TRENDS IN EDUCATIONAL GAMES DEVELOPMENT

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Abstract: In this paper we will give a literature review related to game-based education, in the first place at university, as well as the analysis of existing solutions which should enable this type of eLearning. The main topic of this research will be capacity for applying modern information technologies for developing game-based learning platform. When we chose this topic, we started form the fact that there are no applied game-based eLearning systems at universities. During analysis phase, we found that more research is needed in order to improve application of games in education. In the first place, these studies should cover listed problems: how to design educative games in order to achieve better learning effects; how to develop software tools to automate educative game development process; establish methods and techniques for knowledge and skills assessment utilizing educative games.

Keywords: Game-based learning, eLearning, Games, Motivation for learning

INTRODUCTION

With the development of personal computers and their penetration into all sectors of the economy, and also into many aspects of everyday life, it became clear that computers can be used as machines for entertainment. The first computer games appeared in the fifties of the 20th century - since then, their development has proceeded at a vertiginous speed. It was almost impossible to assume that they will become one of the dominant social phenomena, and that, in the last decade of the 20th century, the industry of computer games generates more revenue from the film industry. This game development has enabled them to become more complex, richer in content, more attractive - and also more appealing to customers. Great popularity of computer games has led to the fact that they have become an integral part of modern culture.

The popularity of computer games led to thinking about their application in education. Games became an integral part of modern society. They are the ideal platform for presenting new content and new technology - a lot of people play computer games and accept them as a normal form of entertainment. Research shows that it is not only the youth who plays games - big part of the playing population represents adults [13]. According to the report of the American Association for entertainment software (ESA - Entertainment Software Association) in 2006, the 69 percent of the U.S. population plays video or computer games. The average age of players is 33, and 25 percent are older than 50. Men make up to 62% of the population [9].

Electronic games are a new mass medium, with its characteristics, as compared to the now traditional media such as books, television, film or music. In contrast to all existing media, games have the opportunity to interact, allowing the user to actively participate, not just passively receive information. That is why the last few years we can see more and more use of computer games for education. Educational games are social, card, or computer games that are specifically designed to teach people about a certain subject, expand concepts, reinforce development, understand an historical event or culture, or assist in the development of certain skills.

GAMES

Game as a concept is not easy to define. There is a field called game theory and is principally engaged in the strategy of playing moves between play-

ers based on mathematical rules. It deals with the choice of optimal moves, and its greatest application is in economics and politics. However, it has almost nothing to do with the development of video games. We can certainly say that what unites all forms of games is fun. It is the main reason for the success of the games. The aim is to exclude us from reality and bring in another reality that is governed by other rules, and other forms of behavior. It is a unique form of real-world simulation that comes as abstraction of the important elements for the functioning of game logic. The human brain must constantly process large amounts of information in the real world, while in the games, the level is much lower because it uses only the information relevant to the game scenario. This leaves to the brain a lot of room to entertain while playing game, and also the possibility to acquire certain knowledge during the play. First of all, the games are looking for a challenge [35]. From the simplest games like Rubik's Cube to the most complex computer 3D simulation the player expects a challenge. In every game there must be obstacles that the player will invest time and effort to overcome and that will give him emotional satisfaction. The player expects to earn the respect of other players with achievement of certain success in the game. Another important factor in games is imagination. It is expected from the game to enable an opportunity to develop imagination, and that through narration player gets involved into the game world. Due to the specifics of educational games, it is reasonable to conclude that it is crucial to find a good balance between fun and some seriousness that educational content carries. With respect to this principle, we can expect the maximum impact of this form of knowledge transfer.

Games became a very important tool for knowledge transfer because of their ability to actively hold the attention of participants and because of the fact that they are creating an impression of fun in learning. In particular, computer games gain the significant role in education. The development of information technology makes it possible to create more interesting games that have more and more power to actively engage the players and introduce them into the story. This leaves ample room for the application of educational games. Also development of the Internet opens up many possibilities of distance education, and inclusion of more physically remote users in the educational game.

E-LEARNING

Changes caused by the development of computer networks and information technology were such that they have an impact on all aspects of society, including education. There was a justified need for the introduction of computers and the Internet in education systems. E-learning (electronic learning) is a comprehensive term, generally used to describe a computer-assisted learning. It often includes other devices such as digital assistants (PDAs), mobile phones, etc. However, all these devices, given the way they work, can be classified as mini-computers. So, E-learning can be defined as computer-assisted learning. Also, e-learning can include materials based on web technology, and hypermedia in general content (multimedia CD-ROMs, web sites, discussion forums, collaborative software, e-mail, blog's, wiki's, educational animation, simulations, games, software for course management, etc.), often a combination of different methods. E-learning is a natural extension of distance education that is present since the 1930s when they created the first correspondence school.

