VIDEO GAMES AS AN EDUCATION TOOL

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Abstract: Today Internet and technology are important part of every aspect of life. They are especially significant in education. Video games are a part of that technology. History of video games goes back to 1930s and first flipper machines. Throughout the 1970s universities started developing computer video games. Today, video game industry is one of the most productive in the world. Although researchers have tried to point out negative effects of playing video games, such as addictive and violent behavior, they have also proved that it has many positive effects. It is a complex activity that stimulates senses, includes strategic thinking and develops motivation for learning. Gamers think, analyze and plan to achieve goals. As an education tool, video games are fun, simple, adaptive and rewarding. In this paper we described several good examples of educational video games and pointed out their potential benefit in the process of learning and education.

Keywords: video games, education, learning

1. INTRODUCTION

Over the past few decades, video games have become important part of children's play and adult's leisure time. History of video games goes back to 1930s and first flipper machines. Throughout the 1970s universities started developing computer video games. At the beginning of the 21st century commercial video games and Internet started to intertwine, and Internet soon became a place for distribution, playing and buying video games [19]. Today this is a very successful industry that generates profit of more than 70 billion dollars a year [9].

According to their content, video games can be divided into the following genres: (1) *action games*, which mostly include battles and avoidance of capture or violent death (e.g., *Super Mario*, *Virtua Fighter*); (2) *adventure games*, which are based on exploration and certain adventurous plot (e.g., *Myst*, *Legend of Zelda*); (3) *casual games* with simple rules and easy technique good for relaxation (e.g., *Tetris*); (4) *simulation games*, in which gamers create worlds similar to reality (e.g., *The Sims New Five*); (5) *strategy games*, which require careful assessment of the situation and wise planning in order to win (e.g., *Diplomacy*, *C&C*), and (6) *sport games*, in which gamers play certain sport and develop a strategy of the game (e.g., *Madden NFL*, *Tiger Woods*) [19]. In addition to these entertainment genres, there are a number of video games that can also be classified as *educational games* (e.g., *Math Blaster*, *Learnalot*). Since they are designed to both educate and entertain, using them is often described as educational entertainment or *edutainment* [6].

However, using video games for education is still not well-excepted across the world, although playing them encourages development of character that all parents and teachers would like their children and students to have: interested, competitive, cooperative, and results-oriented, actively seeking information and solutions [14]. Part of the reason for this rejection of using video games as an education tool is fear of risks and dangers connected with frequently playing video games, especially when they include aggressive content. Let us mention some of those risks and possible ways of reducing them.

2. REDUCING NEGATIVE EFFECTS OF VIDEO GAMES

The emergence and rising popularity of video games was accompanied by parent's, teacher's and researcher's concern about the effects and consequences of their use. Their concern is especially pronounced when it comes to children and youth, because they often do not understand or critically observe media contents.

It is important to point out the possible risks and dangers of playing video games for the psychological, social and emotional well-being and development of young gamers. Most reported negative effects of video games are game addiction and increased aggressiveness [5]. As Laniado&Pietro [11] write, video games produce idols (e.g., *Tamagotchi*, *Norna*) which try to eliminate boundaries between virtual and real worlds, so gamers are in danger of responding to the content of video game as it is real. In addition, by frequently playing video games, gamers can adopt patterns of movement, clothing, and behavior of game characters / idols. This is especially dangerous when video games are full of bloodthirsty killing scenes, violent chases, and pornographic visuals. Exposure to the scenes of brutality in video games cannot leave gamers indifferent. In real world, murder is a punishable crime, while in video games it can bring points and progress to higher level of the game [11]. Logically, this twisted value messages cannot have positive impact on children and youth.

Only aware of the negative effects, it is possible to work on their prevention and elimination. In 1994 video game industry established an evaluation committee for entertainment software (*Entertainment Software Ratings Board* - ESRB) as a self-regulatory mechanism. ERSB grading system has been developed to offer concise and unbiased information about the content of video games and thus help the consumers, especially parents, in making decision upon purchasing a particular video game for their children. It consists of a total of seven ratings: EC (for over three years), E (for over six years), E 10+ (for older than 10 years), T (for age 13 and older), M (for 17 years old), AO (over 18 years), and RP (not yet rated content). A proper assessment of each video game should also include a short summary of the game with explanation why it is attributed with a certain score [1].

