The Sixth International Conference on e-Learning (eLearning-2015), 24-25 September 2015, Belgrade, Serbia

GAMIFICATION IN HIGHER EDUCATION LEARNING – STATE OF THE ART, CHALLENGES AND OPPORTUNITIES

SNEŽANA ŠĆEPANOVIĆ
University "Mediterranean", Faculty of Information Technology, snezana.scepanovic@unimediteran.net

NAĐA ŽARIĆ
University "Mediterranean", Faculty of Information Technology, nadja.zaric@unimediteran.net

TRIPO MATIJEVIĆ
University "Mediterranean", Faculty of Information Technology, tripo.matijevic@unimediteran.net

Abstract: *The studies consistently found that game based learning can impact positively on problem solving skills, broader knowledge acquisition motivation and engagement. Gamification is newer concept than game-based learning. It is about using elements from video game design for motivation in a variety of non-game contexts. This paper presents concept and current status of gamification used in Higher Education learning. Research, discussion and evaluation, are based on literature review and analysis of implementation the concept of gamification in Higher Education learning.*

Keywords: *gamification, game-based learning, e-learning, mobile game based learning*

1. INTRODUCTION

There are numerous reasons for spending significant amounts of time playing games. Whether games are played for relaxation, sheer enjoyment or to satisfy our need to compete, they are a part of our daily life.

Nowadays, game concepts are being increasingly incorporated in areas other than just standard playing environments. It can be said that the basic principle of every game is to reach a certain goal. Regardless whether this goal is to win a prize, accomplish an assignment, beat the competitor, or to be ranked first in the leaderboard, it is, without doubt, a mechanism that involves motivation, engagement, emotion and certain behavioral pattern. Having said that, it is not surprising that game elements are being implemented in non-game contexts like marketing, business, e-commerce, education, work environment, social media, etc. This process is referred to as gamification [1].

Gamification vs game based learning

Gamification as a term was mentioned for the first time in 2008 and, from that point on, much work has been done and many papers written on this topic [2]. Certainly, massive adoption of new technologies by public makes gamification an excellent tool to reach out to new users and keep the existing ones. Some examples of gamification are: Foursquare, Red Critter Tracker, Crowdrise, Open Badges, etc. [3].

Game based learning, however, is somewhat older phenomenon, dating back from 1970's [4]. While gamification utilizes game mechanics to transform the learning experience into a game, game based learning integrates games into the learning process to teach a specific skill or achieve a learning objective. Games are essentially used as learning activities to give learners the opportunity to acquire new knowledge or skills sets in a fun and engaging way. All learning games typically have rules and specific objectives and learners run the risk of "losing" when they participate. Another important distinction between gamification and game-based eLearning is that in a game based learning strategy the content is designed to fit into the confines of the game [5].

An important distinction exists between game based learning and gamification. Game based learning provides students with games that have an educational objective that are achieved through the game play [6]. These games can supplement frontal teaching or replace it, but it is clearly a game. The essence of gamification is that it occurs in a non-game context therefore it would be applied in such a way that would not change the existing practice of learning and instead focus on making it more engaging and challenging for students.

Structure of the paper will be as follows. In section II we present concepts of games and game elements concerning gamification and connections of gamification and learning. In section III we give an overview of current status of gamification in higher education and we present eight studies on gamification that were conducted on European and North American Universities. Section IV consists of authors' discussion on the studies and overview of general impact that different game elements had on courses participants. Section V is conclusion of the paper.

2. GAMES AND GAMIFICATION

There is an increasing number of case studies and research dealing with gamification in general [7] and in educational contexts [8]. The objectives of gamification in these educational context studies has been to increase student motivation to attend class, download course material, participate in on-line discussions, and

complete extra assignments. While majority of studies report overall positive results as a result of adding game elements, not all have exhibited these results.

Gamification in education is used as a way to increase the student's engagement and learning. In education, the term *student engagement* has grown in popularity in recent decades, most likely resulting from an increased understanding of the role that certain intellectual, emotional, behavioral, physical, and social factors play in the learning process [9]. In the context of education, gamification can be viewed as the inclusion of game elements into the traditional classroom, existing training materials, and the Learning Management Systems (LMS).

Game elements

To understand gamification it is necessary to understand the core concepts of games. The game elements are also referred to as mechanics and dynamics. According to Schell [10], there are four equally important game elements: mechanics, story, aesthetics and technology.

Game mechanics are described by game components, behavior and control mechanisms, and defining the actions a user can implement within a game system to achieve a set goal while following the game system's set of rules [10, 11]. The game mechanics need to facilitate a positive experience with the game. Game mechanics constitute an element of gamification.

