

# Developing a Customizable Serious Game and Its Applicability in the Classroom

Anita Kéri

**Abstract**—Recent developments in the field of education have led to a renewed interest in teaching methodologies and practices. Gamification is fast becoming a key instrument in the education of new generations and besides other methods, serious games have become the center of attention. Ready-built serious games are available for most higher education institutions to buy and implement. However, monetary restraints and the unalterable nature of the games might deter most higher education institutions from the application of these serious games. Therefore, there is a continuously growing need for a customizable serious game that has been developed based on a concrete need analysis and experts' opinion. There has been little evidence so far of serious games that have been created based on relevant and current need analysis from higher education institution teachers, professional practitioners and students themselves. Therefore, the aim of this current paper is to analyze the needs of higher education institution educators with special emphasis on their needs, the applicability of serious games in their classrooms, and exploring options for the development of a customizable serious game framework. The paper undertakes to analyze workshop discussions on implementing serious games in education and propose a customizable serious game framework applicable in the education of the new generation. Research results show that the most important feature of a serious game is its customizability. The fact that practitioners are able to manage different scenarios and upload their own content to a game seems to be a key to the increasingly widespread application of serious games in the classroom.

**Keywords**—Education, gamification, game-based learning, serious games.

## I. INTRODUCTION

GAMIFICATION has been a continuously studied topic in recent years. Researchers have an extensive interest in it, as some of them see gamification as the future of education. Even though there are several definitions of gamification, perhaps the most widely used term states that gamification is “the use of game design elements and game mechanics in non-game contexts”, while improving user experience (UX) [1].

Gamification in general could not only be applied in education. However, this paper focuses on gamification in education, more specifically in higher education and entrepreneurship education.

After defining what is meant by serious games, the already existing games are reviewed and summarized based on their features and applicability in entrepreneurship education. Then, the Entrecomp framework of the European Union is introduced, based on which the serious game ‘Entrepoly’ is being prepared in the framework of a European Union

Erasmus+ project, ISGEE – Implementing Serious Games in Entrepreneurship Education. A need analysis is conducted with higher education teachers to get relevant feedback on their views on the applicability of a serious game in the higher education classroom. The revision of secondary literature, the existing serious games and a need analysis of stakeholders provide an opportunity to develop a new serious game especially for entrepreneurship education.

This paper intends to introduce the literature review, serious game overview and need analysis of HEI (Higher Education Institution) teachers.

## II. GAMIFICATION AND SERIOUS GAMES

Gamification has been at the center of research interest in the previous years. Several different definitions surfaced, but one of the earliest could be attributed to Brett Trill, who stated that gamification is “taking game mechanics and applying them to other web properties to increase engagement” [2]. While according to others, it is “the adoption of game technology and game design methods outside of the games industry” [3] or it is “the process of using game thinking and game mechanics to solve problems and engage users” [4].

Reference [1] includes a definition which was later challenged and a more complex definition was needed. Gamification was later defined as “a process of enhancing a service with affordances for gameful experiences in order to support user's overall value creation” [5].

In the current paper, the latter definition is used, affordance meaning the “possibilities that allow actors to take actions to satisfy their needs” [6].

Serious games are considered to be the tools of gamification, as they are defined as “games (that) have been developed for the broader purposes of training and behavior change in business, industry, marketing, healthcare and government NGOs as well as in education” [7].

It should be noted that the concept of ‘serious games’ is often used interchangeably with ‘game-based learning’, the difference being that serious games are developed for specific learning outcomes [7].

Most serious games have three main elements: Mechanical (progression, instant feedback, etc.), personal (status, visibility, leaderboards, etc.) and emotional elements (psychological state or flow), and gamification refers to using any of these elements [8]. Different approaches have been considered to define gamification, depending on which gamification elements were chosen for each definition [9].

Reference [10] has investigated 1164 research papers on gamification and found that the most common types of

Anita Kéri is with the University of Szeged, Faculty of Economics and Business Administration, Szeged, H-6720 Hungary (phone: +36-70-425-2238; e-mail: kerianita@eco.u-szeged.hu).

research in gamification are development of proof-of-concept prototypes (computer science education, ecological lifestyles and sustainability and motivational tools); theoretical papers arguing the components or applicability; studies presenting the eLearning concepts such as massive open online courses. The current paper adds to the literature by analyzing the needs of HEI educators.

#### *A. Gamification in Education*

Another large number of scientists review the effectiveness of gamification in education [11]. Reference [12] states that education and learning is the most studied context of gamification implementation (over almost half of the papers studied). One of the reasons why gamification is such a field of interest at the moment is because the needs of the new generation, in other words, the digital natives, challenge educators, as they demand new and innovative learning methods and pedagogical models. The traditional ways of teaching seem to be ineffective for the young students [13].

