

# Gamification of Higher Education by the Example of Computer Games Course

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**Abstract** - Use of game elements in course design is one example of gamification. The course of *Computer Games* was selected as a basis for gamification because game-like approach can support the understanding of the course content. A case study was conducted to find out how students perceive game-like course. The course of *Computer Games* was organized like a game. At the end of the course, feedback was collected. Although most of the game elements were well accepted by the students, it did not lead to deep immersion.

**Keywords** – Gamification; Game elements; Computer Games.

## I. INTRODUCTION

Video gaming is one of the most important entertainment industries after the movies [1] and its importance is growing. According to Gartner Inc. the game industry turnover for the year 2013 was 93 billion dollars, for the 2015 the revenue is estimated to be 111 billion dollars [2]. Universities feel increased need to provide curriculums and courses related to computer games. Teaching computer game design and development provides different possibilities to combine technology, pedagogy, art and business [3]. One possible approach among others is gamification [4]. This method is not new and is frequently used in marketing and business conditions [5]. Education is one field where game elements have been increasingly used lately [4]. In most cases the gamification is implemented for increasing the engagement among students [6]. In the course of *Computer Games*, gamification can be used also for delivering content – study elements are integrated to the course management [7]. What are those game elements and how can they be used for organizing the work in the course of *Computer Games*? How students are accepting game mechanics in non-game environment? To answer these questions a course *Computer Games* was organized as a game. Later, a survey was conducted among students to find out how well different game elements were implemented.

Research design is based on case study. In the 2<sup>nd</sup> section, the literature review is provided, game elements are specified and research questions are stated. In the 3<sup>rd</sup> section, the case – course of *Computer Games* is introduced. In the 4<sup>th</sup> section, research methods are described. In the 5<sup>th</sup> section, findings are presented.

## II. GAME ELEMENTS

Gamification is the use of game elements and game-like thinking in non-gaming environment [4]. Examples of

gamification vary from the single game-like learning activity [4] to the entire course that is designed like a game [7]. Experience points, scoreboards and awards are the most frequently used game elements in gamification but games provide much richer list of elements. To find out what game elements can be used for gamified course it is important to be clear what “game” is.

“Game is a activity of play in the pretended reality where participants try to achieve challenging goal by acting in accordance with rules” [8]. By this definition game does not have to be a competition. Some authors distinguish games from the simulations saying that game is always a competition against something or somebody. Game does not have to be purely entertaining. For example, educational games have a serious goal. Some serious games are not even fun (e.g., medical simulators).

There are different ways how to classify game elements. For example, Werbach and Cevin [9] structure game elements in three levels: components, mechanics and dynamics. In this article the game elements are structured by the main game aspects mentioned in the previous definition.

### A. Challenging Goals

Course Goals can be seen as game goals. Every assignment has goals and they can be seen as game challenges [4]. Combining learning goals with game goals is not only related with gamification. This is a starting point for any approach related with game based learning [10].

### B. Play

Interactive activities are needed for achieving the goals and completing the challenges. Course activities can be designed as game activities. For example, easiest way to implement interactive activity is to use quiz instead of test [7]. Researchers have found that gamified activities have better results in practical assignments [11].

Feedback – To provide enjoyable playing experience the games should provide instant and rich feedback [8]. Unfortunately this is not always so in the education field. Teachers do not have enough time to provide qualitative and fast feedback to all students. The easiest way to provide fast feedback during the course is to organize interactive activities in the classroom or to design game-like virtual learning environment (VLE) that provides automated feedback for typical activities. Studies have shown that positive feedback stimulates students learning [12].

Collaboration is one form of interactivity. When majority of the games are based on competition, the collaboration mode is used in party based interaction modes or in role playing games [8]. In both cases, collaboration is achieved through teamwork. Game collaboration models can be used for improving teamwork in learning conditions [13] and in workplace [14].

Competition – Not all games have competition (e.g., simulations) and not all players like to compete with each other. Still it is seen as one of the key fun factors in games [8]. Competition is not commonly used in education. Comparing students by the results is even seen as a bad instructional design method (sometimes forbidden by the law). Still the easiest way to implement gamification in the classroom is to use a scoreboard. Also, learning activities can be designed as competitions or fights. For example, debate between two students or teams can be seen as fight. Some instructional designers use graphical game elements for avoiding dissemination of personal learning data but still implementing friendly competition between students [15].