The story of a game stands for the goals, obstacles and conflicts a player faces in a game system. This element is an essential part of gamification, as any gamified system should have a clear goal for the user and build the user's journey.

Game aesthetics plays a major role in creating the player experience with the game. The aesthetics stand for a combination of representation tools that contain information necessary for the player to experience control over the actions [11]. Therefore, aesthetics is an essential part of a gamified system, since it is the touch point of the user with gamification due to its visibility.

Dynamics are generated by the application of specific mechanics and in response to other player interactions or expected interactions [12]. It is the run-time behavior of the mechanics, depending on player inputs and each other's outputs over time, and can be viewed as the pattern of play. Typical dynamics found in games are constraints, emotions, narrative, progression, and relationships [13].

Mechanics, dynamics and aesthetics (MDA) are elements of game design framework [14]. From designer's point of view, the mechanics lead to dynamic system behavior that results in an aesthetic experience when the user interacts with the system.

Gamification and learning

Virtual Learning Environments and Learning Management Systems are commonly used for the implementation of gamification in education. This is because they typically provide all of the functionality required to support gamification activities in learning. There are three basic parts in most games: goal-focused activity, reward mechanisms, and progress tracking [15].

Activities in games are typically goal-oriented with a clearly defined combination of events, accomplishments and a number of obstacles to overcome in order to complete the activity [16]. Games are generally structured so that players have various "levels" of goals. Generally, the requirements of each "level" of goal in a game gets increasingly harder from completing initial tasks until completing the game. This allows players in games to learn and practice skills, prior to having to demonstrate mastery of those skills in the most challenging parts of the game [17]. From previous definitions, it is clear to see the similarity between games and learning, with players/learners being directed to undertake tasks in order to achieve a desired outcome, moving to the next level/mission in the case of a game, or complete understanding a complex topic in the case of education.

Course activities can be designed as game activities. For instance, before completing a course, learners must complete several modules. To complete a module, several topics must be completed. In order to complete a topic, several objectives must be finished. And finally, each objective requires several goals to be completed. Course goals can be can be defined as game goals [18] and course activities can be designed as (interactive) game activities.

Most common game reward mechanics are Points, Leaderboards and Achievements [3, 19, 20]. Points are used in games to report performance and achievements. Playing a game to "win" is very similar to student commenting to get a better grade. The easiest way to integrate Points is to bind them with levels of the game. Levels in the course can be seen as lessons or learning units. Also, Levels can be related with the difficulty of the game and can be used for grading students' activities. Leaderboards are lists of players according to their success within the game. For example student's grades are points and form the score of player listed on the leaderboard. Achievements gives recognition of the activities completed by the player. Usually achievements are icons displayed publicly on online profiles of the people. Open Badges are emerging trend that reveals benefits for traditional institutions and alternative learning programs alike. The Open Badge standard allows any person or organization to define a badge (achievement) to recognize knowledge or skills represented by that particular badge [21].

Progress tracking is necessary element of each game. Method of progress tracking is analogous to the provision of feedback within education. An important part of providing feedback to users in games is to let them know how much progress they've made. It is also

important to measure progress at multiple levels. If the course consists of several modules, and within each module there are several topics, progress tracking needs to be implemented at each of these levels. There are many ways to represent this, but the most effective are always represented graphically. One of the most effective ways to show progress in games is through character upgrades or progress bars [17].

3. CURRENT STATUS OF USING GAMIFICATION IN HIGHER EDUCATION

Teachers and instructors had often been struggling with keeping students' motivation and concentration to the course. It is the fact that students, especially nowadays, often do a lot of things in classroom except of learning. That is why many universities and academic institutions are searching for a way to increase the engagement among students and to keep them motivated and interested. One of the methods they are trying is implementing game elements in their courses. In section II we gave an overview of game mechanics and elements. In this section we are analyzing relevant studies on gamification in higher education in order to see which game elements were implemented and which of them had the biggest impact on participants' cognitive and emotional behavior. Later on we will discuss the research results of gamification approaches within higher education.

Table 1 demonstrates the relatively large variety of different elements tested in the examined studies, although Experience Points (XPs), leaderboards, levels and feedback were clearly the most frequently found variants.