Reference [13] states that students nowadays are searching for interactive, fast-paces, visually stimulating and engaging learning methods. The key to understanding them and offering all these is to create serious games for them, which are such games in which education is the primary goal, rather than entertainment, and can facilitate learning from the experiences of others. In the context of education,

“SGs have learning goals and structure, but in addition are adaptive and interactive and most importantly they provide enjoyment, pleasure, motivation, ego gratification (through competition and winning) and emotion, in order to achieve learner engagement and involvement” [13].

At the same time, teachers can monitor students’ data and track their progress [14].

In the educational context, gamification incorporates game-centered thinking and game elements. Therefore, gamification is usually applied in learning to enhance learning outcomes and motivate students [15]-[19]. Reference [15] argues that gamification has a great potential to become an impressive force in education, and can include the development of skills such as creativity, critical thinking, collaboration, and communication.

Gamification in education can be divided into two different categories, which are gamified courses – course-long gamification, typically applied at the university level – and gamified activities – supplementing teaching instead of replacing it [8].

Gamification principles in education most usually include elements of the game such as visible user status (reputation and recognition, social engagement, freedom to fail (low risk submission), goals, challenges, quests and immediate feedback. Moreover, the most used game mechanics include badges, points, levels and leaderboards. These gamification methods are most used in the subjects of computer science, information technology, programming, mathematics, science and engineering [20].

The more and more widespread application of serious

games and the continuously growing number of papers on the topic conclude that the effects of these games seem to be positive [20]. The main benefits of gamification in education are called the ‘four freedoms’, which include the freedom to fail, freedom to experiment, freedom to assume different identities, and freedom to effort. It would also allow automated teaching and individualized learning. Potential challenges of gamification include distracted attention of the learner, the social tension of being a newbie, and extrinsic rewards (short-term rewards or badges) [8]. Additional barriers could be educational, technical and financial [21].

Serious games can have several learning outcomes and they were categorized and it was found that knowledge acquisition and understanding, perceptual and cognitive skills, motor skills, behavior change, soft skills and social skills, affective and motivational outcomes, physiological outcomes can be affected [7]. Therefore, gamification and serious games should be studied in the context of higher education as well.

#### *B. Gamification in Higher Education*

Similarly to the research about gamification, in general, scholars have shown a keen interest in studying the concept in the higher educational context as well. The main reason is that teachers are challenged by the new generation who have different needs and preferences in terms of education. Teachers have been using new and different teaching methods to adapt in higher education too by adapting game elements in the learning process.

The higher education gamification process started in the 21<sup>st</sup> century, when the usage of game-like elements (points, rewards, awards) began to take off, as classes with gamification elements had significantly better results and output higher quality work than those without [22]. Especially in an academic environment, gamification can be positively applied to an online context [23].

Reference [19] states that a successful gamification model in higher education includes three main aspects that have to be carefully planned and weighted. These elements are mechanics (player’s progress, tasks, controls and features), dynamics (rewards, tasks, controls, features), and aesthetics (sensation, challenge, discovery, narrative). If a game is successful, it would have a positive effect on student performance and attitudes at a university level [24]. Reference [25] also looked at the motivational changes aroused by gamification and found that both teachers and students could confirm that they had an increasing motivation and fun towards learning.

Reference [26] researched the motivation of students who experienced game-based learning, but did not find significant differences between the pre- and post-motivation of students.

Reference [27] investigated the applicability of gamification in higher education and found that it could successfully be applied in several study-fields, such as business studies, communication, computing, entrepreneurship, languages, engineering, mechanical engineering, nursing, pedagogy, psychology and science.

Several other studies were concerned with the applicability

of gamification in higher education and most of them found that the gamification approach resulted in better academic achievement, engagement and attitude [28]-[30]. Based on these results, it can be concluded that entrepreneurship is a field which is suitable for the application of gamification and serious games.

### C. Gamification in Entrepreneurship Education

The literature seemed to lack an extensive study of serious games in entrepreneurship education even though entrepreneurship and its education is one of the key issues today. However, there is a renewed interest in entrepreneurship education and relevant research started to appear. Reference [27] recognized that gamified learning is being increasingly studied and applied in business and science studies.

Entrepreneurial learning and related serious games initially have been studied [31], [32]. The games' characteristics include fun, play, rules, goals, interactivity, outcomes or feedback, conflict, and problem solving [33].

The essence of gamification in entrepreneurship education is that the games are not directly associated with knowledge and skills, because the games affect student behavior, commitment and motivation, which then would have an effect on knowledge and skills [34]. Moreover, most serious games help developing the entrepreneurial mindset, motivation, skills, innovation and ability of finding new solutions and understanding others' needs, while fostering lifelong learning. If the curriculum is difficult to be explained in words or in the traditional educational system, serious games can help [35].

