Possibilities of Using and Implementing of Serious Games in Education to Improve Skills, Knowledge and Abilities

Marián Host'ovecký
University of Ss. Cyril and Methodius in Trnava
Department of Applied Informatics
Nám. J. Herdu 2, 917 01
Trnava, Slovakia
e-mail: marian.hostovecky@ucm.sk

DOI: https://doi.org/10.15414/isd2022.s5-2.05

Abstract
Main goal of this paper is describe possibilities of integrating of serious games (SG) in education and their perspectives in education. These kind of games represent a specific category of games that is intended mainly for achieving an educational, affective or psychomotor goals. Today, we are a witnesses of increasing rise in many subjects. Today, games not represent just a fun, but also could be use as a tool for improve of knowledges, skills or abilities and competences. Of course, SG projects could be categorized from different points of view from science, art, humanities to medical SG. These games we are implementing at the schools from elementary, secondary schools, high schools to universities. We are presenting some of our design and development of SG focused on English prepositions, Paedagogos and Planetary Geography.

Keywords: serious games, design, development, programming, testing, feedback

JEL Classification: D80, L86, C88

1. Introduction

Kids, pupils or students, adults encounter the term game early in their childhood. We met with this term especially or mainly in its practical form. One of the form of games not just in childhood but also in adulthood are educational games. Games are often connected with the school, as well. Štubňa et al. (2007a, 2007b) claim that each teacher tries to make her subject or subjects as interesting for kids, pupils or students as possible and acquire the knowledge or ability which can be build on in the future. Also, we believe and claim that the game's potential could be used not only in the area of entertainment but in education, as well. Part of games are methods, that include activating methods inducing intellectual and cognitive activities. Petlák (2004) claims that these methods or ways also include didactic games. How the progress of technologies is growing and technologies are more and more implemented in people's lives we distinguish several types and forms of games.

The development of information and communication technology (henceforth ICT) brought new methods of their application. Today, they can be seen in all sectors of the economy, such as agriculture (digital monitoring of fields, need-based irrigation, autonomous agricultural machines, drone pesticides application, etc.), industry (autonomous assembly lines, robotization, automatization and optimization of production lines, quality control, logistics and many others), services (registration, shopping, search for entertainment, online music and TV and many other services) as well as the quaternary sector. Štefková (2016) claims that from the point of the teaching process itself, ICT can be used in every part of the teaching process starting with the motivational phase, then expositional, fixating, checking and finally application phase; their implementation depends on material possibilities and creative
capabilities of the teacher. Digital technologies to a meaningful degree can be integrated into teaching not only at universities but at all levels of education, starting with primary schools, through high schools, including universities of the third age.

1.1 Serious games and digital competencies

New technologies were being implemented not just in science but also in all sectors of the economy including of education from elementary schools to universities. Overall technological innovations and the massive spread of IT resulted in the transformation of society into the so-called information society. This coincides with the birth of new types of services, completely unknown before, such as e-shops (enabling people to order goods and services from their homes), electronic or mobile banking, online trading, online seminars, and lectures, etc. Practical application of IT devices, however, necessitates the ability to use them. The inability to use modern technologies today can become a significant handicap, negatively influencing a person’s schooling or free time but also his or her ability to find work.

In line with the above, one of the forms where could we develop digital literacy are serious games. Development of digital literacy, which has been increasingly used as a result of new technological trends appearing almost daily. Some of these trends become incorporated into real life as soon as they appear. There is up to a particular society to decide which of these trends are going to be considered a priority and, vice versa, which would be refused or considered secondary. This is also the reason for differences in digital literacy between countries but also between particular regions within a country.

As Kokles et al. (2017) state, in May 2010, the European Commission adopted the “Digital Agenda for Europe” in which a strategy for the support of the digital economy until 2020 was introduced. It describes seven priority areas:

1. the establishment of a larger, single digital market,
2. interoperability,
3. increasing the trustworthiness and security of the Internet,
4. faster access to the Internet,
5. greater investments into research and development,
6. improving digital literacy and
7. including and employing ICT in solving problems societies deal with, such as climate change and an ageing population.