Table 1: Overview of examined studies and game elements they used (elements used in a study are marked by "+" sign)

Game elements	Studies, by reference							
	[19]	[20]	[22]	[23]	[24]	[25]	[26]	[27]
Time track			+				+	+
Avatars	+	+			+	+		
XPs	+	+			+	+	+	+
Competition	+	+		+				+
Collaboration	+	+						
Scoreboard	+	+			+	+		
Levels	+	+	+	+		+		+
Badges			+		+		+	+
Progress bar				+	+	+		
Feedback	+	+		+	+	+		
Leaderboard		+		+	+			+

Overview of analyzed studies

Most of the examined studies, except a study from Tallinn University by Sillaots [19], incorporated game elements into their online learning platforms. In that study the whole course took place in physical classroom. They turned their traditional course called Research methods into a game. Course had eight game elements. Course started with introducing the course *goals* (not presented in table 1). *Avatars* – students could pick and use their own nicknames that were related with the course content. Every individual or group activity generated certain amount of *XPs*, based on which students where listed in *scoreboards*. *Levels* were presenting grades that were based on XPs. During the whole course accent was on the on the team work (*cooperation*) and *competition* between groups. *Feedback* was given orally – once the student or group finished their task others could immediately give their opinion and comments.

Once the course was finished, they gave students an online survey. They wanted to collect students' comments and find an answer to question "did game elements have an impact on your motivation and engagement?". Of students who took the course 89% completed the survey. Generally, implementation of all game elements, except avatars, was successful or partially successful (table 2).

The same author from study [19], Sillaots made one more research in field of "gamification in higher education" [20]. In that study he used the same game elements but this time in an online course. What he added was the game vocabulary instead of pedagogical. For example students were called players, teacher was game master, assignments were missions, exam was a "big boss fight", grades were levels etc. The principles of incorporating game mechanisms were mainly the same but results were not (table 2).

Another study that showed progress in increasing motivation with gamification was a Peer Wise study [22]. In this study, researchers tried to incorporate an award-winning web platform into their online course. Peer Wise is a free tool that enables students to create, share and moderate a repository of questions and answers. Students could create their own questions on any topic, offer answers (MCQ), participate in online discussions and rate other students and their topics. Authors used *badges* – users could earn different badges/awards based on specific actions that were separated in groups.

In study [23] researches gamified their "Qualification for users of ICT" course, a transversal course in which students with different grades learned how to use common ICT tools. Through their work, researchers used *levels* - lessons were organized in a tree-like hierarchy; requiring constant participation and providing constant *feedback*; also, a virtual award system was created that reacted positively when a task was finished. They made an achievement *leaderboard*, so students could compete to accomplish higher ranking.

Study from Faculty of Electronics [24] is another example where researchers incorporated several game elements in their online course. For example, they added a personal profile identity for each participant (*avatars*). For tracking the overall learning progress they developed *leaderboard*, where students were ranked based on *XPs* they earned during the class. Also, they implemented *progress bar* and instant *feedback*, so students could track their improvement continuously.

Similar to other studies, JFDI Academy [25] included basic game mechanics such as *XPs*, which allowed students to level up and compete on *a leaderboard* with other students. Similarly to study [20], they also used game vocabulary: assignments were called "missions", bonus questions were labeled "side quests", and class participation and attendance, as well as some other terminology, used phrases from "Star Wars" universe. The course was narrated from a third-person perspective and comic strips started each mission. Through the auto-grading system, instructors were also able to receive *feedback* on a student's progress by seeing how many times a student tried a question, what they did wrong, and the average time per assignment. Students also had the opportunity to raise questions or concerns regarding the assignment, by posting comments on Facebook or within the program, which enabled instructors to help them in a timely manner.

4. DISCUSSION

To be able to identify wheatear the gamification of course had an impact on student motivation and engagement, all of the studies, without exception, choose the same measurement methodology: student survey.

In those surveys they usually had closed type questions with some open type questions for comments or general opinions. The most used marking strategy was Likert's scale, used in [19, 20, 22 – 24], however in studies [25 – 27] descriptive results were given. Table 2 displays the reported findings in the analyzed studies.

Table 2: Estimate of impact on students' motivation by game elements

Game elements	Studies, by reference							
	[19]	[20]	[22]	[23]	[24]	[25]	[26]	[27]
Time track		N	N				NI	NI
Avatars	N	N			P	NI		
Extra points	P	P			P	P	P	P
Competition	P	N		NI				NI
Collaboration	P	NI			P			
Scoreboard	P	P			P	P		
Levels	P	P	N	NI		NI		P
Badges			P		P		P	P
Progress bar				N	P	P		
Feedback	P	P		P	P	P		
Leaderboard		N		N	P		NI	

Meaning of the symbols is: P – Positive impact; N – Negative impact; NI – no measured impact/no significant impact.

All of the studies in education/learning contexts considered the learning outcomes of gamification as mostly positive in terms of increased motivation and engagement in the learning tasks as well as enjoyment over them.

