GAMIFICATION IN TEACHING HUMANITIES – „GAMEHUB" PROJECT

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Abstract: The paper presents the results of implementation of innovative learning methods in university teaching instruction supported by Erasmus+ Project "GameHub – University–Enterprises Cooperation in Game Industry in Ukraine" during 2015–2017. Educational games, which merge instructional content with game characteristics, encourage students to participate actively in learning process: guided by teachers the students have to plan their scientific work, take responsibility for completing it and deliver outcomes of good quality. Although Ukraine has solid educational system, teaching methods in use are traditional, and the approach to education is conservative. Hence, the ambitious objective of the GameHub Project is to build a pioneer education programme, which accommodates the implementation of innovative learning methods in new educational centers that are nowadays being developed at Ukrainian universities. The results are illustrated with a case study of developing a two-stage process of designing board and computer educational games at the GameHub at Odessa National Polytechnic University in Odessa, Ukraine.

Keywords: education, e-technology, higher education, game industry, gamification.

1. INTRODUCTION

This paper presents the results of implementing innovative learning methods in teaching process supported by Erasmus+ Project "GameHub – University–Enterprises Cooperation in Game Industry in Ukraine" (hereinafter called "GameHub Project") in 2015–2017 [1]. The GameHub Project aims at modernizing curricula of universities of science and technology in Ukraine, so that students can gain knowledge and skills necessary to operate successfully in the game industry. Developed courses and learning materials provide students with the background for designing educational games, which are subsequently implemented and tested in other universities involved in the project.

The main objective of technodgical universities is to prepare young engineers for work in technologically advanced environment. Nevertheless, it is important to provide the students with general knowledge. Hence classes on humanities are indispensable part of syllabi for technical majors. Nowadays, academia has to collaborate with enterprises, so that the profile of syllabi can adapt to contemporary educational needs by modernizing content and methodology of offered courses and updating competence profiles of students and academic staff.

GameHub Project aims at modernizing the existing engineering education in Ukraine by providing universities with infrastructure and educational resources needed for enhancing students' knowledge and skills in the field of gamification and digital games. The 3-year project is being conducted in 2015–2018 and is co-financed by Erasmus+ KA2: "Cooperation for Innovation and the Exchange of Good Practices" under the programme "Capacity Building in Higher Education action". The objective of the GameHub Project is to develop pedagogical and technological infrastructure to support those students who in the near future would like to work in game industry. The core task of the project is to design learning modules on computer game design and development. These learning modules will be then incorporated into existing university curricula [2–5].

The reminder of this paper is as follows. Section 2 briefly reviews innovative learning methods such as: e-learning, mobile learning and gamification. In Section 3 the GameHub Project is introduced with reference to the implementation of innovative learning methods (gamification mostly) in educational centers to be built at Ukrainian universities. In Section 4 we present a case study of developing innovative educational methods at the Game Hub at the Odessa National Polytechnic University (ONPU) in Odessa, Ukraine. We report selected results of the GameHub Project obtained in 2015–2017 in Section 5, where we present a two-stage teaching process aiming at transferring knowledge and skills in the area of active and deeper learning to university teachers (the first stage) and then to university students and unemployed people as well as to secondary and elementary school pupils attending open classes at the university. We analyze educational effect with reference to the main objective of the GameHub Project, i.e. establishing advanced educational centers at technological

universities in Ukraine. In GameHub centers students and unemployed citizens can gain knowledge and develop competences needed to start professional career in game industry.

2. E-TECHNOLOGY IN TEACHING PROCESS

Technology is an important part of teaching process at every level of education. It helps teachers to organize teaching process. However, many institutions still face serious difficulties in implementing advanced technologies and innovative approaches in their teaching and learning process. The *NMC Horizon Report: 2017 Higher Education Edition* [6] outlines significant challenges, which restrict the adoption of technology at universities in 2017. These challenges can be divided in three groups: solvable (simple to solve), difficult (hard to find solution) and wicked (so complex that we barely can define them).

The „solvable" challenges are presented by digital tools improving and integrating formal and informal learning. Traditional competences of reading and writing have been extended to the ability of using digital tools for searching for information and – what is even more important – assessing and evaluating the quality of obtained material. In academia there is no consensus on the definition of obstacles which influence developing, measuring and assessing the digital literacy skills. In result numerous higher education institutions are not able to formulate these aspects clearly in their policies and programmes. Definitions of digital literacy address two aspects: (1) balancing competences with a wide range of digital tools for varied educational purposes, and (2) enabling constructive evaluation of resources available on the web. Both issues are broad and meaningful. Digital literacy encompasses different skills for educators and students, because teaching process supported with technology differs significantly from traditional education.