### C. Rules

Game core mechanics are usually complex set of different objects and relationships [8]. They declare how players and game environment interact with each other. One part of the core mechanics is the conditions for the progression. How player can earn or lose points, how the game is divided into levels and what are the pass or fail conditions. This can be easily implemented in education. For example, grades are experience points (XP), XP's form the score and players are listed on the scoreboard [7].

Levels can be treated differently in games [8]. Usually, levels are different parts of the game world and assignments. Levels in the course can be seen as lessons or learning units. Levels can also refer to the rating of the player based on her score. In this case levels can be seen as a final grades for the course. Levels can be related with the difficulty of the game. In this case levels can describe different versions of the same assignment – suitable for personalized learning. The easiest way to integrate levels is to bind them with score and grades [7].

Balance – For providing enjoyable playing experience, game elements must be in balance [8]. In game-like course it is mostly related with scoring system – how many points for certain activity it is possible to get and how the student progress on the scoreboard. Balanced scoring system solely does not guarantee the balanced user experience. The playing activities and the learning content should also be in balance [16]. In the gamified course, there is a risk that too much effort is put in the play and important information is not achieved [17]. Also, the difficulty of the learning activities should be increasing during the course. Assignments should be balanced in the level where the learner is kept away from boredom or anxiousness – in the zone of flow [18].

Luck or randomness is one part of game mechanics. Some games are heavily based on risk and luck (e.g., gambling). Usually, players do not want to be affected by randomness [4]. They prefer to believe that their achievements are based on their own skills. Luck can be

integrated to the course by rolling the dice for selecting the student who has to make a presentation [7].

Risk – Games are entertaining because they provide safe environment for taking risks. Usually, players fail with missions several times before they achieve the goal. Unfortunately this is not acceptable behaviour in educational assignments. Failures are usually punished with negative grades. Taking the final exam more than twice is not tolerated. While in computer games it is normal to have several attempts before defeating the big boss. Risk is a game element that is most difficult to integrate with the course design. Some researchers have shown how using risk simulators will decrease the risky behaviour in real life, for example, in traffic [19]

### D. Pretended Reality

Game world is an imaginary place – magic circle where players go during the game play [8]. Usually, it is created with the help of the story and graphical elements but not always. Sometimes game world is only a virtual space in players' head. Creating this kind of imaginary place in the classroom is quite complicated. One possibility to achieve this is to design VLE as a game world. One example of building the game world is to use the map of local area for students' data collection and presentation activities [20].

Characters are avatars and non-player characters (NPC) [8]. When implementation of NPC's requires environment similar to the computer game [21], the avatar design can be integrated with creating the student's profile in the course VLE [7]. This avatar is used as a character during the entire course. Students can pretend that they are somebody else (e.g., talented game designer). It can increase the immersion to the course [22].

Game aesthetics – Modern computer games have rich graphics. It is complicated to design educational course in the same level of details as commercial videogames have, but it's realistic to design VLE as a game world or use game like icons for illustrating the course materials. One example is to use a virtual tree as a graphical element for representing the students' progress [15].

Story – Games don't have to be based on story. For example, for puzzle games only the rules are important. Some games (e.g., adventure games) are heavily story based [8]. Stories are also used in education. To build the entire course as a story is a complicated task. One method to do this is to implement the journey of a hero [23]. It can be integrated with avatar design in the beginning of the course, with the character growth during the course and self-assessment at the end of the course.

Immersion – When goals are clear and activities are organized in engaging way the participants lose the sense of time and they stop worrying about themselves. This kind of immersion is typical for computer games. [24].

Some of those items are very similar to educational elements. They can be implemented simply by changing the name of course elements. For example, Grades can be called as XP's, assignments can be called as challenges or missions etc. Some elements are not so easy to integrate with the

course or lesson. For example, using game aesthetics in course design requires a lot of time. Some of the elements can be integrated directly; some aspects can be achieved through others (e.g., immersion). Implementation of game elements in education is growing trend but it is not widely studied how those game elements are accepted by the learners. The objective of this article is to answer this question.

