GAME-BASED APPROACH IN E-LEARNING

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***Abstract**: In this article a summary is made of the use of standard electronic game's methods in e-learning. It shows how game-elements and game-mechanics can be applied in e-learning environments. Different types of Serious games – Game-based learning, Gamification of learning, Organizational-dynamic games, Simulation Games and Edutainment have been discussed. The article introduces the game-based model for learning and 70:20:10 education framework. There are examples for e-Learning environments that include some of the abovementioned game-elements and game-techniques. The focus in the conclusion is on the potential benefits of successful implementation of serious games into a learning environments.*

***Key words**: E-learning, Serious games, Game-based learning, Gamification, Game-based learning model.*

1. Introduction

The use of electronic learning (e-learning), electronic resources and activities in traditional learning is growing fast. This brings to the need of new approaches and methods in education. In the near past the electronic games were used only for entertainment, but nowadays they are seen as a successful way for learning. The educational games can be found in e-learning environments both as independent programs for learning as well as additional modules, supporting the uptake of educational content [Paunova'2013].

Development of e-learning environments bring the need of higher quality, more accessible and interactive learning resources. Instead of only giving knowledge, they should involve learners in taking important decisions, communicating with each other and becoming more initiative. According to a research "Summit of educational games" from 2006 [Wince-Smith'2006], made by the Federation of American scientists (FAS): students remember only 10 percent of what they read; 20 percent of what they hear; 30 percent, if they see visuals related to what they are hearing; 50 percent, if they watch someone do something while explaining it; but almost 90 percent, if they do the job themselves, even if only as a simulation.

2. Games in e-learning

The use of game-elements and game-techniques for learning in higher education aims to make complex theoretical knowledge more approachable.

Permanent repetition will lead to a more in-depth learning based on Game-based education model [Connolly'2012].

Games, that are used in education, are also known as the oxymoron "***Serious Games***".

2.1. Serious games

Serious games aim at achieving educational, training and informational goals [Abt'1987]. Serious games cannot be classified as "games", because they are not designed only for entertainment and enjoyment, but for other purposes, such as education [David'2006].

By conventional definition a game is a system, in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome. Key components of games are goals, rules, challenges, and interaction. Games generally involve mental or physical stimulation, and often both. Many games help develop practical skills and serve as a form of exercise.

Serious games are simulations of real world events or processes, designed for the purpose of problem solving. Although serious games can be entertaining, their main purpose is to train or educate users, though, it may have other purposes, such as marketing or advertisement. The serious games are focused on learners, that are not included in traditional education. There are various types of serious games like educational games, advert games, political games and etc.

According to [Cruz-Cunha'2012] the first serious game is often considered to be Army Battlezone, an abortive project headed by Atari in 1980, designed to use the Battlezone tank game for military training. In 2002 another movement had started outside of formal educational sector that was coined as the "serious game movement," which originated from the Woodrow Wilson International Center for Scholars, where David Rejecsk and Ben Sawyer started the initiative. The primary consumer and producer of serious games is the United States Military, which needs to prepare their personnel for military movements in a variety of environments, cultures, and situations. They need to understand their surroundings, communicate on an international level, use new technologies and quickly make decisions [Klopfer'2008]. Other well-known serious games, that were commissioned by the American Army, are America's Army (2002) and Full Spectrum Warrior (2004).

The usage of serious games in various sectors, that are released on the game market after 2002, is shown on Figure 1. [Djaouti'2007]. The education sector is placed second in using serious games.