Developing games specifically for this education is thought to be challenging. However, there are certain benefits once it is successfully implemented, such as studying with modern technology, modularity and flexibility of the game, inclusion of both national and international students, using university alliances and contacts to develop the game, and learning outcome analysis [36].

Reference [37] is of the most recent studies and claims that different types of learning can be relevant in gamified environments, such as active learning (learning by doing), entrepreneurial preparedness (game adds to the learner's experience), reflective learning (reflection encouraged), situated learning (game places learners into a situational context), vicarious learning (level of involvement of peers, mentors or instructors), and affective learning (emotional engagement). Furthermore, a more exact definition of serious games within the entrepreneurship education has been determined.

"Serious games can be defined as computer- based learning simulations that engage players in realistic activities designed to increase knowledge, improve skills, and enable positive learning outcomes. While such simulations are not always "games" per se, the main focus is the use of a digital game-based learning environment to support "serious" outcomes. Despite having an entertainment component, these simulations are designed to promote learning, primarily by leveraging

a narrative or story centered in an entrepreneurial setting. Serious games also differ from entertainment games as they focus on problem-solving tasks and incorporate the imperfect nature of interactions with the real world." [37].

The effects of serious games have also been studied in entrepreneurship education. Reference [38] found that the perceived competence of students is higher after playing the game. Their business-related knowledge is higher and according to the longitudinal results, game satisfaction is high. However, the motivation to start an own business is occasionally lower.

Based on the literature review, it can be concluded that several different serious games exist for entrepreneurship education. Therefore, the next chapter summarizes and analyses these serious games and their applicability in the classroom, with special emphasis on their advantages and disadvantages.

### III. REVISION OF SERIOUS GAMES

Regarding serious games, several steps have been taken to provide students with the appropriate tool for education in the future. In this chapter, already existing games are reviewed [39], [37].

*Entrepreneurship Simulation: The Startup Game* is a multi-player game simulating the establishment of a new company. Students can play the roles of founders, investors and employees in order to reach the success of the company. *Hot Shot Business* (HSB) is a Flash game introducing the entrepreneurship environment to students. Similarly to the previous game, students can open and run their own business, in which they make decisions from very early on, from acquiring their capital to advertising their new business.

*Industry Player* is a massive online real-time game, in which the student has the role of the CEO of a multinational holding company. They can create investments in 245 different industries and compete in real-time with other players on the market. The game has 10 levels, during which there is heavy competition in the market. The aim for the student is to manage the company in the best way, as the game becomes more and more challenging.

*INNOV8* is an IBM Business Process Management (BPM) simulation game, suitable for IT and business players. The aim of the game is to demonstrate the possibility of building a smarter world. The game scenarios include Smarter Traffic, Smarter Customer Service, and Smarter Supply Chains. The virtual world is in a 3D format, in which players can cooperate to solve the business problems and to see how each decision affects their businesses. The 3D version helps understanding the company, while the online single-player game can pursue competition.

*SimVenture* is a single player simulation game in which the player can manage a small computer retail business over a period of one simulated year, or until bankruptcy. The game offers real-world examples without a time limit. Business parameters are shown at the end of each month. Different difficulty levels are available with given scenarios. *The*

*GoVenture Small Business* is a similar game, with more pleasant graphics and unexpected events, in which the player could run a sandwich shop, café, music store, or an ice-cream store. An important factor of decision making is time, as it passes by. It is also more focused than *SimVenture*, because players can select the main business management features. One of the most important features is that it offers a multiplayer mode of up to 16 players.

*Marketplace* is a business simulation game especially used for training in business schools and corporations. It comprises of several modules which represent different business courses. For example, the *Venture* strategy simulation module is about running a start-up, in which students are provided with the capital to start the business. The money could be used to build the company from zero. While in the *Business Management* simulation module, students should make decisions regarding accounting, finance, advanced marketing, and profitability. The newest version of the game includes a 3D environment, in which students can compete with their peers, so it allows multiplayer mode.

*MetaVals* is a quiz manager, used to test the students' knowledge in the field of business. The game is configurable and has individual and collaborative parts too. The critical factor of the game is speed, which makes decision making difficult.

*Team Up* is another 3D game, designed for team training and assessment. The scenario of the game is that four players are on the island and their communication and problem-solving skills can help them to survive. The *Balance Sheet* is a financial analytical game which shows students a life-based problem that has to be solved from a practical viewpoint, on a balance sheet. This game also includes a time limit, which makes the students feel pressed for time.

The *Enterprise Game* is a complex business simulation game of running an enterprise, in which students have to match the customers' and market's needs to create profit while ensuring employees' motivation. Time is also of essence in this game, as quick actions can help to save the company.

In *Supermarketa*, students can try being a manager of a supermarket that has cash flow problems and they have to save the supermarket, while trying to manage operations.

*Interpretive Solutions* also deals with retail simulation, and its learning areas include strategy, analysis, marketing, accounting, and other business issues. The student is the founder of the enterprise and can compete with other students.

