Gamification tools improving university students' involvement in the education process

D. Paľová*, M. Vejačka*

* Department of Applied Mathematics and Business Informatics
Faculty of Economics, Technical University of Košice, Slovakia
dana.palova@tuke.sk, martin.vejacka@tuke.sk

Abstract – Information and Communication Technologies (ICT) influence the field of education in a significant way. Technology makes education more efficient, scalable, accessible and interactive. Current students' generation, the Millennials, ask for different innovative pedagogical approaches. They like technology and it is the natural part of their everyday life as breathing. From the conducted surveys follows, that they are group-oriented and practiced users of digital technology. In order to impress and motivate them to learn, it is necessary to employ ICTs differently and interactively and it does not matter the age. The gamification of learning is a kind of educational approach, which uses game elements in a learning environment. The main aim is to enhance students' interest in learned topics and to inspire them to continue learning. At our faculty, education innovation is one part of the internal development project. The paper will present the short review of tools and methods usable for the gamification of the education process, followed by its implementation to the particular course Informatics II provided by LMS Moodle.

Keywords – education process innovation; LMS Moodle; gamification; enhancement of students’ motivation;

I. INTRODUCTION

The well-known fact is that at present, the world is highly dependent on Information and Communication Technologies (ICT). They influence all aspects of our life, not omitting the education. The current young generation is more "wired" and as ICT natives they naturally expect, that education will use all technologies known by them also in their education process [1]. The technology is part of their lifestyle and identity [2] and brings a huge amount of information by free. This dramatically changes the distribution of "power" between teachers and students. Nowadays, the teacher is not one and only representative of knowledge in the special topic, but his role was shifted to the role of a guide during the students' exploring the knowledge and achieving new skills. The main challenge of education seems to be teaching students how to find and navigate information and critically interpret it and if it is needed, use it by an innovative and creative approach.

According to [1], [3] the young generation spend on average 6.5 hours using ICT and other similar media (e.g. TV, DVD), retrieving new information, listen and record music, view, create and publish Internet content; play video games. It is difficult to compete with such an incentive, which, besides being of interest to the student, also brings content to him in a fetching manner. In connection with that fact, one of the hardest challenges of the teacher is to motivate students to be more involved in education within his field of the subject taught.

So, if we want to attract a student, we have to take several of their basic characteristics into account: they like to be in control, they like choice, they are group-oriented and social, they are inclusive, they are practiced users of digital technology, they think differently, they are more likely to take risks and they value time off because they look uncertain [3]. Only if we consider these aspects when creating the content and structure of education, do we have a chance to succeed and thus increase students' interest in education. In order to achieve the increase of students' involvement in the education process and the effectiveness of learning, the teacher needs to:

- Set clear expectations of what needs to be reached before graduating the course and allow students to manage their education within the learning environment by using a mixture of different internal, external information resources, activities and interactions across the class [4]. It is important to provide analytics of students' activity tracking in order to achieve more detailed insight into the learners, their development needs, which presents the input for the continuous education improvement [5].

- Choose the right combination of modern technologies as LMSs, different kinds of games, Virtual Reality, Augmented Reality, 3D printing or chatbots, etc. The main challenge from that point of view is to use this kind of technology that is supported and available via smart devices. Implementing this, it offers the convenience to students to study anywhere and anytime, which results in their involvement in the education process not only at university but also outside of it. [6]

Implementing modern technologies into education goes hand in hand with the gamification of education. The gamification of education brings great potential for improving the performance, motivation, and engagement of students. The gamification of the education results in students' devotion more time and greater involvement to study what results in the improvement of the knowledge and skills of the students.
II. Gamification of Education

The concept of education gamification is not so fresh. This approach was mentioned first already in the 80-ties of the previous century by the Malone [7], [8] and Bowman [9]. Chapman [10] presented the gamified learning process as a collection of activities taken in reality but supported by the ICT system to discover and validate activities, view progress and communicate and collaborate with other players. Gamification, in general, is presented as “an integration of game elements and game thinking in activities that are not games” [5], [11]. Games have some distinctive features which play a key role in gamification and are used to motivate and facilitate learning process: narrative and users (presented by all participants); challenges/tasks that users perform and progress towards defined objectives; progress mechanism that covers points that are accumulated as a result of executing tasks, levels which users pass after collecting predefined amount of points, badges which serve as rewards for completing actions (that can be repeated in order to reach the goal) and public ranking of users according to their achievements; player control: immediate feedback; social connection and opportunities for collaborative problem-solving. [5], [12]