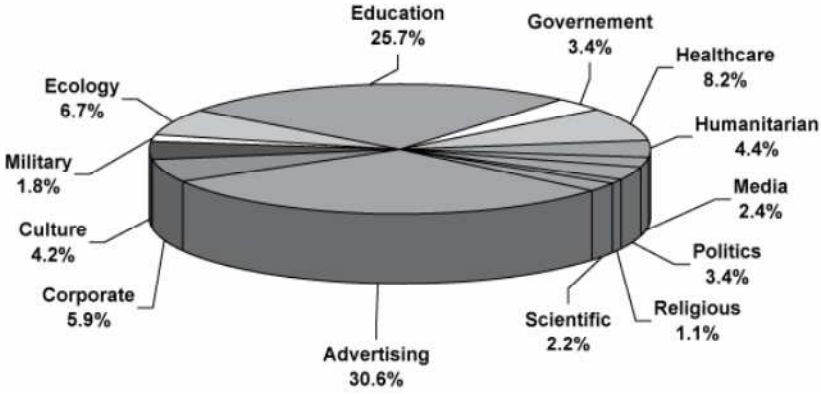

Figure 1. Research of the Serious games market after 2002

The classification of serious games is something that is yet to solidify, there are however a number of terms in reasonably common use for inclusion:

- ***Game-based learning*** – uses video and electronic games for achieving educational goals;
- ***Gamification of learning*** – integrates game elements and techniques with the e-learning process;
- ***Organizational-dynamic games*** – they teach and reflect the dynamics of organizations at 3 levels: individual behavior, group behavior and culture dynamic;
- ***Simulation games*** – games, used for the acquisition or training of different skills, teaching effective behavior in the context of simulated conditions or situations;
- ***Edutainment*** – presents content, designated simultaneously for education and enjoyment (the term is a combination of the words education and entertainment).

2.1.1. Game-based learning

Game-based Learning (GBL) is a part of serious games, which is designed to reach certain results, based on standard education methods. The main purpose of these applications is to combine the achievement of learning goals with the entertainment, learners experience while they are playing games. The applications train the ability of learners to memorize and apply theoretical knowledge in real life [Kapp'2012].

GBL, according to [Diamond], is conducted with lessons that are competitive, interactive and allow students to have fun, while achieving the pre-set goals of the learning resources.

Short definition for GBL, given from [Benson'2014], is education through learning resources, which are presented in the form of a game. GBL can use standard already developed strategical electronic games, as well as games, specially designed for that sole purpose.

[Benson'2014] expresses the view, that Game-based learning motivates and involves learners in a way that traditional methods for learning cannot. Most researches in this area highlight "repetition" as the main advantage in that game approach. It is similar to the „Drill and Practice" or rote memorization in traditional teaching. Games encourage learners to go from a lower level of difficulty to a higher one, leading to a gradual increase in their knowledge and skills (which are also increased with the "repetition" of levels by learners, trying to get to the final highest level of the game. For most players, this repetition is almost automatic and without question, if the player fails to complete some level of a game, they will often practice until they can successfully progress to the next level.

2.1.2. Gamification of learning

The ***gamification of learning*** is an educational approach to motivate students to learn by using video game design and game elements in learning environments [Kapp'2012]. The goal is to maximize enjoyment and engagement through capturing the interest of learners and inspiring them to continue learning [Huang'2013]. Gamification, broadly defined, is the process of defining the elements which comprise games that make those games fun and motivate players to continue playing, and using those same elements in a non-game context to influence behavior [Deterding'2011; E-learning Heroes'2014].

Learning content can be presented in a much more attractive way for the students by using gamification. Game-elements and game-techniques, included into a non-game content can be used to encourage the learners to follow the ultimate goal. At the same time, they train their research abilities in achieving the educational goals.

Gamification, according to [Kapp'2012] can be separated in *two main types*:

- ***Structural gamification*** – This is the application of game-elements to propel a learner through content with no alteration or changes to the content itself. The content does not become game-like, only the structure around the content. The primary focus behind this type of gamification is to motivate the learner to go through the content and to engage them in the process of learning through rewards (for example

using of avatars, leaderboards, awarding with badges, passing different levels);

- ***Content gamification*** - This is the application of game elements and game thinking to alter content to make it more game-like. For example, adding story elements to a compliance course or starting a course with a challenge instead of a list of objectives are both methods of content gamification.