### III. THE CASE COURSE

To find out how game elements can be used in education the *Computer Games* course was designed as a game. The selection of the case was made based on convenience – the author of this article simply had to teach this course. This course is part of the Cross Media bachelor curriculum but the admission was open to all students. 35 students enrolled to the course and 23 (passing ratio 66%) of them completed it with positive result. 1 student didn't achieved the positive end result and 11 students disappeared during the first two weeks of the course. Classes took place in the autumn 2013. Learning was conducted with the method of blended learning. It consisted of 12 face-to-face meetings (4 hour sessions per every week) and online learning assignments. Course virtual learning environment was based on Elgg Social Networking platform [25] and was used for study management, sharing learning materials, submitting home assignments and running online discussions (see Figure 1).

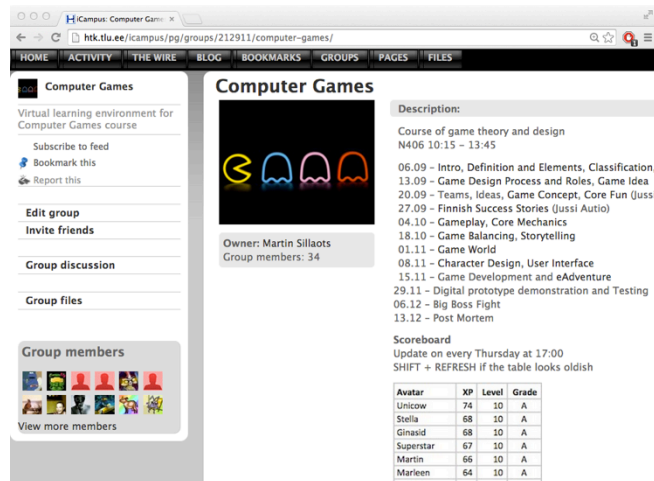


Figure 1. Computer Games ELGG based VLE starting page.

The objective of the course was to provide an overall understanding of game research and theory, design and implementation. The main focus lied on the game design [26]. The content of the course was based on the book "Fundamentals of game design" [8]. Learning activities were inspired by the book "Multiplayer Classroom" [7]. Course was organized like a game. The following game elements were implemented: Goals, Avatar, XP's, Scoreboard, Levels, Luck, Collaboration, Competition and Feedback. The goal of gamification was to achieve deeper immersion among students. Elements like game world, visual elements and

story were left out from the course design because it was too time consuming to integrate them with the learning activities.

Game vocabulary was used instead of pedagogical terms. For example, students were called as players, teacher was a game master, assignments were missions, exam was a big boss fight, grades were levels etc. Most of the assignments were based on teamwork. Students formed teams and designed a new game from the idea to prototype. Every step in this process was treated as stand alone group assignment. Every assignment had three sub-activities:

- Creating and uploading an artefact (document or drawing or prototype),
- Randomly selected groups or students presented the artefact in the class,
- Asking and answering questions from opposing teams.

Most of the activities involved cooperation in the teams and competition between teams and provided immediate oral feedback to the students and written feedback in the VLE with maximum 1-week delay.

Course started with introducing the learning goals. First assignment was to design a personal avatar. Students were encouraged to use nicknames that are related with the course content. They were also asked to design an icon for the avatar and write character background story. The main objective for avatar design was to generate safe names that can be used on the scoreboard and not to violate the personal data protection law.

Next assignment was related with analysing and introducing student's favourite digital game. Students had to write a short paper about one game and to describe its genre, gameplay and other elements. Third assignment was selecting a role for the game design team based on student's background. Based on roles heterogeneous teams were formed with the help of TeamUp (see Figure 2). This tool enables forming groups automatically based on students' preferences.

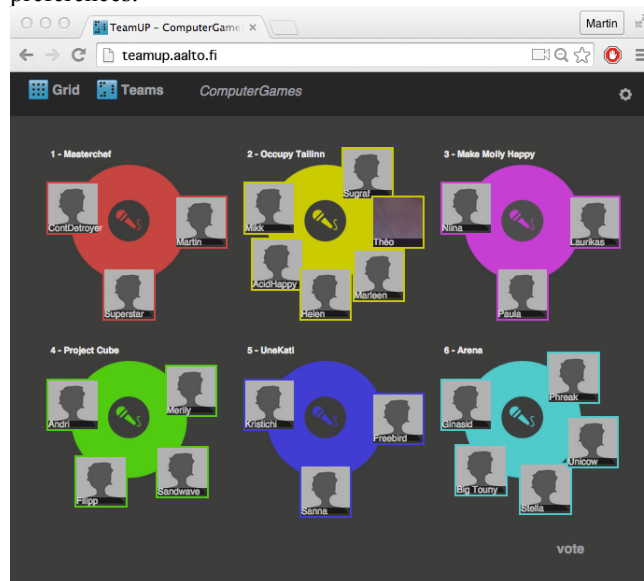


Figure 2. Forming teams with TeamUp.