The main idea of gamification education is to capture the learners’ interest and inspire them to continue learning and help them to focus on meaningful learning tasks [13]. The appropriate composition of tasks helps students realistically estimate their chances of success and dividing complex tasks into shorter and simple subtasks help them to deal with the complexity of tasks. From that point of view, the structure of a course must be changed at different levels: change of roles of the students, teacher and learning environment, change of the language used in the course and finally yet importantly, change of the content of the course. By gamification of roles, a student might be adopting an avatar and the avatars might be grouped into guilds by the teacher (or some other rule), a teacher is responsible for design gamification, embedding game dynamics and providing rewards attractive to the students. [14] Changing the language of the course means, that instead of official terms, a teacher can describe the learning objectives and tasks as "quests", and process of teaching it as "completing a mission". At the same time, also results could be presented in knowledge points (KP) experience points (XPs), health points (HPs) or badges, items, etc. All of this aims to motivate students to participate in the education process and to increase their interest in course content and activities and not pay their attention to the letters that they can achieve in the grade book for participating in the "game".

A. Gamification in LMS Moodle

LMS Moodle is one of the most popular learning platforms. Besides providing an interactive environment for communication and cooperation among all education process participants, it offers different features for gamification of the learning process. Based on the previously listed facts, it could be generalized that LMSs are suitable environments for education gamification. They provide tools for automatic tracking of students’ results and progress. Using the discussions, forums, and blogs, taking part in creating the content of wiki pages, knowledge databases are students encouraged to take part actively in developing learning content.

Based on [15], the gamification of the learning process has the potential to make learning fun. According to [16], 80% of LMS users believe, that gamification would help them be more productive. Based on this survey, students presented a positive attitude towards gamified learning and that the LMS environment is more engaging, challenging and competitive.

LMS Moodle provides more in-build capabilities to gamify the learning process: user’s profile contain a field for uploading a photo, so students can define them as an avatar; possibility to set learning paths – the multiple activity completion conditions/criteria which must be met by the students in order to access the activity; the progress of the students in the course is visible (teacher can it visible also by the progress bar like in games), that help them to understand that their actions are connected in a greater whole; top ranking of the best students in the quizzes or any set activities (what adds competitive nature of the learning); instant feedback on their tests, assignments or other activities help to motivate the students and encourage them in the action; learners could be rewarded by badges upon completion of several activities or for achieving a certain level of knowledge and competence. [5]

Besides above mentioned in-build possibilities of how to gamify the education in the LMS Moodle environment, a teacher has available different plugins and modules that allow creating a more gamified environment within a particular course. The most popular are the following [15]:

- Level up! is a customizable block that a teacher can add to a course to give experience points to students as they progress through a course. It displays their current level and progresses towards the next level.
- Activities: Game module makes use of questions, quizzes and glossaries to create offer a variety of interactive games hangman, crossword, cryptex, millionair, Sudoku, Snakes, and Ladders. The hidden picture, Book with questions. The results of the games are part of the grade book. Using these games teachers can slightly force to study available study materials if they want to achieve the best results.
- Quizventure is a module that loads quiz questions from the course. The possible answers come down as space ships and you have to shoot the correct one. The quizventure is a more attractive way how to motivate the students to self-study also at their homes.
- Stash is a block that allows a teacher to create and then show items around a course. Students can then go and collect these items, which will then appear in their stash block. The stash block is a good way to encourage more interaction with activities and is invaluable for teachers looking to gamify their course.
B. Gamification tools usable outside LMS Moodle

Previously mentioned tools are the part of the LMS Moodle, which presents the on-line part of the education process. Nevertheless, what kind of tools could be used, while the teacher wants to motivate students to be more active during face-to-face learning? At the market, there are tools outside the LMS Moodle environment, but usable for education gamification. They aim to "wake up" students' attention during the lecture or lesson in different ways:

- **Mentimeter** is an on-line tool available at [https://www.mentimeter.com/](https://www.mentimeter.com/) by which you can build interactive presentations with the easy-to-use online editor. It provides the possibility to add questions, polls, quizzes, slides, images, gifs and more with the main objective - to create fun and engaging presentations. When a teacher presents the presentation, the audience (students) uses their smartphones to connect to the presentation where they can answer questions, give feedback and much more. Finally, the teacher can visualize their responses in real-time (Figure 1.). [17]

  ![Figure 1. Example of the final visualization of the audience responses on the question “Why use a word cloud?”; source: [17](https://www.mentimeter.com/)](https://www.mentimeter.com/)

- **sli.do** (available at [https://www.sli.do/](https://www.sli.do/)) is another online tool that empowers students to ask questions, vote in polls and is a part of the discussion by using a simple Q&A and polling tool in real-time (Figure 2.). Live polls are an easy way to kick-start the conversation, check knowledge or get instant feedback. A teacher can use it to warm up the audience's attention, to recap the content and to entertain or test the attendees. [18]