The second „solvable" challenge focuses on the integration of formal and informal learning. Although the Internet is available in every European university, traditional educational methods, which originate in the 18th century, still dominate in many faculties. Nowadays, students are more and more interested in self-directed and curiosity-based learning accompanied with life experience and other forms of innovative learning. So they need new tools which enhance their engagement by encouraging them to follow their own learning paths and interests. Many experts believe that blending formal and informal educational methods can create the environment that fosters experimentation, curiosity, and creativity. Hence, the main goal is to develop ways of accommodating lifelong learning by both students and educators. Note, that the European Commission in *European Guidelines for Validating Non-formal and Informal Learning* [7] set an "influential policy precedent", where the emphasis is put on the validation of informal learning, which "increases visibility of learning outcomes and appropriate value of these experiences".

The key to solve the above-mentioned challenges could be the integrated deeper learning approach. The concept was defined by William and Flora Hewlett Foundation [8] as the set of teaching methods that engage students in critical thinking, problem-solving, collaboration, and self-directed learning. In order to stay motivated, students need to be involved in active learning experiences such as project-based learning, challenge-based learning, game-based learning, inquiry-based learning, and similar methods implemented both inside and outside classroom.

Most researchers define learning as a multidimensional scaffold of *cognitive learning outcomes*, such as procedural, declarative and strategic knowledge, learning skills, and attitudes. Educational games, which merge instructional content with game characteristics, encourage students to participate actively in learning process: guided by teachers the students have to plan their scientific work, take responsibility for completing it, and deliver outcomes of good quality. In other words, we can suggest that a game play cycle could be presented as a typical scientific experiment with setting hypothesis, testing the idea, obtaining outputs, discussing results, and drawing conclusions. Although for several decades game-based learning approach has been successfully applied in formal military training, medicine, finance, physics, etc., the lack of well-designed education games, especially the ones dedicated to secondary school sector, is still enormous [9–11].

3. GAMEHUB PROJECT: E-TECHNOLOGY AND EDUCATION FOR SUPPORTING UKRRAINIAN GAME INDUSTRY

The game industry in a relatively new market segment, but it grows rapidly worldwide. This new industry employs new education policy and local, relevant business community to help the brightest graduates to maximize their potential. According politicians: the IT sector needs not "10 graduate engineers", but "10 creative graduate engineers for problem solving". The *Animation Career Review* reports that colleges and universities modify progressively their education policy, grading systems, courses and curricula according to the contemporary challenges and demands. Each technological university in the European Union has at least one program devoted to the game design [12].

The annual growth of the world IT market is assessed at 5–20%. In 2017 game industry contributed USD 108.9 billion to game revenue. At the same time digital game revenue is accounted for USD 94.4 billion what is 87% of the global market. Mobile, smartphone, and tablet games grow by 19% year over year. In 2017 the revenue of mobile games are USD 46.1 billion, what is 42% of the market [13].

The computer game design (CGD) is one of emerging field in contemporary higher education, where students work in a merged team-based and project-based learning environment. The digital games and gamification approach are becoming ubiquitous in our daily lives. They are utilized in medical therapy and treatment, telemedicine, corporate and military training, crisis management, public policy, corporate management, and education including all levels from primary to higher.

Although the software development market in Ukraine has high potential, Ukrainian IT sector is still based mostly on outsourcing services for companies from Western Europe or the United States. Several globally well-known games have Ukrainian roots, e.g. War of Warplanes, Star Wars: Galaxies, Metro 2033. Ukrainian digital games and software developers influence the global game industry with their highly competencies, quality-orientation, and creativities. They are recognized globally; for instance, Google, Facebook and Microsoft regularly organize headhunting tours in Ukraine to recruit local software engineers and testers for their head and domestics offices [14]. Game

industry takes advantage of international teams, since in this sector it is possible to connect via the Internet employers and employees from different regions. It also allows working as freelance or self-employee. Such cooperation and employability demand modern, top-notch knowledge and skills.

Although Ukraine has solid educational system, teaching methods in use are traditional and the approach to education is conservative. In 2014, when the proposal of the GameHub Project was prepared, almost none of Ukrainian universities and higher education institution offered game design as a certified professional education. Game design is a demanding and resource-consuming discipline, which includes in the academic curricula subjects related to computer science, physics, engineering, visual technology, music techniques, and humanities, e.g., cognitive psychology, art study, and game design. Therefore the ambitious objective of the GameHub Project is to build pioneer educational programme for gamification and computer game design and development [15–17].