Lapinová (2016) says that the acquired information and digital literacy is considered a necessity and is becoming important as the traditional literacies related to reading, or languages and mathematics. In this context, a document called Learning Slovakia – National Program of Education Development states that just as with the technical skills and basic “technical literacy” of the past, also today the “digital literacy” and various digital competencies are formed not only through the school but also through the everyday life. Another definition implies that digital literacy involves the ability to understand information, to use it in various formats and from different sources that are introduced through different IT (Weiszerová, 2014).

1.2 Serious games

In line of context with digital games, Vaculík (2020) asks himself a key questions about digital games: How does playing digital or electronic games influence players’ social interactions? If does playing games lead to social isolation? Is there a relationship between playing games – other free-leisure activities? Does playing electronic games develop social skills? Answers for these questions could be answered by serious games. Serious games represent one of the most purposeful and useful activities at any age. Lot of teachers try to make a subject as interesting
for pupils as possible and build their knowledge. Their purpose is not only to enjoy oneself, spend excess energy or regenerate but also to socialise, educate and train inducing intellectual and cognitive activities. From another of view these games could be implemented and could develop, train or educate sport, movement, psychomotor or cognitive ability. We use these games for socialise, doing with phobias, educate or spend free time or just for relax, have a good time and experience new things. Minhua et al., (2014) show if serious games could be alongside or combined with conventional educational or therapeutic approaches, it could provide a more powerful means of knowledge/skill transfer, promoting healthy behaviours, restoration and rehabilitation.

Games and education have had a long-standing partnership throughout much of human’s history. One of the form of game, which is rising and growing thanks to new digital technologies are serious games. The first time any mention of serious games was made in a book by Clark Abt (1970). Abt claims that simulations and games to improve education, both in and outside of the classroom. Further, the term serious games refers to games that not only primarily entertain, but more importantly educate, train and the player obtains something in some area as cognitive, psychomotor or other skills or competences. Such games are aimed at achieving a certain set goal, which can be verified by feedback in the form of measurement or testing, repetition of a virtual motor skill, and so on.

Serious games are an increasingly important medium with respect to education, training, and social change (Michael et al., 2006). Nowadays, serious games are becoming increasingly more and more favourite and still popular. Serious games constantly grow in number and their importance in society grows as well. In the past, they were not quite so popular and useful. It was caused by low technical standards, inadequate software possibilities and poor Internet coverage in regions. However, over time the situation started to change with innovative software being developed, faster Internet connections becoming standard and more advanced hardware available.

In the line with Agogué et al. (2015) who found that a serious game could support the specificity of learning processes and creativity generation in the ideation context and help participants to collectively explore new alternatives of knowledge acquisition. Hesmer et al. (2013) emphasize that good ideas are often the result of the creativity of a single person or of a group of collaborating persons. An analysis of how innovation “arise” shows that the process is mainly carried out in small discrete steps with or without a given timeframe.

2. Examples of serious games

In the next lines we are going to introduce some of serious games, which has been developed in our cooperation. Some of them were introduced and tested at chosen schools. We have selected the serious games that we characterize below according to their distribution.

The first from serious games is designed for learning and improving English prepositions. Prepositions are one of the most challenging areas that students go through and need to learn. The quality of using a foreign language is immediately known by, among other things, the correct use of prepositions. Therefore, we decided to design and program a serious game for elementary school students. We believe that already primary school children should use and learn English prepositions correctly. For this reason, the 2D graphics of the rooms and the scene are adapted to this target group.
The second serious game is designed for beginning teachers or students of teacher training programs. The game is designed in a cartoon style, i.e. to make the university student feel relaxed and comfortable and to ensure that the game does not create stress in him/her. Wickham states (2015): “While the word cartoon usually refers to animation or a funny drawing, in an art historical context, it can also refer to a full-scale preparatory drawing for a fresco, oil painting or a tapestry. The word we use today comes from the Italian cartone, which simply means a large sheet of paper or card.” The game deals with specific teaching situations from real practice, ranging from so-called specific situations to non-specific situations.

The last third serious game is designed to promote the development of spatial perception. This is one of the areas of mathematics in which students generally score lower on tests. For this reason, we decided to create a game oriented in this way. The player, following the pattern of a generated group of geometric shapes, has to put together the same composition. He has a choice of three geometric shapes: a sphere, a cube, and an ihan. After correctly evaluating the example, the player is credited with the time he will need in the next math problem.

