations,

the financial decisions and the leadership duties and responsibilities when implementing a project. The module includes also the real life risk evaluation connected with the project management process.

The main training method is the virtual simulation. The participants play the role of project leaders in a situation inspired by a real case study. They have to take decisions based on the information and resources available and to decide on team building methods and motivational tools. They can exclude or include new participants in the project and manage crisis situations. After every decision the programme gives detailed feedback for the progress of the project, the used and still available resources, the team motivation and the possible risks. The ALEAS methodology allows the correspondence of the feedback with the leadership style of the participants and the roles he is implementing.

Performance Management Training Programme

With the current simplification of the organizational hierarchies the individual salaries and social benefits are increasingly diversifying. More and more activities and projects are outsourced from the company offices. As a result from that the way on which the performance of the employees is evaluated plays bigger role for the success of the companies. The question is not to find a suitable person for a given position. It is more important is that person to be able to work effectively in a long-term scale even when his duties and the connected with them challenges are constantly increasing.

The basic learning method in the course is again the simulation. The participants play the role of project leaders as they need to take decisions based on the information and resources available. The participants need to implement series of tasks including the tasks to form a team, to distribute the tasks, to use motivation techniques, to resolve conflicts and everything else needed to achieve their goals. The participant should meet the people from his team who should be managed in accordance with their personal characteristics.

The methodology on which the training is based gives detailed feedback information about the achieved results according to the demonstrated leadership styles and their roles in the performance management process.

The demo versions of the simulations are available at http://aleasgroup.com/bg/me-learning-lab and http://www.aleasgroup.com/democenter/.

Average duration of each training course

The training with the "me-Learning" system is an individual process and that's why the time needed for is completion depends on the previous qualification and knowledge of the participant. The duration of the training is connected with the decisions which must be taken during the simulation, as well as with the number of the additional information materials that participant can decide to use. The average duration of completing a chapter from a participant with medium managerial experience is 1,5 hours. The course consists of five chapters as the average time for its completion is about 2 weeks. It is recommended the course to be terminated intensively in those deadlines.

Another commonly used application of the serious game based learning is its implementation as part of the initial or continuous training programmes for professions characterized with higher risk levels. They can be used by starting professionals in the field as by people who are interested in the profession and would like to get more aware of it. Some of the examples in that field are "Virtual hospital" game (available at http://bgflash.com/flash/301/%D0%B2%D0%B8%D1%80%D1%82%D1%83%D0%B0%D0%BB%D0%BD%D0%B0-%D0%B1%D0%BE%D0%BB%D0%BD%D0%B8%D1%86%D0%B0.html) or the "Virtual Pilot" simulation game (available at http://www.simmiles.com/Virtual-Airlines/english.php). Under the virtual hospital game the player is in the role of a surgeon who needs to operate his patient's knee. On the first round the player is given a short description of important for the operation factors like age of the patient, temperature, heart rate, blood pressure, pulse etc. The player should take decision if the patient can undergo a surgery or not. After that the games describes the process of preparation of the patient for the surgery, explores the knowledge of the player about the influence of the medicines given to the patient and gives detailed directions about the actions that need to be taken. Important from methodological point of view is the detailed feedback and the correction of the answers and actions performed by the player.

"Virtual Pilot" simulation game from the other side is an online airline management simulation which allows the candidates for virtual pilots to gain experience playing the role of airline simulator pilot or airline manager. The game is designed on a way that maximally copies the reality and gives the feeling of a real live experience.

Virtual games like those are often used as part of the informal self-guided learning. But can also be used as a reference source or as a testing tool as part of the formal education or in-house training procedures. This allows the trainees from one side to practice and test the possessed by them knowledge and skills. On the other side it

allows the employers to test the basic competencies of their potential and current employees without performing actions which are risky in the real life.