Based on the extensive number of serious games applied in education, it can be seen that their importance is unquestionable. Therefore, it is essential to bring the best features of these games into a new serious game that is being developed by the ISGEE project.

#### IV. SERIOUS GAMES IN EUROPE

Entrepreneurship competences and education have been a neglected field of studies in the past. Currently, there is a growing interest and an urging need to develop entrepreneurship competences of students, as it can provide them with essential skills for their future working lives.

Universities are considered to be actors in global economic relationships, even though the curriculum mostly lacks entrepreneurship-related education. There is a growing concern for Europe to handle entrepreneurship and its education more seriously, while universities are pressured to add entrepreneurship to their curriculum. Europe lags behind other countries such as the USA and Canada, because only a small portion of students learn entrepreneurship and it is only taught in the field of business. However, it would be crucial at other fields of sciences as well, as new business ideas or inventions can stem from there too [40].

The European Union believes that entrepreneurship education is key and has to be fostered. Therefore, there are projects aiming at developing serious games in education, with special emphasis on entrepreneurship education. An earlier project about 'Stimulating Entrepreneurship through Serious Games' (2011-2013) was conducted within the framework of the Erasmus Lifelong Learning (LLL) program, including project partners from the University of Genoa, the Italian National Research Council, the Delft University of Technology, and ESADE Business School Barcelona. The aim of the project was to develop game-based entrepreneurship training [41].

The current Erasmus+ project of the EU is the ISGEE project – Implementing Serious Games in Entrepreneurship Education, which includes partners from the University of Szeged, Hungary, West University of Timisoara, Romania, Technical University of Ostrava, Czech Republic, Stucum, Spain, Univations from Germany, Expertissa from Romania, Nottingham Trent University from the UK, and Mongolian University of Life Sciences. The aim of the project is to develop a customizable serious game to be applied in entrepreneurship education free of charge. The project builds on the theoretical framework of the European Union, namely the Entrecomp framework, which enlists the competences of entrepreneurship.

As the current paper aims to introduce the need analysis results of the ISGEE project, the Entrecomp framework is introduced first. Fig. 1 shows the Entrecomp framework wheel that has been developed by the European Union. The framework has three main elements that are ideas and opportunities, resources and into action. These include other sub-categories such as spotting opportunities, creativity, vision, valuing ideas, or ethical and sustainable thinking. All the competences were taken into account while conducting the need analysis of the colleagues in higher education.

#### V. NEED ANALYSIS OF HEI TEACHERS

The ISGEE project has three main stakeholders, teachers, students and business partners. The current paper aims to introduce the results of the need analysis among higher education teachers through two workshops. The first one was held at the University of Szeged, 05 December 2018, and the second one at the Technical University of Ostrava, 11 January 2019. Altogether, 25 teachers participated in the workshop all of them teaching in economic education. Results of the workshops are introduced according to three main categories:

General views and experience with gamification, role of gamification in education, and the advantages of serious games in the classroom. At the end, general implications and suggestions are summarized.

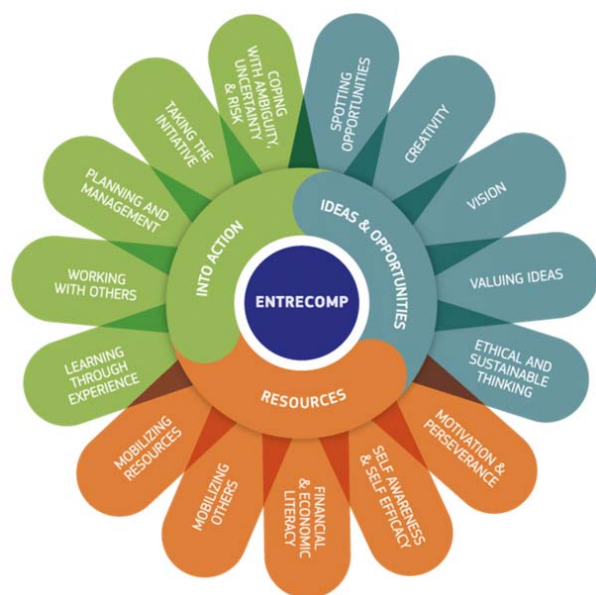


Fig. 1 The Entrecomp framework of the European Union

#### *A. General Views on and Previous Experience with Gamification*

Both gamification and serious games were terms that some of the participants have already heard. Teachers associate gamification with “learning through playing”, “implementation of the learning material into games”, or “the use of games in teaching”. There is a bit of confusion about the term itself, because some teachers regard simple games, such as self-developed board games gamification.

Regarding previous experience and usage of serious games, only the minority of participants have actual experience with applying digital gamification in education. Those colleagues who have experience, mainly used simpler (text) platforms or games, but could enlist many applications that can be used in education and that they regularly use in education.