The GameHub Project [1, 3, 4] was initiated with the objective to equip students of engineering majors in Ukraine with knowledge and skills of CGD. The consortium of twelve institutions from four European countries – Austria, Poland, Spain and Ukraine – was established with the goal to modernize Ukrainian higher engineering education which in the near future would foster the Ukrainian IT sector. The consortium consists of *European* universities: University of Deusto (Spain), FH JOANNEUM (Austria), and AGH University of Science and Technology (Poland), and *Ukrainian* universities: Odessa National Polytechnic University, Donetsk National Technical University, Vasyl Stefanyk Precarpathian National University, Kherson National Technical University, Kyiv National University of Construction and Architecture, National Technical University Kharkiv Polytechnic Institute; and the NGOs: VIRTUALWARE LAB, Quality Austria – Training, Certification and Evaluation Ltd., and Ukrainian Association of Information Technology Professionals.

The GameHub Project follows specific goals: (1) to establish a system for monitoring the competence profiles needed on digital labor market in Ukraine, taking into account international networking and business opportunities; (2) to create Open Education Resources (OER) for the new discipline – computer game design enriched by practice-based activities using developed game lab and advanced modules on entrepreneurship; (3) to develop the infrastructure for the GameHub centers, so that these places can offer education resources, coaching and consulting, and in result they can contribute to the development of knowledge and competences needed in the digital game sector and entrepreneurship; (4) to enable and enhance collaboration between academia and the companies, which work in the game industry. Hitherto implementation of the GameHub Project and obtained results are presented in the next section as the case study of a project conducted in the GameHub center at the ONPU in Odessa, Ukraine.

4. UNIVERSITY GAMEHUB CENTER – CASE STUDY OF ONPU IN ODESSA, UKRAINE

During preparation of teaching materials for trainings to be provided in the GameHub center at the ONPU in Odessa, Ukraine, it was found out that nowadays IT-companies need for their project teams people who had not only specific professional competencies, but also general competencies in the field of humanities [18].

In Ukrainian higher education system students can widen their general knowledge at non-mandatory humanities-related classes included in the curricula of IT-oriented majors. The students can choose classes from the set of humanities-related courses, among which can be listed: history, cultural studies, Ukrainian language for professionals, foreign languages, the basics of jurisprudence, philosophy, political science, psychology, ecology, economics and business, the basics of labor protection, or even physical education.

Unfortunately, the number of teaching hours (lectures and classes) of these courses is limited; therefore, teachers need to encourage students to continue their work on particular subjects independently after classes. One of useful approaches to do this is to combine gamification and deeper learning [19]. It seems that the most powerful tools are educational computer games and advanced board games [20]. However, successful implementation of this method in educational process is limited by the shortage of games referring to particular topics or high prices of existing ones. Moreover, there is a significant shortage of trainings for teacher, where they could prepare themselves to use educational games in the classroom, not to mention to create educational games. To partially cover this shortage the GameHub Project team at the Odessa National Polytechnic University (ONPU) in Odessa, Ukraine, decided to develop the original methodology of gamification of humanities courses for IT students. The methodology is based on reorganizing learning process and establishing a map of educational process, where all elements and interactions between them are identified (see Figure 1).

The first stage of the educational process is the training "Computer Game Design for Education" for academic staff of humanities disciplines. The objectives of the training are as follows: (1) getting academic teachers familiarized with the concept of gamification as well as with the ways of utilizing educational games as effective means of active learning; (2) developing practical skills for creating educational board games; (3) developing educational computer games.