9.2. Examples of Serious-Games

9.2.1. Factory™

The Austrian Game management game Factory deals with business administration for employees and managers. It enhances the development of cost-oriented, entrepreneurial thinking and strengthens the understanding for strategically decisions within companies. Especially in difficult situations (e.g. a crisis) the game support to promote measures and activities to overcome this situation.
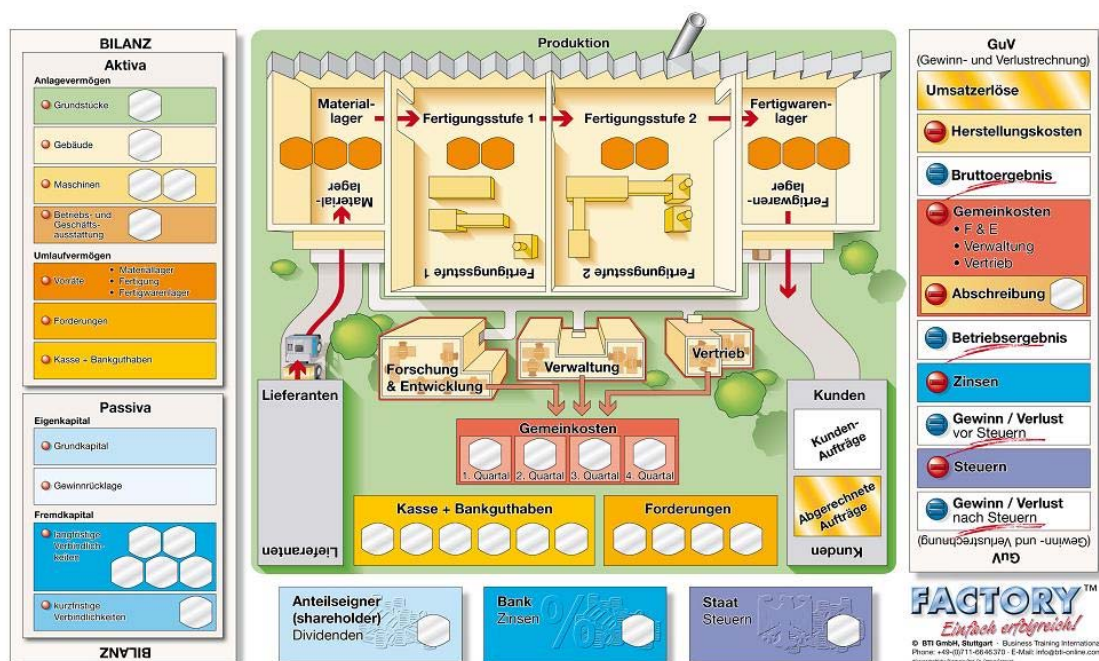
Picture 7: Factory game board (BIT Company)

9.2.2. The Skillz

Picture 8: www.the-skillz.de

Apprentices are learning intercultural competencies by playing four characters, which are performing as a band, as a team through a story where it is necessary to decide on certain situations regarding an intercultural background! This game was awarded with the German Serious Game Award In Bronze 2010.