Forth assignment was providing an idea for the new computer game. Every student introduced their ideas in front of their team. Voting was made inside the group and the selected idea was introduced to the rest of the class. The owners of the selected ideas earned some extra points. After that the rest of the activities were conducted in teamwork. The aspect of chance was reduced during the team activities because it affected only the order of presentations.

Next, students were asked to compose a document describing the specification of the new game. It included design of the game challenges and activities (gameplay), defining core mechanics of the game (rules), writing a story for the game, sketching the graphical items for the game world (backgrounds, characters, objects), composing paper prototypes and implementing digital prototype. For digital prototype development the eAdventure platform was used. eAdventure does not require programming skills [27].

The course ended with the final exam (Big Boss Fight) where teams introduced their game specifications and demonstrated digital prototypes. Visitors from game industry were invited to listen students' presentations and ask questions. After the exam students were asked to conduct self-evaluation. They had a chance to adjust the amount of points that were collected during the teamwork.

Every activity generated certain amount of experience points (XP). Based on XP's students were listed on the scoreboard. Game levels were based on scores and later they were converted into grades. Course included several bonus activities and possibilities to earn extra XP's like testing and evaluating different game projects and providing links to additional learning materials.

#### IV. METHODOLOGY

Observation diary, online questionnaire and group interview were used for data collection. Teacher of the course made notes after every class. In the end of the course, face-to-face group interview and online survey was organized to collect feedback from students. All together 27 questions were asked (see Table 2). The questions were expressed in the form of a Likert scale, with a free text field for additional comments. 15 students (63%) out of 24 answered the questionnaire.

The interval scale with four values (see Table 1) was used for the answers. The neutral answer was left out intentionally to force students to take clearer standpoints. Descriptive statistics was used for data analysis. Arithmetical averages and standard deviations were calculated for every question and for the group of questions (game element).

TABLE I. SCALES FOR THE QUESTIONS AND RESULTS

Options	Value	Min	Max
Yes	4	3.26	4.00
Rather yes	3	2.51	3.25
Rather no	2	1.76	2.50
No	1	1.00	1.75

Later average results were tied with text-based explanations (see Table 1). The range of possible results from 1 to 4 was divided in to four equal segments. When the

average score belongs to the range from 4 to 3.26 it means that this game element was successfully implemented and accepted by the students (Yes). If the aggregated result falls in to the range from 3.25 to 2.51 this game element was partly successful (Rather yes). If the result is between 2.5 and 1.76 the game element was not successfully implemented (Rather no). 1.75 to 1 is a bigger failure (No).

During the data analysis quantitative results were enriched with qualitative data collected with the help of open questions from the online questionnaire, with notes from the observation dairy and comments provided during the group interview.

TABLE II. SURVEY RESULTS PER QUESTIONS AND GAME ELEMENTS

Game Elements and Questions	M	SD
<b>Goals</b>	<b>3.47</b>	
1. Objectives were clear during the entire course	3.47	0.74
<b>Avatar</b>	<b>2.30</b>	
2. Design of a personal avatar was good for the immersion to the course	3.07	0.96
3. Avatar influenced my behaviour on that course	1.53	0.92
<b>Scoreboard and XP</b>	<b>3.42</b>	
4. Scoreboard generated the sense of competition	3.53	0.64
5. Scoreboard motivated me to achieve more	3.53	0.64
6. Provided XP's were in balance with the effort needed	3.20	0.56
<b>Luck</b>	<b>3.23</b>	
7. Points that I earned depended on luck [inverted scale, yes = 1]	3.13	0.64
8. Points that I earned depended on my knowledge and contribution	3.33	0.49
<b>Collaboration</b>	<b>2.98</b>	
9. I felt cooperation between the group members	3.13	0.92
10. Course supported communication between students	3.13	0.74
11. Teamwork was smooth	2.73	1.10
12. Forming teams was justified	3.13	0.99
13. The way how the teams were formed, was suitable	2.73	1.16
14. Presentation of the teamwork results was engaging	3.20	0.94
15 Thanks to the teamwork it was possible to earn points without contribution [inverted scale, yes = 1]	2.77	1.01
<b>Competition</b>	<b>3.10</b>	
16. I felt competition between the students	2.67	1.05
4. Scoreboard generated the sense of competition (repeated)	3.53	0.64
<b>Feedback</b>	<b>3.58</b>	
17. Feedback to the learning activities was fast enough	3.80	0.41
18. Feedback was rich enough	3.40	0.51
19. The virtual learning environment was easy to use	3.67	0.72
20. I had clear overview about my progress during the entire course	3.47	0.74
<b>Big Boss</b>	<b>3.87</b>	
21. Big Boss Fight was a suitable format for the final exam	3.80	0.41
22. Inviting external experts to the Big Boss fight made the challenge more engaging	3.93	0.26
<b>Immersion</b>	<b>2.55</b>	
23. Learning activities were engaging	3.20	0.56
24. During the learning activities I forgot about my everyday troubles	2.13	0.64
25. During the learning activities I felt that time is passing faster than usually	2.33	0.90
26. During the learning activities the concern about self disappeared	2.53	0.92
27. During the learning activities I felt emotional connection with the other students	2.53	0.92
<b>Total</b>	<b>3.09</b>	