They mentioned five different games, one of which is the banking game, where students take part in the management of a bank. The second game they mentioned was team cooperation game, which lets students get a delegated role within the company. The third game was an HR management game, which included finding the appropriate skills of potential candidates in the recruitment process. Another game was a software development game that allows students to be involved in the software development process, while the last game mentioned was an investment game. Only one participant could name concrete games, which were Marketplace, JaTitan, Markethero.

As a conclusion, the majority of teachers know about the term gamification, but the exact meaning behind it is not always clear. They can name many software and applications

they use to make learning more joyful for students, but serious games are rarely used and less known.

#### *B. The Role of Gamification in Education – Risks and Opportunities*

Participants were mainly open and positive towards the concept of gamification and serious games. They found many positive effects of gamification: “The game is able to develop application skills, ability to teamwork and promotes competition”, “The game allows a natural division of roles”, “The game will help reveal the characteristics and abilities of students”, “The game can convince students that theory and practice goes hand in hand”, “Games provide a great background for the research. We can observe the behavior of students, which can be an inspiration to upgrade games”.

On the other hand, one participant stated that if the game provides students with a PDF file, then students would just ignore the game and go for the book instead. Therefore, it is questionable whether a serious game can transfer hard skills to students. Moreover, some participants were concerned about the role of the teachers. Once the game is brought into class, they did not know what happens to the teacher, while students are playing. Additionally, real-life risk cannot be simulated in a game, which is a barrier when developing a game aiming at developing soft skills. They stated that “the main downside is that students may over time find out the principles of the game and start to make decisions mechanically. They cease to think” and “Competition during the playing of the game can lead to fights in the group”.

Participants were asked what ideas they have for the development for serious games. They identified that activities have to be subject-related, so students have to know the notions and the basic theoretical background in order to be able to play. Adding a spying element could raise excitement, if you have to ask for some information from others or from the game. A special ‘user guide’ for each player could be useful and would introduce avatars of players.

#### *C. What a Digital Game Is Good for in General*

When teachers were asked about what a digital serious game is good for, they enlisted certain potential characteristics of a good serious game. First of all, it should provide practice, develop students’ soft skills, and can substitute tests or exams. It is though, not a practical way of transferring study material.

Additionally, students should be able to check their knowledge with the help of the game. The game should be applied and be useful for courses with a high number of students, where individual contact is not feasible. If students play throughout the semester, their progress or lack of progress can be monitored. Moreover, certain game theory examples can be illustrated (prisoner’s dilemma or tragedy of the public) with the game. These can be linked to more than one course.

Serious games do not seem to strengthen the student-teacher relationship, but it could potentially build stronger student-student relationships. Therefore, there should be a common platform, where students can see their own progress and

shows all their subjects in which they can play serious games. Table I shows the purposes serious games can be used for.

TABLE I  
SERIOUS GAMES' MAIN PURPOSES

Target group	Purpose
Students	practice
Students	self-check
Students	personal bonds between students
Teachers	testing students
Teachers	monitoring students
Teachers	illustrating theory with practical examples

Source: Need analysis of the ISGEE project.

#### D. A Serious Game that Can Be Brought to Classes

As one of the primary target group of the 'Entrepoly' is teachers, they were also asked what kind of serious game they would like to bring to their classrooms. Their answers can be grouped into three big categories. These are suggestions about the introduction of the game, game characteristics and game content.

First of all, regarding the *introduction of the game* to classes, the game should have an introduction and a users' guide, which would enable the potential users to understand the logic of the game easily. The reason for this is that social media sites such as YouTube made it natural for them that they take tutorials for granted. If there is a users' manual for teachers, they would also be more likely to accept the game and take it to class. If teachers had the opportunity to customize the game themselves, they would also be more likely to accept it and take time to learn it.

In terms of the *game characteristics*, teachers suggested that competition is a factor that has to be present among students or groups of students. Additionally, the competition can even last a whole semester. There should also be a link between the students, which could be a chatroom, a direct messaging contact or a common platform, which can link courses too. The characters should be customizable in the game, so that students would feel personally connected to their character. They should also be able to collect certain items, such as badges, money and different achievements. The story of the game should be a real-life scenario. "*It is appropriate that there should be a story. The game should represent a real case*". Additionally, the game should have a limited time for certain tasks that would put a pressure on the students, but encourage having the task done in a timely manner. Having a modularly structured game could also enhance the player experience as it would allow students to play a shorter game or a game extended throughout the whole semester.

"It depends on the type of module and type of game.

For some modules it may be appropriate to only play one exercise, in other module game can be played full semester."