The most successfully implemented were XPs, badges, scoreboards and feedback that had positive impact in all of the examined studies. We did not find surprising the fact that badges and XPs invoked positive reaction in students, as there is nothing negative about awarding someone for successfully finishing a task. Still, it is very important to keep balance between given effort and amount of points/badges they get for current assignment. Even though feedback was implemented differently in studies, in all of them students enjoyed having clear overview about their progress during the entire course.

As we speak about negative or poor impact on students' motivation we point out: avatars, time track and competition. The use of avatar did not cause stronger immersion into the course [25] where students agreed that it did not change their behavior. Designing avatars was fun and entertaining [24], but on the other side a lot of participants found it silly, embarrassing and even distracting [19, 20]. Time track created negative effect mostly because students felt pressure, especially in cases when the reason for failing was not lack of knowledge but time. Still, we do not recommend completely removing time track from gamified courses: it should rather be better implemented and tested with different students, ensuring that all of the participants have enough time to finish a task, considering that they have the necessary amount of relevant knowledge and/or experience.

Results showed that scoreboards generated strong sense of competition and raised students' motivation to achieve more [19, 20, 24, 25]. Still, competition-like elements as scoreboards and leaderboards should be implemented with care, because "transparent results" may have negative impact on some learners, who do not feel comfortable knowing that anyone can see their achievement, or just do not like to compete [20, 23, 26]. In favor of, competition was found positive only in one study [19]. This could be attributed to the fact that the course was held in real classroom and required physical presence of all participants. In study [23] a student was quoted as saying: "I prefer traditional activities because I don't think that leader boards are a good representation of who gets more knowledge about the course," and another who states: "I think that it would be more interesting to improve the traditional version, instead of making competitions."

Students rather appreciated that the format of the game was primarily based on collaboration [19, 24] and not on competition. The main reason is that when students are gathered in groups there is an equal chance for participation and contribution in group work for both more and less skillful students. Only then competition may be introduced at group level, opposing to mostly negatively scored competition on individual level [20, 23, 27].

5. CONCLUSION

The important part of successful gamification is content and learning material. Because of learning being a linear process we suggest material to be given in linear way, in a sense that student should not be able to see the next step before they (successfully) finish the previous one. On the other hand, students must have all the material and

literature necessary for task to be finished. In other words, student must not be obstructed in accomplishing the goal by nothing other than their knowledge and/or skills. Considering the fact that all of the mentioned studies gamified some practical tasks, we may argue that gamified activities can help develop practical competences, but there is still no positive proof on whether gamification can improve mastering the theoretical material.

Examined studies showed that there was significant number of students who did not want to participate in gamified version of courses. That is why learning by game should always be optional, not mandatory. Final grades and real results should not depend on game-learning. In implementing game elements in online courses researches should not forget that main goal is to increase students' motivation and to add a value to traditional teaching and learning – not to play.

From the studies that were analyzed we have identified the following future research challenges:

1. Further work towards agreement on the relationship between academic achievement and gamification is needed.
2. As gamification is being used to make a social impact on participants, future researchers could take into account analyzing the impact of gamifying team tasks. Collaborative work could be implemented, where students' points and progress would depend on team work.
3. In the analyzed studies no testing was done from a teachers' point of view. Further efforts are needed to measure the impact of teaching process in educational context and in which way teachers could improve their program by gamifying their course literature and material.

None of the analyzed studies had neither control nor parallel groups, thus provided data and findings rely on subjective opinions and emotions of participants. Also, it is very important to note that same game elements implemented in the same or similar manner but in different surroundings or courses may lead to opposing effects, as seen in studies [19. 20]. Introducing control and/or parallel groups in future research should help identify possible new variables and help with both problems.

LITERATURE

[1] J. Anderson, L. Rainie, *Gamification: Experts expect 'game layers' to expand in the future, with positive and negative results*, May 2012

[2] *A brief history of gamification: part III – the definitions*, online blog: http://edulearning2.blogspot.com/2014/03/a-brief-history-of-gamification-part.html, accessed on July 1, 2015

[3] I. Glover, *Play as you learn: gamification as a technique for motivating learners*, in Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications, AACE, Chesapeake, VA, 2013, pp. 1999-2008

[4] *The difference between gamification and game based learning*, online blog: http://inservice.ascd.org/the-difference-between-gamification-and-game-based-learning, accessed on August 16, 2015

[5] *Gamification vs. Game- based learning: Can you tell the difference?*, online blog: http://elearningindustry.com/gamification-vs-game-based-elearning-can-you-tell-the-difference, accessed on August 16, 2015