Today, e-learning in higher education tends towards the formation of virtual learning environments (Virtual Learning Environment - VLE), which in conjunction with controlled information system becomes a controlled learning environment (Managed Learning Environment – MLE). This environment is characterized by a consistent user interface that is standardized throughout the educational institution. An increasing number of universities, both traditional and virtual, include as an offer, a specific degree and relevant courses that can be completed online. Some of them require students to be present at the campus, but there are courses that are fully completed online. The advantages of e-learning are flexibility and convenience to users, especially when they have other obligations, then good communication between students, adoption to student's needs, versatility compared to traditional courses, and the presence of multimedia content to facilitate adoption of learning material.

The largest number of authors cited a lack of interaction with mentors as well as physical isolation of students as a shortcoming of e-learning. Many of them even say that this process is not educational in character, speaking from a strictly philosophical point of view. First mentioned disadvantage can be partly removed from the video and audio conference system on the network. As for the isolation of students, it can be compensated by the existence of forums, chat services and other forms of online communication.

Cost-effectiveness of e-learning is the subject of much debate, primarily because of the high initial costs, which can be compensated by the massive offering. Especially development of network software could prove as a costly investment. The development of flexible educational materials may also be time-consuming compared to the production of the classic material. Also, when switching from traditional methods of education on e-learning, significant financial resources must be set aside in the name of training for the use of both hardware and software components of the system. Among the first institutions which founded e-learning, in the mid 90s, are the Western Institute of behavioral science (Western Behavioral Sciences Institute), New York Institute of Technology, System for exchanging information (EIES) Institute of Technology and Organization of New Jersey and Connected Education founded by Paul Levinson. According to the Sloan Consortium, virtually all institutions of higher education, like most private institutions now also offer online classes. In contrast, only about half of the non-profit educational institutions offer this service. Sloan's report says that, according to a survey in academic circles, most students are satisfied with online classes at least as much as they are satisfied with traditional learning methods.

Communication technologies used in e-learning can be divided into synchronous and asynchronous. Synchronous activities are those that require that all participants communicate simultaneously. This type of activity belongs to interactive messaging (chat), and other multimedia content (e.g., whiteboard), and virtual classrooms and meetings. Asynchronous activities can be web logs (Blog's), the contents of which anyone can change and update (wikis) and Internet forums and discussion groups.

To test student's knowledge in the process of e-learning, different methods of computer evaluation are used (Computer-Aided Assessment and e-Assessment). These methods are diverse and range from simple automatic processing questioner to more complicated systems that include recognition of words and short sentences. Systems often include obtaining immediate test results, along with any corrections and instructions, known as feedback. Some systems perform error analysis that the student made thereon and are adapted to test each student individually. However, it is obvious that all of these systems are still in their infancy and have yet to reach their maturity.

Educational Games

The paper focuses on educational computer games. They combine education and entertainment in a concept known as edutainment. This concept usually assumes that users provide lessons in a fun environment recognizable: television, computer games, movies, music, websites, multimedia software and so on.

It is known that computer simulation has long been used to train civilian and military pilots. Modern flight simulation games are so highly developed that they have greatly surpassed the commercial software, especially in the quality of sound, graphics, and the degree of realism in general. In Germany, it is already being worked on a program very similar to computer games that simulates driving a car in the city and on the open roads. The advantage of these flights and car-simulations are that they represent a cheap way to simulate incidents and enhance response by participants. Disadvantage is that in comparison to modern computer games they reminiscent to clumsy attempts at 3D animation of the twentieth century.

There are indications that even a shooting game in first person in some areas can be used as an educational tool. Some armies take them to be cost-effective way to supplement tactical knowledge of military and anti-terrorist units, as well as orientation

and coordination skills. Many social and computer games that are not intended to be strictly educational carry a significant educational aspect. Monopoly teaches us basic principles of market economy, Microsoft's Age of Empires series, Total War games, and Civilization teach political economy, history, military theory, and even sociology and ecology. There are also many games that teach management: Transport Tycoon (management of urban and intercity transport), Railroad Tycoon (managing railway), Rollercoaster Tycoon (managing amusement park), SimCity I-IV (management of the modern city), Football Manager (managing a football club) and many others.

It is significant to mention the educational games for kids. Sales of classic toys have shown a downward trend from year to year and almost all the kids spend more time in front of the screen. Thus, this genre of computer games is becoming extremely important. Children's educational games are educational in the true sense of the word. There are games for all ages, from those that resemble picture books in electronic format, to games like The Sims to help teenagers to cope with and resolve problems in the real world.

OVERVIEW OF THE FIELD APPLICATION OF ELECTRONIC GAMES IN EDUCATION

This section contains an overview of existing research in the field of application of electronic games in education.

The most important classification

This section presents the most important classification of educational games. Classification aims to highlight the main factors that connect games, and to emphasize the critical differences between the groups and members of the group games. Well-designed classification will often suggest the unexplored areas of making games. More importantly, classification reveals the principles that underlie the development of games. However, the classification is the only way to organize a large number of related objects. As the field of games is too young, and the sample is small, it is not easy to find a good criterion for the division. Games that exist today are more product of chance rather than an inevitable result of well-organized forces [11].