Table 2. Examples for usage of game-elements and game-techniques in non-game context

Game-elements and techniques	Usage in electronic or board games	Usage in e-learning
Story	Passing specially designed sequence of events	Students learn through educational schedule created by the teacher
Rules	List with instructions of what is allowed and what is not	Requirements and recommendations for the course
Research ability	Search for hidden treasures	Including extra content (more learning resources)
Interactivity	Development of different potential in players through a variety of interactive actions	Practice of various interactive activities, leading to a higher level of understanding and remembering
Feedback	Indication from the game that an action or progress has been noticed	Usage of points, badges or other awards to show that there is development detected
Time limits	Simulation of extreme situations	Time limits for tests and exams
Reluctance to loss	The loss is twice more motivating than the win	Motivating learners with leaderboards
Repetition of levels (the whole game)	Opportunity to better the last performance	Predispose to re-study the learning resources
Continuation game	Opportunity to continue the game after it has been left	Continuing the learning at the point it's been left

In Table 1. examples for using game-elements and game-techniques in e-learning are shown. The same elements and techniques are taken from the electronic and board games.

2.1.3 Simulation games

Simulation games (including ***Role-playing games***) are oriented for entertainment, but they are suitable to be used as a tool and form of learning [Corti'2006]. Learning, based on these games, gives the learners opportunity to solve problems and participate in situations, impossible or inappropriate in real life in terms of cost, time, logistics or security reasons. The simulated environment or the realistically recreated storyline of a role playing game (a bussiness meeting for example) may allow participants to experience something that is too expensive, too risky or even physically impossible to achieve in the real world.

3. Models for learning

3.1 Game-based learning model

Serious games are based on ***input-outcome game-based learning model***. The model combines learning content with game methods and triggers a cycle of processes, leading to motivation of learners and desire for self-improvement.

First, the objective is to design an instructional program that incorporates certain game features or characteristics.

Second, these features trigger a cycle that includes user judgments or reactions such as enjoyment and interest, user behaviors such as greater persistence on completing a task and more time spent on it, and further system feedback. To the extent that we are successful in pairing instructional content with appropriate game features, this cycle results in recurring and self-motivated game play.

Finally, this engagement in gameplay leads to more motivated achievement of training objectives and specific learning outcomes.

This instructional model is illustrated in Figure 2. [Ahlers'2014]. There are several benefits that this perspective offers. First, the ***traditional input-process-output*** model of learning emphasizes "single-trial learning", a learner performing a task over a single trial. Although the current model adopts the input-process-output framework, the key component is the "***game cycle***" that is triggered by specific game features. The main purpose of this model is the realization of multiple "repetition" of a gaming action, which motivates students to go over and over again through the learning content. The game cycle is shown as an iterative process, which is close to the one when playing standard entertainment games. It encourages players to repeat given behaviors and decision-making processes [Ahlers'2014].

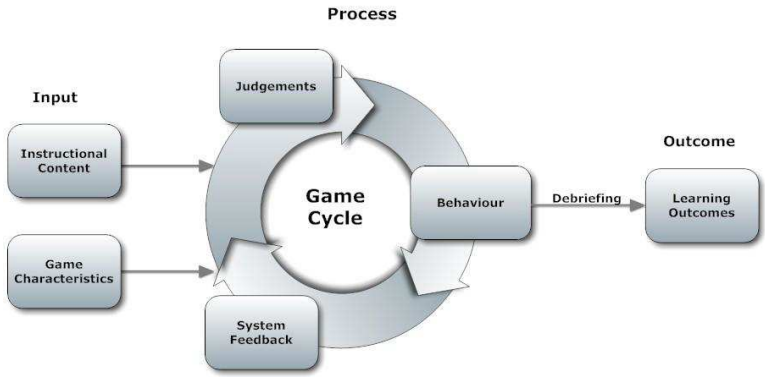

Figure 2. Game-based learning model [Garris'2002]

The freedom of failing and continuing with the tries without any negative consequences, inspires students to choose the motivating elements themselves and the ability to practice independent or collaborative decision-making, related to educational issues after failure [Li'2013].