Since they have an important role in development of media literacy, it is also very important for parents to actively work on eliminating negative effects of playing video games on their children. There are many suggestions how to make video games a useful tool with positive effects [11]. Parents should make an effort and learn the basic technical terms, jargon and abbreviations in order to obtain as much of information about video games. In that way they will be able to choose appropriate game for their children. In choosing the right game it is necessary to pursue games that are interactive, transmit appropriate values and messages, and have good technical quality. Video games should be tailored for their age, starting with simple games for the youngest children and progress towards complex strategy games for older adolescents. Today's children can hardly imagine life without TV, Internet or mobile phone, which they often use for playing video games. So they are in danger of social exclusion. Instead of forbidding them to spend their time playing video games, they should be encouraged to play video games with their friends. Patricia Greenfield points out that violent video games played in pairs can have a cathartic effect or even reduce aggression, while video game with violent content played alone can intensify aggressive behavior [4]. However, daily exposure to video games should be limited. Games should be avoided immediately before or after sleep, and should not interrupt other more important daily routines such as homework, extracurricular activities or playing outdoors. Television and computers should not be placed in bedrooms because parents could lose control over the time their children spend playing video games. In addition, it is particularly useful for parents to occasionally play video games together with their children. In that way they can better understand the content of video game and thus increase children's level of understanding and interpreting them. By following the above recommendations and suggestions, parents greatly reduce the potential negative effects of playing video games and expand positive ones.

3. VIDEO GAMES AS AN EDUCATION TOOL

If they are designed for educational purposes, video games can be impartial and patient teachers. Number of research confirmed that video games in general have positive influence on social and cognitive development of children, including positive effect on academic achievements, cognitive abilities, motivation, attention, and concentration [10]. Let us mention a few proven benefits of video games when used in the educational process: video games benefit better understanding of algebra and encourage reading comprehension; they develop IT skills, build self-esteem, set goals and provide feedback; they contribute to development of complex thinking skills related to problem solving; they benefit language development of children with learning disabilities; they are good motivators because they challenge, stimulate curiosity and allow control of individual operations; they increase concentration while learning new information, etc. [15]. In short, video games are places where learning, adoption of knowledge and skills is stimulated by the content of games [12].

Laniado&Pietro [11] described several advantages of video games when they are used for learning. Because of its narrative frame, content of video game is easy to remember. Video games are often connected with the story and evoke emotions of gamers. They immediately provide feedback, which is very important in the learning process because it encourages re-attempts and further progress. Therefore, success is instantly rewarded by switching to a more complex level of game/learning. Rapid changes of the scenes, music volume and tonality of voice triggers formation of new connections between brain cells. Video games also enhance coordination and activate all senses. For example, watching the monitor is followed by handling a joystick. Furthermore, video games promote associative thinking. Screen provides a number of symbols or icons which open doors to new virtual spaces. Instead of linear teaching from the book, in video games progress is achieved through association. Getting use to this approach from an early childhood is very useful due to the growing presence of computer technology in all spheres of social life. Video games also develop intuition and hypothetical thinking. If the gamers want to learn and follow the rules, understand the plot and become heroes, they must activate their inductive processes, be imaginative, adaptive, and good observers. On the other hand, traditional school education insists on following the rules without questioning their meaning and usefulness.

There is a certain resistance to the inclusion of video games in education process. This resistance is based on the perception that video games are purely entertainment media and thus cannot be education tool. Part of the reason is lack of teacher's knowledge and skills for using modern information and communication technology in education, and insufficiently developed effective educational hardware and software [15]. Including video games into official curriculum is not to be taken likely. Teachers need to be well informed about appropriate video games, so they can be able to fully integrate and succeed in their mission. That includes enough time to prepare, good technical support, ability to create balance between fun/entertainment and learning/education, and carefully planned roles of students and themselves [13]. Some authors believe that the future of education is

beyond schools, in simulated and virtual worlds where we participate in communities of our interest [18]. In order to improve this future goal it is necessary to develop good educational video games in cooperation with teachers, scientists, and also children.