9.2.3. TechForce
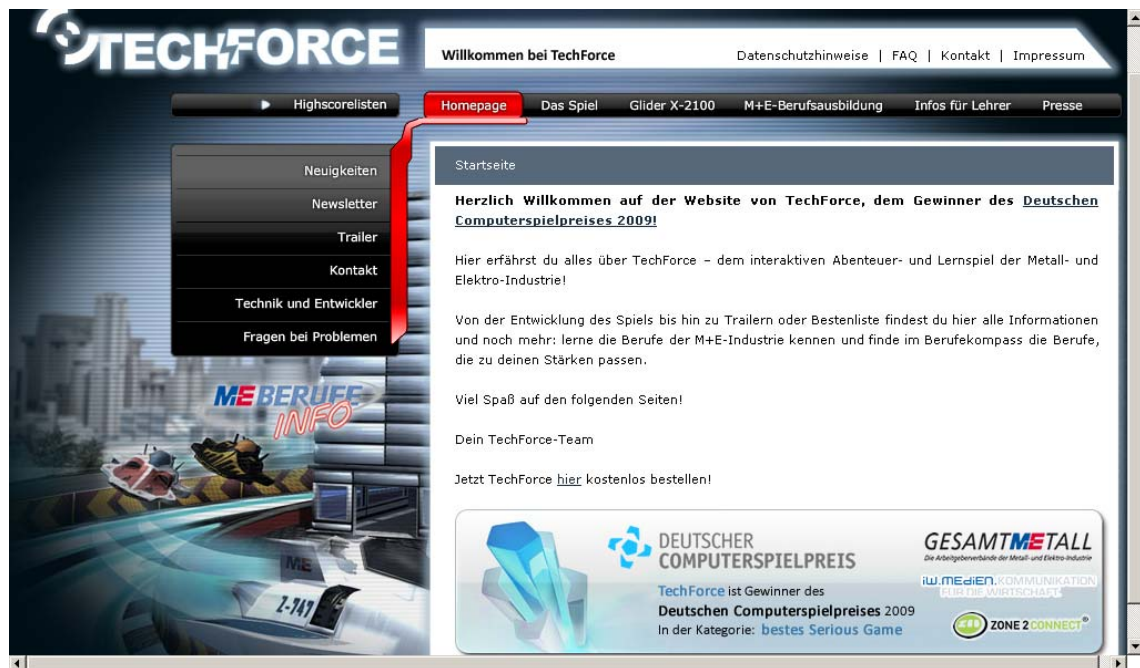
Picture 9: www.techforce.de

Young people should be interested in jobs around metal- and electric industry! An award winning game with several interesting elements of a serious game. The game consist of a part to play (where it is necessary to draw, to construct and to use a glider) and a part of guidance, where young people should be informed about the possibilities in mechanical and electrical industry as the challenges in these professions. The game was awarded by the "Deutscher Computerspielpreis" in 2009.

9.2.4. Sharkworld

Picture 10: http://www.sharkworldgame.com/index.php
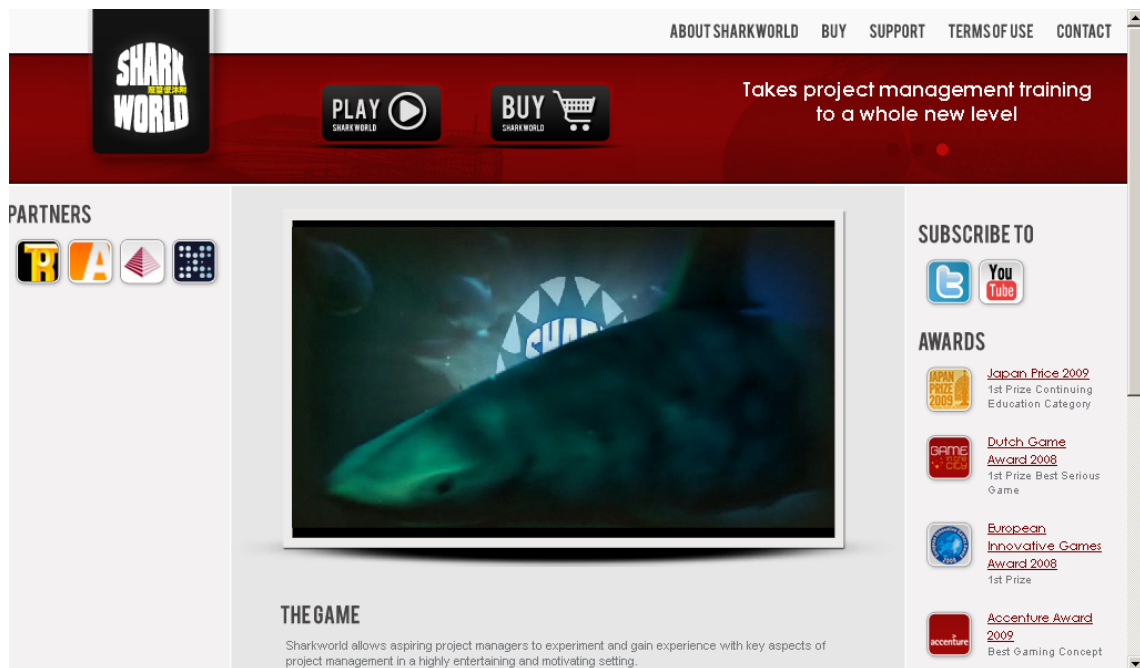
Sharkworld is a very interesting project management game. Especially the combination of mobile and game based learning. An interesting story leads the player to be the project manager of the building up of a huge aquarium, named Sharkworld. The games uses different kind of media, such as E-Mail, sms etc. and is called a 24/7 game, which means, that the player is also involved (information, necessary decisions), even when the player is not actually playing the game. Take a look at the trailer.