## I. RESULTS

In general, the implementation of selected game elements was partly successful. The total rating for the case is 3.09 – rather yes, although the immersion was achieved in lower level (2.55 – rather yes, but close to the average).

### A. Goals

Game and course goals are not so different from each other. Based on the total result (3.47 - yes) it seems that the course goals were clearly understood by the students.

### B. Avatar

The use of avatar was not causing stronger immersion into the course (total result 2.30 - rather no). Students agreed, that creating an avatar helps them to immerse with the course in some level (average result for the question 3.07 - rather yes) but it did not change their behaviour during the course (average result 1.53 - no). In positive comments, they said it was fun to design a new personality and it also created some humorous situations during the course (e.g., teacher trying to call students with their avatar names). In negative comments they mention that this was not creating additional value to the course. Some felt it to be silly or even embarrassing.

### C. Scoreboard

Replacing traditional grades with XP's, levels and a scoreboard was well accepted by the students (total result 3.42 -yes). Students agreed that XP's were in balance with the effort needed for completing the assignments (3.20 - rather yes), scoreboard generated strong sense of competition (3.53 - yes) and motivated them to achieve more (3.53 - yes). Students provided only positive comments like: "We like games and competition" or "It was fun to over score your friends."

### D. Luck

Students were satisfied with the level of randomness (total result 3.23 - rather yes). They did not feel that points depended on luck (3.13 – rather no – inversed scale) and they had a feeling that points are related with their knowledge and contribution (3.33 - yes).

### E. Collaboration

Although most of the assignments were executed in teamwork, the collaboration was moderate (total result 2.98 - rather yes). In general, students said that the work in teams was rather justified (3.13 - rather yes) but they were not very satisfied with the method how teams were formed (2.73 - rather yes). Students found that this was the main reason why teamwork was not smooth enough (2.73 - rather yes). In positive comments, some students justified this grouping method because it provided equal chances to everybody. Other suggested to form teams based on game ideas, then all team members are interested in the outcomes. According to students' evaluation they did not abuse the teamwork for doing nothing (2.77 - rather no - inversed scale). But, it seems that some of the students were not honest while answering this question. One of the student said: "Maybe students think they are simply smart when they are letting

others to do their work, not realizing that the others DO realize that they are abused. The work still needs to be done and someone has to do it."

Students agreed that the design of the course supported collaboration (3.13 - rather yes) and communication (3.13 - rather yes) among them. One mentioned that communication took place mostly inside the teams. She wanted to feel stronger connection with other teams as well. Some students commented that it was difficult to get the group together for team assignments.

Students agreed that teamwork presentations were engaging (3.20 - rather yes). In negative comments they said that more time for preparation was needed (one week was not enough).

### F. Competition

Students felt moderate competition during this course (total result 3.10 - rather yes). Because most of the work was organized in teams, the competition between individual students was low (2.67 - rather yes). Students rather appreciated that the format of the game was mostly based on collaboration and not on competition. They did not feel a need for additional competition elements (e.g., quizzes). Only game element that created the sense of competition was the scoreboard (3.53 - yes).