Teachers' ideas about the *game content* were also of broad scale. They suggested that for developing negotiation skills, the game can include a scenario where the student meets two different people. The first one is hard to come to terms with one, while the other one accepts every solution. At an

international trade class, the game could be used in intercultural situations, in which the first person is a Chinese partner, the second is a Polish, and the third is American. In HR classes, the script could be that an employee is undermotivated and has to be motivated. Table II summarizes the findings of the required features of a serious game in a classroom.

TABLE II  
HOW TO APPLY SERIOUS GAMES IN A CLASSROOM

Category	Idea
introduction	users' guide for teachers
introduction	users' guide for students
game characteristics	customizable avatar
game characteristics	collectibles (badges, money)
game characteristics	competition
game characteristics	connected students
game characteristics	real-life situation
game characteristics	time limit for decision making
game characteristics	modular structure
game content applicable	negotiations skills, HR, international trade classes

Source: Need analysis of the ISGEE project.

#### VI. 'ENTREPOLY' – A CUSTOMIZABLE SERIOUS GAME

The need analysis of teachers provided valuable feedback for the development of the serious game at hand. The current results will be supplemented with the need analysis of students and business partners too in the future. In this chapter the current results are analyzed and an ideal customizable serious game concept is introduced.

The game might be *suitable* for developing entrepreneurship competences, but much more for introducing entrepreneurial competences and self-check. It should also contain a handbook with a clear description of the game and its mechanics.

The game could be made *attractive* for teachers if it is able to connect students and classes with a high number of students, and can get to those students, who do not attend regular classes. It is also able to strengthen student-student or student-teacher relationships. The interface can become familiar to students after playing at one class. For the second time, they will already know the mechanics. Moreover, the game can link many different topics in a scenario.

A good serious game is *able* to develop soft skills rather than hard skills and is good for students' own self-check. It can also link not only study materials of one course, but several courses too. It should also be able to expose users to failure scenarios. Moreover, a good game is *fun* to play. Collecting badges, ribbons, money, or certain items can bring fun to the learning experience together with an attractive design. Once a game scenario is played, students should be able to replay it, but with various other questions or scenarios. This way, they will not get bored and can play many different times if they want to spend their time on one specific competence.

The risks and potential problems of developing a serious game also have to be taken into account. Not surprisingly, there have been fewer risks and obstacles were found than

advantages. First of all, it consumes a lot of time to prepare and to keep a serious game up-to-date. Setting the rules and scenarios of the game is thought to be extremely challenging, similarly to evaluating the results and getting a standardized game.

TABLE III  
FEATURES OF A GOOD SERIOUS GAME

According to teachers, a good serious game
is attractive for both teachers and students
attracts students who do not attend regular classes
is easy to understand based on its handbook
strengthens the relationship between students and teachers
links different topics at a course
develops soft skills
is good for self-check
is able to link courses
is able to produce failure situations
is consistent regarding the interface
including collectibles (badges, money)
repayable with different scenarios

Source: Need analysis of the ISGEE project

TABLE IV  
POTENTIAL CHALLENGES OF DEVELOPING A SERIOUS GAME

According to teachers, developing a serious game is challenging, because of
time-consuming preparation and maintenance
complicated rule development
problematic evaluation of results
problematic standardization

Source: Need analysis of the ISGEE project

## VII. CONCLUSION

All in all, we can conclude that serious games provide value in education, as students can engage in activities that can make learning fun, while they are learning by doing [31]. Serious games allow student to use an interactive learning environment and develop their entrepreneurial skills relatively risk-free [37].

The aim of the current paper was to uncover the real needs of higher education teachers of a serious game they think is necessary in today's education system. The paper introduced a proposed concept of a currently developing serious game 'Entrepoly', in the framework of the Erasmus+ project of ISGEE (Implementing Serious Games in Entrepreneurship Education). The importance of these findings is not questionable, even though further steps are taken to conduct the need analysis of students and business stakeholders.

## ACKNOWLEDGMENT

A. K. thanks the ISGEE (Implementing Serious Games in Entrepreneurship Education) Erasmus+ project, its manager Szabolcs Prónay and its every member for the support and for making the article possible with their expertise.