The training format is a typical "teach the teachers" training which focuses on following tasks: (1) familiarizing teachers with methods of active student learning (e.g. flipped learning, action learning, critical thinking and learning from failures; game based learning); (2) studying the state-of-the-art of educational games and the best practices of using games in order to optimize the educational process at various levels; (3) understanding the features of setting rules for educational games in various genres, reproduction and maintaining the game balance; (4) studying educational, social and cultural functions, communication process in game design, and information and documentation support for educational computer games design; (5) developing practical skills for the game design, development, prototyping, and introducing computer games in education; (6) mastering methods for transforming the Game Design Document into the Technical Design Document using the Unified Modeling Language; (7) familiarizing teachers with technologies for developing prototypes of computer games based on the visual programming tool – MIT App Inventor; (8) familiarizing teachers with technologies for developing prototypes of computer game based on the Unity 3D environment tool.
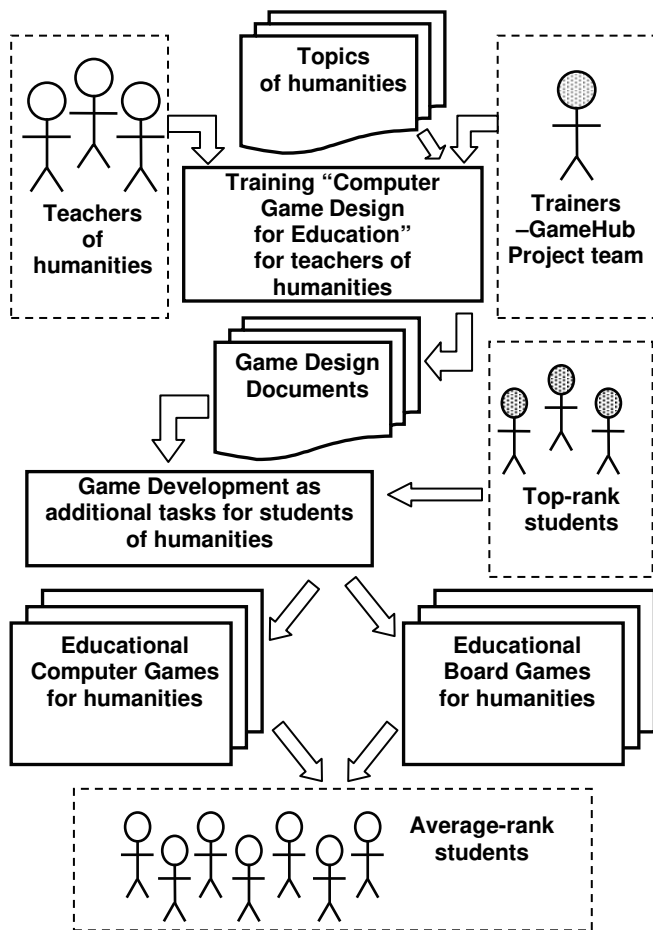
Fig. 1. A map of the educational process enabling gamification of humanities courses for IT students

The training consists of 60 in-class hours covering two subjects: humanities content and technological support. Humanities-related content of classes was developed by the members of the Humanities Faculty (the Department of Cultural Studies and the History of Art, and the Department of Information Technologies and Media Communications). Courses covering engineering content were developed and are taught by the members of the Institute of Computer Systems (the Department of System Software and the Department of Information Systems).

The outcome of the trainings was the Game Design Document created for each board game and computer game. The top-rank students provide their feedback on the Game Design Document. It was an extra activity assigned to them as an additional task during their standard humanities courses. The prototypes were evaluated by students who were engaged to test the game, and prepare experiment report. After testing and debugging the games were presented to academic teachers, so that they could use them in the educational process.

In December 2017 and January 2018 the first training was organized for 19 academic teachers of different departments of the Humanities Faculty: the Department of Information and Media Communications (10 people), the Department of Philosophy and Methodology of Science (3 people), the Department of Psychology and Social Work (3 people), the Department of Culture and Art Studies (2 people), and the Department of Ukrainian History and Ethnography (1 person). The participants created 19 Game Design Documents [21].

Amongst the most interesting Game Design Documents we can list following proposals:

(1) "Communicatium or Overthrow the Great Tyrant" – the game was developed for the course "Theory of Communication". It is a quest+logic-game dedicated to people who want to acquire communication skills indispensable for conducting successful interactions. During the play the players must answer correctly to substantial questions referring to the theory of communication, so that they can move to the next level of the game.

(2) "Subconscious Games" – the game was developed for the course "Foundations of Psychology". It is a quest+logic-game with a map of three locations. Locations represent three main stages of the development of psychology as a scientific discipline: the period of antiquity (philosophical stage), the medieval period (religious and natural stage), and contemporary psychology which begun in 19th century (scientific stage).

(3) "Creativity and Art" – the game was developed for the course "Cultural Science". It is a puzzle-game for self-management during a project; it consists of several stages of promoting an individual's own business idea: 1 – creating the idea, 2 – implementation and modeling, 3 – going with the idea to the market.

(4) "Arche" – the game was developed for the course "Philosophy". It is a quest-game; a player communicates with ancient Greek philosophers, solves their problems and reveals the primary elements of the world – e.g. water, fire, and atoms. The player accumulates "wisdom" and moves to the new level when he/she meets the wisest opponent and defeats him in a dispute.