9.2.5. Houthoff-Buruma – The Game

Picture 11: http://www.youtube.com/watch?v=kUn8JvlGTV8
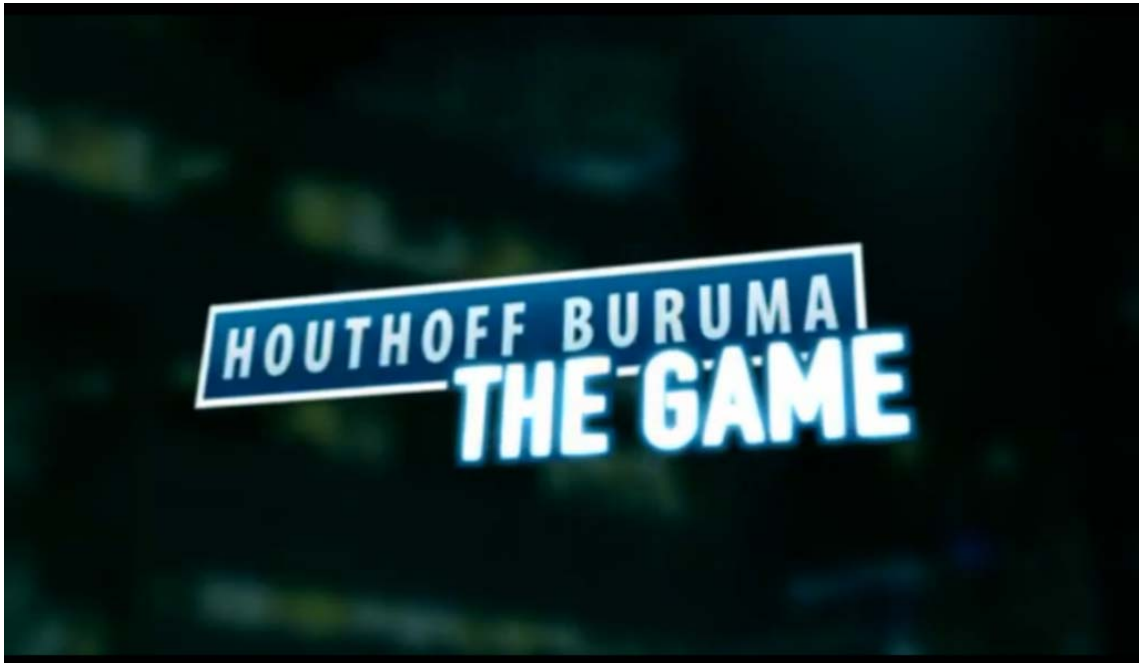
The player represents China Mining & Marine. To meet the unprecedented energy goals of the Chinese government, this state-owned giant has to construct the Panlong Renewable Energy Park within an ambitious time frame. To succeed in such a short time, China Mining & Marine needs six specific vessels equipped with a unique installation technology. However, these six vessels are all in the hands of one company: 't Hoen Marine & Offshore, a century-old Dutch family business that also possesses the latest technology and the essential know-how. China Mining & Marine needs those six vessels as soon as possible and is determined to acquire 't Hoen. The player has 90 minutes to convince enough shareholders to sell their shares and to draft a 'Letter of Intent'[33]