Many commercial and non-commercial web sites offer lists of popular video games, including educational ones. For example, *Wikipedia*'s list includes *Big Brain Academy: Wii Degree*, *Bot Colony*, *Genomics Digital Lab*, *Gizmos & Gadgets*, *Immune Attack*, *Urban Jungle*, *Democracy*, *Global Conflict: Palestine*, etc. [21]. Also, many video games that are not marked as educational ones have s great potential to teach and develop skills. However, in this paper we decided to refer to video games as an education tool that can be used in education process. Video games offered in schools must have a strong educational character, which means they have to offer certain type of knowledge whether it is about world history, mathematics or other school subjects. With no intention for advertising them, we choose a few good examples of educational video games that cover different areas of education and are developed for different age groups. This selection of video games and their description could serve both parents and teachers in making decision which game to buy or use in classroom.

Strategy video games titled **Civilization** or *Sid Meier's Civilization* are intended for older children and youth. The content of video game is set in 4000 years BC, and the gamers have a task to develop their empires through different historical periods up to modern times and near future. The game includes construction and expansion of towns, gathering resources, accumulation of wealth and power, making contact and conflict with other civilizations and changes in the political system. It is suitable for learning history, geography and for understanding the basic concepts and ways different social and political systems function. Its potential benefit for educational purposes was first presented by Kurt Squire [18], who included the game in the official curriculum of his history class, and then followed reactions and impressions of students. He noted that the students, playing *Civilization III*, adopted a number of new technical terms and concepts, and understood better the world geography and basic events of world history. However, their overall reaction to the game was negative because they found it to be too difficult to play. This way of learning was something new and unusual for them. Squire [18] believes that the reason for such reaction is their habit of linear learning, in which teachers teach and students learn from their lessons and literature. This type of learning also continues at higher levels of education. That results in an underdeveloped creativity and closeness to new ideas, which are especially valued in today's new economy and the digital era we live in.

Image 1: *Civilization* game (source: https://upload.wikimedia.org/wikipedia/en/a/a7/CivilizationAmigaAGA.png)

Another suitable video game for older children and youth is **Food Force**, designed by the United Nations World Food Programme. Gamers of *Food Force* participate in missions for distribution of food in famine-affected countries and assist them in their recovery and gaining independence. Plot is set at fictional island Sheylan in Indian Ocean, which is suffering from drought and civil war. Gamers are scientists of the UN team, who actively participate in estimation of the number of hungry people and their location; production of daily food packages for individuals, distribution of food packages by helicopters; purchase of food; overcoming obstacles in the transportation of food by trucks, aircraft and ships, and planning the long-term development for the island Sheylan [7]. *Food Force* video games teach global economy, production and distribution of food and the activity of World Food Programme's. They are very useful when it comes to raising awareness about world hunger problems, war and inequality and possible measures that could reduce these problems. Thus, they develop social sensitivity. It would therefore be desirable to include them in classes in developed countries, where the famine and war are usually thought through dry statistics in textbooks.

National Geographic Challenge is a quiz type video game which includes questions that allow gamers to explore world history and geography. Since the game acquires certain knowledge, it is fitted for older children. This video game encourages competition because it can be played with others. When gamers play in a group they have to coordinate with each other's so they learn to function as a team, which is a skill need in modern work [3]. Good quiz games should present children with educational material in a fun and dynamic way. National Geographic offers a whole range of games for computers and mobile phones. They cover fields of history, biology, geography, ecology, etc. They are mostly made as puzzle or quiz games and have a great potential in building interest in different filed of human knowledge.

Image 2: *National Geographic Challenge* game (source: https://psmedia.playstation.com/is/image/psmedia/blus-30851-ss4?$MediaCarousel_Original$)

Video game ***Influent Language*** provides children and adults with an opportunity to learn foreign languages. In a 3D environment gamer chooses different kinds of objects that surround him and learns their names and proper pronunciation. The game also includes testing of acquired knowledge [8]. Self-test through a video game has a great potential of reducing the fear of exams and also encouraging self-progress. This video game develops vocabulary and improves pronunciation. It offers possibilities of self-learning, self-examining, repetition, listening to authentic language, etc. Gamers have to actively understand the rules of the game and follow them in order to achieve something. It has been noticed that role playing and multitude of rules in video games are very useful when it comes to learning languages [20]. For instance, Väisänen [20] showed that Finish secondary students who played video games had better grades in English language class.