[6] B. Kim, H. Park, Y. Baek, *Not just fun, but serious strategies: Using meta-cognitive strategies in game-based learning*, Computers & Education, 52(4), 2009, pp. 800-810

[7] J. Hamari, J. Koivisto, H.Sarsa, *Does gamification work? – A literature review of empirical studies on gamification*, 47th Hawaii International Conference on System Sciences, Hawaii, USA, January 06-09, 2014

[8] G. Barata, S. Gama, J. Jorge, D. Gonçalves, *Engaging engineering students with gamification*, 5th International Conference Games and Virtual Worlds for Serious Applications (VS-GAMES), September 11-13, 2013

[9] *The Glossary of Educational Reform*, online resource: http://edglossary.org/student-engagement, accessed on June 19, 2015

[10] J. Schell, *The Art of Game Design: A Book of Lenses*, Burlington (MA): Morgan Kaufmann Publishers, 2008

[11] Z. Kosmadoudi, T. Lim, J. Ritchie, S. Louchart, Y. Liu, R. Sung, *Engineering design using game-enhanced CAD: The potential to augment the user experience with game elements*, Computer-Aided Design, 45, 2013, pp. 777-795.

[12] D. Codish, G. Ravid, *Personality Based Gamification – Educational Gamification for Extroverts and Introverts*, In Proceedings of the 9th CHAIS Conference for the Study of Innovation and Learning Technologies: Learning in the Technological Era, 2014, pp. 36-44

[13] K. Werbach, D. Hunter, *For the win: How game thinking can revolutionize your business*, Philadelphia, PA: Wharton Digital Press, 2012

[14] R. Hunicke, M. LeBlanc, R. Zubek, *MDA: A formal approach to game design and game research*, paper presented at the AAAI Workshop on Challenges in Game AI, San Jose, CA, 2004, retrieved on July 03, 2015 from: http://www.cs.northwestern.edu/~hunicke/MDA.pdf

[15] M. D. Dickey, *Engaging by design: how engagement strategies in popular computer and video games can inform instructional design*, Education Training Research and Development, 53 (2), 2005, pp. 67-83, retrieved on June 16, 2015 from: http://medicina.iztacala.unam.mx/medicina/Engaging%20by%20design.pdf

[16] S. Smith-Robbins, *This Game Sucks: How to Improve the Gamification of Education*, Educause Review, 46 (1), 2011, pp.58-59, retrieved on July 05, 2015 from: http://net.educause.edu/ir/library/pdf/ERM1117.pdf

[17] R. Raymer, *Gamification: Using Game Mechanics to Enhance eLearning*, retrieved on July 07, 2015 from: http://elearnmag.acm.org/featured.cfm?aid=2031772

[18] E. Adams, *Fundamentals of Game Design*, Second edt., New Riders, 2009, p. 700

[19] M. Sillaots, *Gamification of Higher Education by the Example of Course of Research Methods*, in Proceedings of the 13th International Conference on Web-based Learning – ICWL, Tallinn, Estonia, August 14-17, 2014, pp. 106–115

[20] M. Sillaots, *Gamification of Higher Education by the Example of Computer Games Course*, The Seventh International Conference on Mobile, Hybrid, and On-line Learning – eLmL 2015, Lisbon, Portugal, February 22-27, 2015, retrieved on July 08, 2015 from http://www.thinkmind.org/index.php?view=article&articleid=elml_2015_4_20_50048.

[21] *Open Badges for Higher education*, retrieved on July 09, 2015, from https://www.pearsoned.com/wp-content/uploads/Open-Badges-for-Higher-Education.pdf

[22] P. Denny, *The Effect of Virtual Achievements on Student Engagement,* CHI 2013: Changing Perspectives, Paris, France, pp. 5-8

[23] A. Domínguez, J. Saenz-de-Navarrete, L. de-Marcos, L. Fernández-Sanz, C. Pagés, J. Martínez-Herráiz, *Gamifying learning experiences: Practical implications and outcomes*, Computers & Education 63, 2013, pp 380-392,

[24] V. Todor, D. Pitică, *The gamification of the study of electronics in dedicated e–learning platforms*, in Proceedings of 36th International Spring Seminar on Electronics Technology (ISSE), Romania, 2013

[25] B. Leong, *Gamification: How to do it Right and Why it is No Good*, Technology in Pedagogy, No. 13, November 2012

[26] W. Hsin-Yuan Huang, D. Soman, *A Practitioner's Guide to Gamification of Education*, University of Toronto, 2013

[27] Z. Bodnar, *Using Game Mechanics to Enhance Leadership Education*, eLearn magazine, 2014, retrieved on July 1, 2015 from: http://elearnmag.acm.org/archive.cfm?aid=2583703