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[33] http://en.wikipedia.org/wiki/Houthoff_Buruma_The_Game, last seen on 29.12.2011

10. Summary and Conclusion

10.1. Summary

It is a fact that serious games have been gaining increasing importance and visibility. Initially, this kind of games was available for free by creating organizations and there was no feedback to the developers. Today, serious games are developed and distributed all over the world for a wide variety of platforms and applications. In commercial terms, serious games tend to assume a great importance, since organizations are increasingly recognizing their contribution in earnings and productivity.

The serious games market is now much more oriented to the business, "Business to Business," although there is much room for progress in other areas. In terms of investment, this model tends to generate economies of scale, which is why investments in this market are largely supported by private funds. However, the latest designers have focused extensively on aspects such as design, pedagogy and technology in order to expand the development of new business models.

The results of several market studies show that most businesses and educational organizations predict a large increase in use and popularity of "learning games". These conclusions are based on the positive contribution made by the change of attitudes and positions on this matter. In fact, factors such as changes in the profiles of employees or the need for simulation of increasingly complex systems and lower costs are major reasons for the increased use of serious games in professional institutions. Schools, universities, nongovernmental organizations and companies of various sectors attach great value to this method of learning that enables them to transmit messages and knowledge in a more productive and attractive way.

The serious games are used by business organizations in order to improve the overall learning outcomes, such as increasing the skills of workers in the workplace, increased management capacity for more effective control of the working groups and the related increase in overall productivity of employees. On the other hand, the fact that this educational approach allows a drastic reduction of costs compared with other teaching methods, it becomes very attractive. Basically, the main objective is to find the most effective way to generate a workforce better and more competitive.

Video games based on the formation of socially valued practices can create an educational system where users learn to work and think like professionals. The aim is not to train students for these professions, but to provide students an opportunity to see the world in ways that are based on core competencies of society. Thus, this kind of games will help its users to develop a particular professional skill or knowledge.

10.2. Conclusion

The so-called gaming requires reading, problem solving and critical thinking skills that help adolescents and those who practice it to learn in a way that is unusual for many people. However, many educators are beginning to use the games to help teach concepts that have been historically difficult to teach through other educational means. Just as teachers realized the need for change in education systems, managers and entrepreneurs have taken serious games as an essential learning tool these days.

The trends in the sector of "serious games" are defined by a number of demographic factors and converging markets that is generating a growing interest in the use of serious games in areas such as education, health, ecology, politics, science, administration and training business. While some companies are still taking its first steps, by assuming the development of serious games they recognize that this new approach is needed for more effective learning.

While serious games are still a small market compared to the global market for video games, their sector has experienced annual growth rates in double digits over the past five years, expected to reach values of around 2 billion dollars over the next five years. These numbers have been boosted by the growing use of serious games in the above areas as a way of developing the various skills associated.

An ever more scientists understand that the game, particularly those that exploit virtual sets, develops in children and adolescents several motor skills and reasoning. Other studies show the rapid decline of the traditional methods of preparation and training of business and governmental institutions, mainly for financial reasons. The total cost associated with the development and implementation of courses and the displacement of people to participate in these learning processes is becoming increasingly less attractive. Thus, the use of video games with these characteristics is becoming a recurring practice of institutions that aim to reduce costs and improve their human capital.

Although they are mere representations of reality, the games are extremely positive both in terms of personal growth and social development and in terms of experience. Thus, games are the ideal model to match the content in different ways and incorporate problem-solving and reasoning stimulation, which results in learning core competencies.

11. References

11.1. Literature

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11.2. Pictures

11.3. Tables