Video game ***MetaboSIM*** is a puzzle game from Zachtronics Industries. It is based on the metabolic system of humans and plants. Gamer has a task of carrying out the metabolic processes by maneuvering oxygen, glucose, water, etc. The game is presented as a part of Amplify curriculum, which is a team of USA digital experts providing services in education [22]. A gamer is given instructions based on biology facts that he needs to follow, but these game instructions are actually science knowledge. Hidden teaching function reduces the possibility for a game to become dull and uninteresting. This game could be ideal for children who are just starting to learn the complex human organism and the way it functions.

Image 3: *MetaboSIM* game (source: http://i.ytimg.com/vi/HC5IP4flhes/maxresdefault.jpg)

Another video game related to biology is ***History of Biology***, designed by Spongelab Interactive, and suitable for education of high school students and other people interested in the field of biology. The plot is set in the 17th century during invention of the microscope and appearance of first microscopic descriptions of life. Gamers take a role of assistant who tries to solve riddles made by mysteriously missing Doctor Walden Shayari. In order to solve riddles, gamer goes through 14 different missions while being thought of fundamental concepts, discoveries, and important people in the field of biology. Video game includes special notes for teachers, which point out issues and problems students encounter while playing the game [16]. Since science subjects are often described as heavier than others, this video game could be a very useful tool that motivates students to learn biology in a fun and interesting way.

Blaster Learning System is a series of educational video games designed by Davidson, but currently are property of Knowledge Adventures. First of them, ***Math Blaster***, was intended for education in the field of mathematics. Due to its popularity, the *Math Blaster* has undergone a number of extensions, not only in the field of mathematics, but also in teaching languages (e.g., *Reading Blaster*, *Spelling Blaster*). *Math Blaster* is designed for children in a age group 3-12, with purpose of creating a fun environment for development of math skills. The game is set in space, gamer's tasks range from simple to more complex mathematical operations. By solving math problems, he collects points and advances in game. Although children often think that math is something boring and difficult, in this game math is presented in an interesting, useful and fun fashion.

Image 4: *Math Blaster* game (source: http://www.gamefabrique.com/storage/screenshots/genesis/math-blaster-episode-1-02.png)

Roman Town is an educational game in which gamers take a role of an archaeologist. The game includes virtual digging up of historical artifacts from the site of an ancient Roman city. It also includes problem solving and analytical thinking through solving puzzles and mini-games while analyzing artifacts. Its interactivity allows gamers to walk through ancient architecture and get a sort of experience of uncovering ancient objects [2]. This kind

of a game is suited for children who are interested in archeology and history because it can give them an insight into this profession.

Decades of research have shown that students rarely can apply their knowledge to solve problems or understand the conceptual lay of the land in the area they are learning [3]. Above mentioned and described examples of video games, and many more of them that are not mentioned in this paper, could be a good platform for overcoming that problem. Teachers could use them as a support in teaching process, thus making it dynamic and interesting for their students.

4. CONCLUSION

In modern societies information and computer technology is an integrative part of all human activities and present in all stages of life. From a very young age, children are in contact with that technology. As soon as they become capable to turn on the television, radio or computer, and select the content they want to watch, listen or play, they often choose to play video games because of their entertaining and dynamic content. At this point, parents need to start developing their media literacy and encouraging healthy and useful use of video games, thus reducing their potential negative effects. They need to know there are many educational video games. Few of them are mentioned and described in this paper. Those video games can be fun, useful and interesting for adults too. Also, parents should be aware of the fact that many games are advertised as educational, but are not necessarily so. So they should be much more critical to the commercials they see. Video games are a part of consumerist society and their aim is to make profit. If they choose to buy a game, they should insist on quality of technology and content, as well as scheduled and supervised playing.

Playing video games is a complex activity that stimulates senses, includes strategic thinking and develops motivation for learning. Gamers think, analyze and plan to achieve goals. As an education tool, video games are fun, simple, adaptive and rewarding. However, video games are not a competition to school, textbook or traditional learning, they are merely an addition. This technology has a great potential in education, so its inclusion in the curriculum could be very useful.

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