  ![Figure 2. Questions and votes in Live polls in Slido application; source: [18](https://www.sli.do/)](https://www.sli.do/)

- **Kahoot!** (available at [https://kahoot.com/](https://kahoot.com/)) is a game-based learning platform, used as educational technology in schools and other educational institutions. It provides learning games like multiple-choice quizzes trivia quizzes (Figure 3.). Kahoot! can be used to review students' knowledge, for formative assessment, or as a break from traditional classroom activities. [19]

  ![Figure 3. Example of quiz question designed in Kahoot!; source: [19](https://kahoot.com/)](https://kahoot.com/)

III. EDUCATION INNOVATION OF INFORMATICS II USING GAMIFICATION

A. Subject Informatics II at Faculty of Economics, Technical University of Košice

The obligatory subject Informatics II is taught in the summer semester of the first year of bachelor study of the study branch Finance, Banking and Investments provided by Faculty of Economics, Technical University of Košice (FoE at TUKE). The main objective of the subject is to lead the students into the domains that they will meet in their practice on a daily basis, the domains of business informatics and business data analysis. The content of the subject is composed concerning students’ previous knowledge and skill in the field of ICT [20]. The main covered topics are:

- **Fundamentals of business informatics** cover the history of business informatics, the introduction into different information systems used in enterprises like ERP (enterprise resource planning), CMS (content management systems), SCM (supply chain management), BI (business intelligence), etc.

- **Business process modeling (BPM)** is concerned with processes in the business itself and ways how and what kind of data management is needed to model and improve business processes.

- **Business data analysis** presents different types of data used in the business environment and for what purposes they are used.

- **Tools for business data processing** illustrate how ICT tools can be used for data processing and modeling. For that part of the subject, we examine and use a tool like ARIS, MS Excel, MS Access.

- **Economic aspects of business informatics**, where the students are introduced to how ICT could affect the financial part of the business.
• The trend of business informatics tries to show the upcoming technologies and their benefits for companies in the future.

The realization of the subject uses could be described in a way of blended learning. It is divided into two main parts (Figure 4.):

• F2F learning is realized by the lectures, where the students are provided by theoretical information further used during practical PC labs, where the students implement theoretical knowledge in solving real-world problems.

• Online learning part realized via LMS Moodle, serves mainly to publish study materials, news, tasks for students’ self-study and preparation for practical exercises, for self-testing and for submitting semestral project files that are a part of the final evaluation of the particular student. It is also a space for online testing, chatting, feedback, etc. which ensures two-way communication between the participants in the education process.

Figure 4. Model of Informatics II Education; Source: own contribution

Every time, after finishing the subject, there is realized the feedback on the subject. In an annual subject survey by the students, the subject is evaluated as a demanding but rewarding for their future life. In connection with the topic of the paper – possible gamification of the subject, we researched the habits of the students connected to the preferred way of study and the use of supportive LMS Moodle platform. From the conducted survey results, we are concerned with the following particular questions:

1. What kind of study materials do you use during the study of the subject?
2. How often do you visit and use the course Informatics II in the LMS Moodle?
3. Is the information published in the LMS Moodle supportive to you during your study?
4. What kind of activity/study material did you miss during the study the Informatics II?

As can be seen in the Figure 5., the most widely used resources include online materials published in LMS Moodle (indicated by the 85% of respondents) and practical tasks and assignments, which are also published in LMS Moodle, but they are continuously solved during the F2F learning (indicated by the 92% of respondents).

Figure 5. Preferred kind of study materials; Source: own contribution

In addition to the published materials, we were also interested in the frequency of visiting the course in LMS Moodle. The main reason for this interest was that in the past, we have noticed that students do not have an overview of what is available within the course in the system and they were not prepared for the practical exercises. One of the reasons is, that if the student does not visit the system regularly, he/she can easily lose the overview of the current course, which can affect his/her preparation for the final exam and his/her final evaluation. The survey shows that 58% of students attend the LMS Moodle course more than once a week, which is not a satisfactory number, especially if they have assignments and documents for preparation for F2F lessons just in LMS Moodle. At the same time, from that point of view, we realized also the alarming, that 11% of students visit the course in LMS Moodle even just once a week or less (Figure 6.).

Figure 6. Frequency of students’visit of the course Informatics II in LMS Moodle; Source: own contribution

Within a more detailed analysis of individual students’ logs in LMS, we found that students do not attend study materials during the semester, but only a list of tasks for the next practical PC lab. Their home preparation, therefore, consists only of identifying tasks that they are not able to work out independently. However, if they had previously studied the provided materials, this problem would not have arisen. However, students only view these
support materials (i.e., study materials, tutorials, etc.) before a credit or final exam.