2.1 Serious game for English

This was the first serious game, we developed. It was designed and focused to teach on foreign languages – English. Serious game is focused on English prepositions of place. The main goal is to increase cognitive level of pupils in English prepositions (Fig.1). Target group are pupils of elementary schools.

In terms of the characteristics and description of the game, the aim of this serious game is to find all the highlighted objects (glass, chair, table, cube, first aid kit...) through the sprite (character Pillipi). When Pillipi come to an object, the game pauses and displays the sentence with the missing preposition. Three possibilities are always given below the sentence and a player chooses one of them options. If a player chooses wrong choice, a player has got second the attempt to choose another option. In the upper left corner, the total number of objects are displayed. After each found an object, this number decreases. In this way, each player knows immediately how many tasks (objects) still left. In addition, the number of correct and incorrect answers is displayed in the same corner. A correct answer is only counted if a player answers (selects) the correct answer the first time. Even if the player is allowed to select the answer again, the correct answer is no longer counted on the next attempt. However, if the player selects an incorrect answer, it is counted in the incorrect answer category. A player has allowed to move around three different rooms (Fig.2). He can also move between them without restrictions, as long as he does not find all the highlighted objects and does not answer all the tasks. The whole game is composed of two separate levels. In each level there is a total of tasks. The first level takes place in the apartment, the house and the next level in the garden.

Figure 1: Splash screen of ENGLISH PREPOSITIONS

Source: own source
2.2 Serious game for Pedagogy

Another serious game, which is introduced in following lines is a serious game, which is focused on specific and non-specific pedagogical situations, named Paedagogos (Fig.3). This serious game is designed for beginning teachers and students in the last years of teacher study programs.

Student or beginning teacher especially during their field training (mainly during performance-based teaching practice), students of teaching may find themselves in need of guidance or a way to approach a given situations correctly. This designed a serious game could help us deal with the situation adequately so that no one from students and teachers are faced with negative effects. It is no possible and we are no able to cover all possible pedagogical situations from pedagogical practice. We chose just the most frequent ones, but also included situations that may be rare but may result in serious adverse events and that are difficult to solve.

Teachers are often presently facing various situations that occur either directly during classes or breaks. Every teacher has a unique personality, which means that we may all respond to a given situation differently. Some teachers might take a more responsible approach than others. Some are short-tempered, while others are perhaps far too terse. Some teachers try to deal with a given situation through shouting at students, some tend to stay calm and learn from a newly arisen situation. Variety of situations that one may encounter brings a variety of challenges for the teachers (Fig.4). This is the reason why we believe it could be beneficial to design a video game that would describe situations every educator may sooner or later be confronted with:

- **specific pedagogic situation**: describes situations that occur during classes and that are not considerably life-threatening or health-threatening to students, teachers or other staff.
- **non-specific pedagogic situation**: describes situations that may be life-threatening or health-threatening to students, teachers or other staff, or may cause damage to the school property.
2.3 Serious game for Mathematics

Mathematics is another subject from spectrum of science education. It belong to the most complex subject where could be develop a lot of applications from from geometry to arithmetic or spatial imagination (Fig. 5). The serious game is focused on the design and development of an application for support do develop of spatial imagination of pupils with the support of virtual reality. The application was created in 3D view (Fig. 6).

The aim of this serious game is to model the math objects in right part of lab, which are generated in the left part in 3D space lab (Hosťovecký et al., 2019). A player has to arrange the different objects according to this generated model in order to make them match the template. Whenever an object is correctly fitted in the right part by a player, it is evaluated whether it is correctly or incorrectly fitted. The difficulty is higher after each generated objects (shapes).
3. Conclusion

Main goal of this paper was describe possibilities of serious games in education. How can we see, there is huge opportunity for students use innovative technologies in education as serious games. These games improve, train, educate and simulate. In our opinion, serious games should be integral part of education from elementary schools to universities. Teachers, students or pupils can identify, which themes from each subjects are problematic, which themes cause problem to understand the topic etc. The create the space to integrate something what should help to students. We are in the line with opinions, that serious games improve skills, abilities, cognitive, psychological, pedagogical or other skills. It depends on subjects, from the difficulty of the topic and experiences of designers of serious games and their creativity.

Acknowledgements

This paper was created with the financial support of EUNIS. In addition, I would like to thank especially RNDr. Darina Tothova, PhD. for her support and patience.

References