3.2 70:20:10 framework for education

70:20:10 framework [Lombardo'1996] is a model for education, which separates and describes apart the methods for assimilation of the learning content. The creators of the model Morgan McCall and his colleagues from the Center for Creative Leadership (CCL) express that the 70:20:10 framework is a learning and development reference model, which captures the three types of learning (experiential, social and formal) and explains the relationships between them. The percentage distribution is as follows:

- **70% experiential experience** - learning and developing through day-to-day tasks, challenges and practice;
- **20% social exposure** - learning and developing with and through the aid of others, including coaching, exploiting personal networks and other collaborative and cooperative actions;
- **10% formal education** - learning and developing through structured courses and programs.

Many successful companies use this framework and integrate it with gamification and game-based learning. The main purpose of this combination is to improve the way they train and teach their employees and make it more engaging.

4. Learning Management Systems that includes serious games

Some Learning Management Systems (LMS) are using methods and ideas from serious games and most of all from game-based learning and gamification. Examples of such systems are GENIE, TalentLMS, Frog and Expertus One.

4.1 GENIE

Through the web-based application ***GENIE*** [GENIE] of Growth Engineering projects and courses can be created and managed. Genie includes libraries with questions, pictures and videos and gives users the opportunity to add their own libraries, which can be used to create projects or courses. All projects and courses can be exported to SCORM format (the system supports SCORM 1.2 and SCORM 2004).

The implementation of elements from serious games in GENIE is done by:

- Rewarding with badges and points for achieving learning goals;
- Preparation of leaderboards for stimulating the competitive spirit;
- Putting deadlines to tasks;
- Learning through gradually passing through levels.

The users can add their own game-elements or use the already created templates, provided by GENIE.

4.2 TalentLMS

TalentLMS [TalentLMS] is a SAAS (Software as a Service) cloud-based platform for e-learning, which gives the opportunity to create and manage learning resources. The learning resources can be presentations, videos (YouTube for example), web-resources, wikis and etc. The platform supports importing learning resources in SCORM format.

Talent LMS implements gamification through :

- Giving points for performed actions (going through learning resources for example);
- Collecting various badges for passed tests;
- Receiving certificates and awards for finishing the course;
- Re-certificate on certain time periods;
- Leaderboards – displayed by charts and diagrams;
- Passing the course by levels.

5. Conclusion

Learning, based on games, allows learners to get deeper into the learning content and train themselves in tasks and situations, which would be impossible or undesirable for their price, time, logistics or for security reasons in real life.

Potential benefits from successful integration of serious games in a learning environment are numerous, but the most essential ones of them are:

- Increase of the entertainment and the enjoyment from doing the learning activities;
- Opportunity to represent learning content through various levels of education, depending on complexity or different preferences of the learners;
- Visualizing of the learning content
- Opportunity for motivated repetition of the learning activities for better understanding of new material and skills;
- Practice in an environment that simulates real-life experience

The successful usage of the game method in learning environments should be differentiated [Ivanova'2007], depending on the specific needs of the learners (level of education, competences and skills). Motivation is a key aspect of effective education and it makes the learning process much easier.

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ИГРОВИ ПОДХОД В Е-ОБУЧЕНИЕТО

Мария Гачкова, Елена Сомова

***Резюме**: В статията се прави обзор на използването на подходите от стандартните електронни игри в е-обучението. Показва се приложимостта на конкретните игрови елементи и методики в средите за е-обучение. Разглеждат се видовете сериозни игри: игрово-базирано обучение, Gamification of learning, Organizational-dynamic games, Simulation games и Edutainment. Представят се игрово-базирания модел за обучение и 70:20:10 модела за обучение. Дават се примери за среди за е-обучение, в които са вградени някои от игровите елементи и методики. В заключение се акцентира на потенциалните ползи от успешното прилагане на сериозните игри в учебна среда.*