(5) "Kaleidoscope of Advertising" – the game was developed for the course "Creative Advertising Technologies" for the specialization in "Information, Library, and Archives". It is a logic-game; the player creates an original advertisement for the assigned idea. The player can use the set of different elements: archetype images, artefacts, various characters (fairytale, typical, historical, etc.), styles, phrases and words, fragments of texts, and sounds that shuffle and drop out randomly.

(6) "Political Tic-Tac-Toe" – the game was developed for the course "Political Science". It is a logic-game with historical layers. The players try to seize their territories by responding correctly to questions on political science.

(7) "Complaint" – the game was developed for the course "Fundamentals of Social Work". It is a quest-game for studying the development of social work at two historical levels: 1st level – until the 20th century; 2nd level – during the 20th century.

(8) "Mobius Quest" – the game was developed for the course "Higher Mathematics" for the specialization in "Information, Library, and Archives". It is a quest+logic-game with many rooms for solving mathematical tasks and transitions between rooms in the form of isomorphic and homeomorphic graphs, function graphs, diagrams Euler-Venn, Moebius Letters, Klein Bottles and projective planes.

(9) "Bubble Words" – the game was developed for the course "Ukrainian Language for Professionals". It is a logic+ shooter-game. The teacher distributes bubbles containing professional terms in Russian or English, and the student tries to find the necessary words of the Ukrainian language.

(10) "Style and Fashion Dictionary" – the game was developed for the course "Ukrainian Language for Professionals". It is a logic-game; the aim is to "color" the semantics of a text accordingly to the clothing of the

characters. The outfits vary from business suit, though casual clothes, laboratory uniforms, up to historical costumes. If the player is mistaken in semantics, the character in the game wears a senseless outfit and looks ridiculously.

In January and February 2018 the development of several games was conducted during the student professional practice at the Department of System Software. The remaining games are planned to be developed by IT-students in the next months of 2018 during the classes of humanities for IT-students. It is planned during the next training to invite teachers of economics, physics, jurisprudence, political science, and physical culture to broad the topic of the educational games that could be available for the school and university curricular

5. CONCLUDING REMARKS

In the paper the general description of innovative pedagogic approach in education is described as a background for a presentation of the GameHub Project. Hitherto obtained results in developing educational board games and computer games show that it is possible to create a network of specialists from different disciplines (humanities and information technologies) which can effectively elaborate educational games (ONPU case study). The key to success was organizing multiple-stage training: (1) transferring knowledge and competences from European universities to Ukrainian partners, (2) identifying gaps in curricula where educational games can be used, (3) organizing "teach the teachers" trainings, (4) inviting students to evaluate, develop and test educational games, (5) introducing games to educational process. The results of this process are twofold: developing educational games and increasing students' skills in the field of game design. They are in line with the main objectives of the GameHub Project: (1) increasing the adjustment of the competence profile of university graduates to the requirements of the industry, and (2) strengthening students' professional development and employability.

6. ACKNOWLEDGEMENTS
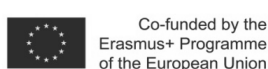
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E-TECHNOLOGIE W DZIAŁANIACH EDUKACYJNYCH W PROJEKCIE GAMEHUB

W artykule przedstawiono rezultaty wdrożenia grywalizacji i innowacyjnych metod nauczania w procesie kształcenia realizowanym w ramach projektu "GameHub – University–Enterprises Cooperation in Game Industry in Ukraine Project" w latach 2015–2017. Gry edukacyjne łączą wykonywanie poleceń ze specyfiką zabawy i rywalizacji, co powoduje, że gracz zaczyna myśleć i zachowywać się jak naukowiec-odkrywca i silniej angażuje się w proces przyswajania wiedzy, a także czuje się odpowiedzialny za przebieg całego przedsięwzięcia edukacyjnego. Programy nauczania na ukraińskich uniwersytetach pozwalają na zdobycie rzetelnej wiedzy, jednakże sposób jej przekazywania wciąż jest bardzo tradycyjny i nie zaspakaja potrzeb edukacyjnych dzisiejszych studentów. Dlatego jednym z ambitnych celów projektu GameHub było stworzenie pionierskiego programu nauczania, który byłby realizowany z wykorzystaniem nowoczesnych metod edukacyjnych. Sposób tworzenia i implementacji takiego programu został pokazany na przykładzie procesu projektowania, rozwijania i wdrażania gier planszowych i komputerowych w centrum GameHub w Odeskim Narodowym Uniwersytecie Politechnicznym.

Słowa kluczowe: kształcenie, szkoły wyższe, e-technologie, branża gier, grywalizacja.