## REFERENCES

- [1] S. Deterding, M. Sicart, L. Nacke, K. O'Hara, and D. Dixon, "Gamification: Using Game Design Elements in Non-Gaming Contexts. In Proceedings of the International Conference on Human Factors in Computing Systems", May 7-12, 2011 pp. 4-7. [CHI 2011, Extended Abstracts Volume, Vancouver, BC, Canada].
- [2] B. Terill, "My Coverage of Lobby of the Social Gaming Summit." Retrieved January 9, 2019, from <http://www.bretterill.com/2008/06/my-coverage-of-lobby-of-social-gaming.html>.
- [3] D. Helgason, "2010 Trends – Unity Blog". Retrieved January 9, 2019, from <https://blogs.unity3d.com/2010/01/14/2010-trends/>.
- [4] G. Zichermann, "A Long Engagement and a Shotgun Wedding: Why Engagement is the Power", 2011, Retrieved January 9, 2019, from <https://www.slideshare.net/gzicherm/g-summit-opener>.
- [5] K. Huotari, J. Hamari, "Defining Gamification - A Service Marketing Perspective", 2012, In 16th International Academic Mindtrek Conference pp. 17-22.
- [6] P. Zhang, "Motivational Affordances: Fundamental Reasons for ICT Design and Use", 2008, Communications of the ACM, 51(11), 145-147.
- [7] T. M. Connolly, E. A. Boyle, E. MacArthur, T. Hainey, and J. M. Boyle, "A systematic literature review of empirical evidence on computer games and serious games.", 2012, Computers and Education, 59(2), 661-686. <https://doi.org/10.1016/j.compedu.2012.03.004>.
- [8] Oxford Analytica, "Gamification and the Future of Education". Oxford: Oxford Analytica, 2017, <https://doi.org/10.1016/j.ymgme.2015.09.007>. Obstructive.
- [9] E. Kai, "The Impact of Gamification - Recommending Education Scenarios, International Journal of Emerging Technologies in Learning.", 2013, Vol 8, 15-21, <https://online-journals.org/index.php/i-jet/article/view/2320/2458>.
- [10] J. Kasurinen, A. Knutas, "Publication trends in gamification: A systematic mapping study", 2018, Computer Science Review 27, 33-44.
- [11] D. Gray, S. Brown, and J. Macanuso, "Gamestorming. A Playbook for Innovators, Rulebreakers, and Changemakers." St. Petersburg: Piter. 288p. Toyama, K. (2015). The looming gamification of higher ed. The Chronicle of Higher Education, <https://www.chronicle.com/article/The-Looming-Gamification-of-233992>.
- [12] J. Hamari, J. Koivisto, and H. Sarsa, "Does Gamification Work? — A Literature Review of Empirical Studies on Gamification." In Proceedings of the 47th Hawaii International Conference on System Sciences, Hawaii, USA, January 6-9, 2014.
- [13] D. Pappa, L. Pannese. "Effective design and evaluation of serious games: The case of the e-VITA project." World Summit on Knowledge Society. Springer, Berlin, Heidelberg, 2010.
- [14] G. Kiryakova, N. Angelova, and L. Yordanova, Gamification in education. Proceedings of 9th International Balkan Education and Science Conference, 2014.
- [15] T.L. Kingsley, M.M. Grabner-Hagen, "Gamification Questing to integrate content knowledge, literacy, and 21st-century learning", 2015, Journal of Adolescent & Adult Literacy, volume 59, no 1, 51-61.
- [16] D. Kayımbaşioğlu, B. Oktetin, H. Hacı, "Integration of Gamification Technology in Education", 2016, Procedia Computer Science, Volume 102, Pages 668-676, <https://doi.org/10.1016/j.procs.2016.09.460>.
- [17] M. Aparicio, T. Oliveira, F. Bacao, M. Painho, "Gamification: A Key Determinant of Massive Open Online Course (MOOC) Success", Information and Management, 2016, 56(1), pp 39-54.
- [18] J. Martí-Parreño, E. Méndez-Ibáñez, A. Alonso-Arroyo, "The use of gamification in education: a bibliometric and text mining analysis", Journal of Computer Assisted Learning, 2016, 32,663-676, doi: 10.1111/jcal.1216.
- [19] G. P. Kusuma, E. K. Wigati, Y. Utomo, L. K. Putera Suryapranata, "Analysis of Gamification Models in Education Using MDA Framework", Procedia Computer Science, 2018, Volume 135, 385-392, <https://doi.org/10.1016/j.procs.2018.08.187>.
- [20] D. Dicheva, C. Dichev, G. Agre, and G. Angelova, "Gamification in Education: A Systematic Mapping Study", Educational Technology & Society, 2015, 18(3), 9-22. <https://doi.org/10.1016/j.infsof.2015.03.007>.
- [21] E. Tsekles, J. Cosmas, and A. Aggoun, "Benefits, barriers and guideline recommendations for the implementation of serious games in education for stakeholders and policymakers", British Journal of Educational Technology, 2016, 47(1), 164-183. <https://doi.org/10.1111/bjet.12223>.
- [22] B. Huang, K. F. Hew, "Implementing a theory-driven gamification model in higher education flipped courses: Effects on out-of-class activity completion and quality of artifacts", 2018, Computers & Education, volume 125, 254-272.
- [23] M. S. Kuo, Y. Y. Chuang, "How gamification motivates visits and engagement for online academic dissemination – An empirical study", Computers in Human Behavior, 2016, Volume 55, Part A, 16-27.