### G. Feedback

Students gave high ratings to the quality of feedback during the course (total result 3.58 - yes). For them the feedback was fast (3.80 - yes) and rich (3.40 - yes) enough. The Elgg based VLE was easy to use (3.67 - yes) and thanks to the scoreboard they had always clear overview of their progress (3.47 - yes). In positive comments, they mentioned that personal feedback presented for every group after the team presentations was good enough. Only negative comment was related with the fact that students have to use too many different VLE's (Moodle, Blogs, etc.).

### H. Big Boss

Course ended with the exam (big boss). It did not demand a lot of extra work if all course assignments were delivered on time and with sufficient quality but it required some presentation skills and courage. Students were very satisfied with the format of final examination (3.80 yes). Also, the invitation of external experts was very well justified (3.93 - yes) total rating 3.87 - yes. Students gave high value to the questions and comments provided by the experts. The format of the final exam created a serious and challenging atmosphere. Some suggested to organize "small boss" before the big boss to make better presentations. It is true that training how to make good presentations was missing.

### I. Immersion

Although most of the game elements were well accepted by the students (except avatar), the immersion to the course was weak (total score 2.55 - rather yes). In general, they found learning activities engaging (3.20 - rather yes) but it did not lead to forgetting everyday troubles (2.13 - rather

no). It did not cause the time to pass faster (2.33 - rather no). Loosing the concern about self (2.53 rather yes) and feeling emotional connection with other students (2.53 rather yes) was achieved in low level. The biggest obstacle for the immersion from the students' point of view was the method how teams were formed (teams first ideas later). One student suggested that the reason was the scoring system – when points are given to teams as whole, individuals in the team stop contributing. She recommended to giving points to the teams but letting team managers decide how to distribute them. Some were not satisfied with the duration of the class. They claimed to have a short attention span and 4 hours is too much time to keep focus on the same topic. Finally, the physical environment of the course was not supporting the immersion. Classes took place in a cinema hall. It was nice environment but too big room with too comfortable chairs. This caused the student's attention drifting away during the presentations and was not supporting the work in teams at all.

## II. DISCUSSION AND CONCLUSION

The goal of this article was to find out how to implement game elements in course settings and how students accept them. The game elements like clear goals, scoreboard, luck, feedback and big boss fight were perceived well by the students. To some extent, those findings are similar to previously conducted survey results. For example, different rewarding mechanics e.g., scoreboard, is the most commonly used elements in gamification [4]. The element that got the highest approval from the students was the big boss fight - final exam in the format of presentation in front of experts from the game industry. It is worth to mention that students were also satisfied with the level of luck used during this course. Implementation of randomness was successful thanks to the fact that it was used for smaller learning activities. Users usually prefer to feel that their achievements are based on their skills not on luck [8].

Game elements like collaboration and competition were implemented partly successfully. In general, students agreed that course of game design should be based on teamwork and not based so much on competition but they were not satisfied with the method how the teams were formed. Forming teams on a voluntary basis around the game ideas should be preferred instead of randomly generated groups and finding ideas inside the teams. Because the interaction mode for this course was mostly based on collaboration, the game elements supporting competition can be reorganized. Although scoreboard seemed to be engaging for students it can be replaced with some less competition based rewarding system e.g., badges. Some mechanics should be provided to reduce possibilities to earn points without actual contribution to the teamwork. One method is to provide certain amount of points for the teamwork and team members have to decide how to share them. If the points are shared in equal level, the personal score for every team member is automatically reduced by one point. Another method is to allow sacking group members who do not contribute at all.

Game element “avatar” was not successfully integrated with the course. It was only implemented for creating user

profile and using anonymous names in the scoreboard. To give more value to the course, avatar can be integrated with the story of the course or journey of the character development.

For conclusion, the immersion among students was recognized but unfortunately not in very deep level. Mostly it was caused by the fact how the teams were formed – there was no strong emotional connection between team members and between the students and the game idea. Also, the way, how the learning was organized, had an effect. For example, too much time was spent on traditional presentations. Students did not feel the need for stronger gamification in learning activities but they agreed that more innovative approach like flipped classroom [28] (listening lectures at home and doing assignments in the classroom) can be useful. Also, the physical classroom conditions had a negative effect on immersion. It would be worth of trying to design a game world for the course with the help of game aesthetics and interactive story. Creation of imaginary virtual place should have a positive effect on deeper immersion.

For broader conclusions, additional research should be made. For example, how similar gamification approach can be implemented in other subjects and courses. Also, the level of immersion can be measured more exactly with the help of the flow model [29].

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