100% of respondents agreed that study materials and tasks are supportive and useful during their study of the subject, but they miss the more interactive and motivating environment. 32% of respondents asked for more video-tutorials and 9% for more tasks for practicing, which will help them study better and in a more collaborative way.

B. Gamification possibilities of Informatics II

Based on the achieved results from the feedback on the Informatics II subject we try to find out how to motivate students to participate more actively in the educational process. As we found out, students use the published materials especially before the credits and final exams. What is a positive finding that students visit LMS Moodle more often, but they miss there an impulse, which would navigate them what to self-study. Therefore, we have decided to implement elements of gamification in order to improve the teaching of the subject Informatics II. We did not gamify the whole course, just the identified problematic parts by using some of the above-mentioned tools (Figure 7.).

Figure 7. Gamified Model of Informatics II Gamification; Source: own contribution

At this stage, it is very important to realize the age of the target group and keep in mind the reasons for introducing a gamification approach to the course. Among the most critical parts of teaching the Informatics II, we can currently include the weak and passive attendance of students in the lectures. To solve this problem it is possible to use tools such as Mentimeter, Kahoot! and sli.do, which are accessible on-line and via smartphones, which the students have with them at the lecture. These tools are useful for “awakening” students’ attention, especially in case of an explanation of the difficult topic when the students often lose their concentration while they just passively receive the information. These tools can be used to attract the students not only at the beginning of the lecture, but also to initiate the activity and participation of the students in the lecture’s topic during the lecture, or to get instant feedback, resp. to discuss the issues that most interested the students within the explained topic at the close time of the lecture.

The second problem, what we expect to be solved by education gamification is to reach the continuous study of published study materials throughout the semester by the students. In that case, we can employ tools and plugins of the LMS Moodle that were designed for that purpose, all together with the appropriate setting of the learning paths in the Informatics II course, in order to raise the attractiveness of the learning environment.

At the higher education level, the students are not oriented only on the gaming aspects, but they take into consideration, how their participation affects their results in the subject evaluation. From that point of view, we are limited by the accreditation concerning the mandatory parts of the evaluation. Therefore, we decided to put the extra points to the gamified part that can be used to fill in the missing points in the final determination of the mark of the subject. Each student participating in the gamification part of the course could gain points for completing several simple tasks. The number of gained points depends on task completion (like attending classes) or actual student performance (like writing tests or completing the final project). If the student missed any test or failed to pass it, he was not given negative points as a penalty. He/she can choose to study in an obvious way. Of course, since this is a game, students who do not participate will not affect it in any way.

IV. Conclusion

Games shape the identity of the students as people and as learners. The gamification of the whole education process or just its particular parts presents a way to provide students with opportunities to act autonomously, to display competence, and to learn in relationship to others [21]. The research is done in [22] and [23] proved the positive impact on students’ involvement after employing the gamification methods into the education process. Gamification, apart from the entertaining and more motivating form of education, help to build up and increase the skills and competencies that cannot be ignored in case of education for future jobs, especially: digital skills, digital navigation skills (what means finding information, prioritizing information and assessing the quality and reliability of information), followed by communication skills, literacy (e.g. media literacy, digital literacy, reading), critical thinking and judgment, problem-solving, teamwork, personal resilience and reflection [24].

Taking into account the previous paragraph, the gamification of education may look very attractive, but Fitz-Walter [25] and Decker [26] highlighted not only the potential benefits but also the challenges and potential conflicts when applying the gamification into Higher Education. There are no general rules or procedures on how to implement the gamification approach into education, it is highly dependent on the age of the attendance, learned subject and the purpose why the gamification of education needs to be implemented [12]. It is important teachers know the students, but take into consideration not only their interests but also the specific learning goals that hit on elements of knowledge from the curriculum.
The paper presented the main outcomes of the students’ behavior towards course Informatics II in LMS Moodle and the expectations or proposals of the students on how we could enhance their engagement in the learning process. Based on the results of the conducted survey among our students and our research in the field of innovative teaching methods and tools, we decided to implement the learning gamification principle via different tools. During our research, we found out many various tools supporting the learning process gamification. After critical evaluation of them, we have to conclude, that the main aim is not to gamify the education for any price, but to find out the appropriate level and ways of gamification, which motivates the students but at the same time encourages them to study in entertaining way and not merely to concentrate on playing the games themselves.

There are a huge amount of tools supporting the process of gamification, but the topic of the subject and the level of education limit their use. Within this paper, we proposed an idea of how to gamify the courses taught at the higher education institution. The presented gamification proposal is implemented already in the course Informatics II and it will be tested during the next semester.

REFERENCES