- [24] I. Yildirim, "The effects of gamification-based teaching practices on student achievement and students' attitudes toward lessons", *Internet and Higher Education*, 2017, 33, 86-92.
- [25] B. Taspinar, W. Schmidt, H. Schuhbauer, "Gamification in Education: A Board Game Approach to Knowledge Acquisition", *Procedia Computer Science*, 2016, Volume 99, 101-116, <https://doi.org/10.1016/j.procs.2016.09.104>.
- [26] E.T. Ang, J. M. Chan, V. Gopal, Li Shia N., "Gamifying anatomy education, *Clinical Anatomy*", 2018, 31(7): 997-1005, <https://doi.org/10.1002/ca.23249>.
- [27] S. Subhash, E. A. Cudney, "Gamified learning in higher education: A systematic review of the literature", *Computers in Human Behavior*, 2018, Volume 87, 192-206, <https://doi.org/10.1016/j.chb.2018.05.028>.
- [28] D. J. Fisher, J. Beedle, and S. E. Rouse, "Gamification: A Study of Business Teacher Educators' Knowledge of, Attitudes toward, and Experiences with the Gamification of Activities in the Classroom", 2013, *The Journal of Research in Business Education*, 56(1), <https://www.questia.com/library/journal/1P3-3948504681/gamification-a-study-of-business-teacher-educators>.
- [29] L. De-Marcos, A. Domínguez, J. Saenz-de-Navarrete, and C. Pagés, "An empirical study comparing gamification and social networking on e-learning", 2014, *Computers & Education*, 75, 82-91.
- [30] B.C. Müller, C. Reise, G. Seliger, "Gamification in Factory Management Education – A Case Study with Lego Mindstorms", *Procedia CIRP*, 2015, Volume 26, 121-126, <https://doi.org/10.1016/j.procir.2014.07.056>.
- [31] M. Low, S. Venkataraman, and V. Srivatsan, "Developing an entrepreneurship game for teaching and research", *Simulation and Gaming*, 1994, 25(3), 383-401, <https://doi.org/10.1177/1046878194253006>.
- [32] K. Hindle, "A grounded theory for teaching entrepreneurship using simulation games, *Simulation and Gaming*", 2002, 33(2), 236-241, <https://doi.org/10.1177/1046878102332012>.
- [33] M. Prensky, "Fun play and games: What makes games engaging", *Digital GameBased Learning*, 2001, 5, 1-5.
- [34] W. H. Y. Huang, D. Soman, "Gamification of education. Research Report Series: Behavioural Economics in Action", Rotman School of Management, University of Toronto, 2013.
- [35] E. Klopfer, S. Osterweil, K. Salen, "Moving Learning Games Forward, Obstacles Opportunities & Openness, The Education Arcade", Massachusetts Institute of Technology, 2009, [http://education.mit.edu/wp-content/uploads/2018/10/MovingLearningGamesForward\\_EdArcade.pdf](http://education.mit.edu/wp-content/uploads/2018/10/MovingLearningGamesForward_EdArcade.pdf)
- [36] W. Ponnawatt, and P. Lehmann, "A framework for using business intelligence for learning decision making with business simulation games", *CSEDU 2015 - 7th International Conference on Computer Supported Education*, 2015, Proceedings, 2, 283-288, <https://doi.org/10.5220/0005474902830288>.
- [37] J. Fox, L. Pittaway, and I. Uzuegbunam, "Simulations in Entrepreneurship Education: Serious Games and Learning Through Play", *Entrepreneurship Education and Pedagogy*, 2018, 1(1), 61-89, <https://doi.org/10.1177/2515127417737285>.
- [38] W. C. Kriz, and E. Auchter, "10 Years of Evaluation Research Into Gaming Simulation for German Entrepreneurship and a New Study on Its Long-Term Effects", *Simulation and Gaming*, 2016, 47(2), 179-205, <https://doi.org/10.1177/1046878116633972>.
- [39] F. Bellotti, R. Berta, A. De Gloria, E. Lavagnino, A. Antonaci, F. Dagnino, M. Ott, M. Romero, M. Usart, I. S. Maye, "Serious games and the development of an entrepreneurial mindset in higher education engineering students", *Entertainment Computing*, Volume 5, Issue 4, December 2014, Pages 357-366, <https://doi.org/10.1016/j.entcom.2014.07.003>.
- [40] F. Bellotti, Francesco, R. Berta, A. De Gloria, E. Lavagnino, F. Dagnino, M. Ott, I. S. Mayer, I. "Designing a course for stimulating entrepreneurship in higher education through serious games." *Procedia Computer Science* 15 (2012): 174-186.
- [41] I. Mayer, G. Bekebrede, C. Harteveld, H. Warmelink, Q. Zhou, T. Van Ruijven, I. Wenzler, "The research and evaluation of serious games: Toward a comprehensive methodology", *British Journal of Educational Technology*, 2014, 45(3), 502-527, <https://doi.org/10.1111/bjet.12067>.