By the type of the game

We decided to name the classification given by Chris Crawford, in his book 'The art of computer games' [11], published for the first time back in 1970. It is a classification by the type of the game, and essentially covers the actual games today.

1. Games of skill and action
a. Combat game
b. Maze
c. Sports Games
d. Games blow
e. Racing Games
f. Various other games
2. Strategy Games
a. Adventures
b. D & D (Dungen & Dragons) game
c. War Games
d. Games of Chance
e. Educational and children's games
f. Interpersonal games

Games of skill and action - Represents the largest and most popular group of computer games. Most people link all the games with this category. All arcade games are games of skill and action, also almost all the games for the Atari 2600 belong to this group. Features are playing in real time; the reliance is on graphics and sound effects and using the joystick rather than keyboard. The basic skill required of a player is to coordinate hand and eye movements, and have quick reaction time.

Combat game - Combat games are a direct violent conflict. The player has to shoot and destroy the bad guys controlled by computer. The challenge is that the player is positioned to avoid the attack and the shooting by the enemy. This is a very popular group game, and there are many variations on the theme, the environment in which to play, and the types of weapons used.

Maze -Another subset of games class skills and actions represents the game with a maze. PAC-MAN

is the most successful representative of this group. Primary characteristic is the existence of the maze, the path which the player must pass in order to successfully beat the game.

Sports games - These games are modeled as popular sports. The basic idea is to design games that simulate sports games in the real world. Because players are already familiar with these games in the real world, it is easier for electronic version to find the way to them. For example, there are games based on basketball, football, baseball, American football, tennis, boxing and other sports. Such games usually ignore certain aspects of the real sport in order to be able to be played on computer.

Paddle games - We use this term to describe a game based on the PONG game. PONG is certainly one of the most successful games, with more successful clones and sequels. The basic characteristic of this class of games is to intercept and divert the object that is moving. The original version was made for two players, an electronic version of the game ping-pong, from which comes the name. The version that made the greatest popularity was the one in which a player, who has the task of retrieving the ball, destroys a wall made of bricks.

Racing games - Some video games include classic racing. Most of these games allow players to move at a constant speed, and require players to skillfully avoid obstacles and operate the vehicle. For example, a player in the game of skiing has to avoid trees and rocks, the result is based on the time it takes for a player to finish the race. MATCH RACER is a racing car on the road with obstacles such as oil stains. NIGHT DRIVER is also a race car with a view of the road from the cabin. The problem with this class of the games is that they are not real games for several game-type puzzles, because there is no real interaction between players and enemies. Indeed, it is difficult to identify the enemy in these games.

Strategy games - Strategy games are another large group of computer games. These games favor thinking rather than handling. That does not mean that some of the games from skills and action have no strategic content. The main factor that distinguishes the strategic game of skills and games type of actions is that the game requires motor skills from a player. Strategy games do not require motor skills, while the games of skills and actions do. Playing in real time is very rare in strategy, although in recent years more real-time strategy appears on the market. Strategy games usually require more time for playing than the games of skill and type of action. Strategy games are rare on gaming consoles like the Atari 2600; they occur more frequently in the version for the home computer.

Adventures - This group of games is derived from one of the earliest computer games, which is also called 'Adventure'. In adventure a player moves through the complex world, collects items and tries to overcome every obstacle, until it finally reaches the goal.

D & D - Completely independent way of development was followed by games based on D & D games. The first game of this type was a board game, no computers, dungeons and dragons (Dungeons and Dragons) by Gary Gygax, which included research, cooperation and conflict, and was located in the fairy tale world of castles, dragons and wizards. Group of players led by leaders of the game, the so-called dungeon masters, go in search of treasure. The game is played with very few props. Players are around the table and use the block trading. The leader of the game defines rules of the game and controls the players. He has the authority to rule on all the events during the game. In this way we can create very complex systems without burdening the complex rules. The atmosphere is very relaxed and informal. For these reasons, D & D has become a very popular game, with unlimited number of variations.

War Games - The third subclass is war strategy games, games which are the most complex and most demanding games available to the public. Books with the rules often look like corporate merging contracts, and playing time is often more than three hours.

Games of Chance - Games of chance are played in the past several thousand years, and were expected to be implemented as computer games. They are quite simple to program, so there are many versions of these games. Despite the great deals, these games did

not prove so popular, mainly because they do not take advantage of the computer. These games are simply transferred from one game medium to another.

Educational and children's games - The next category are the educational games. Although all the games are educational in their own way, the games in this group are designed with explicit educational goals. A group of these games is still not so much popular, probably because people in the field of education have not yet addressed enough attention to creating games.

DEVELOPMENT TRENDS

Although the use of games in education recently became a hot topic, games have always been one of the available techniques for education. Education is often the first field for testing new technologies [7], and video games can be considered as a type of technology for education [29].

After several years of intensive research, during which the main focus was to attract attention to the possibility of using games in education, the situation has changed and led to wider interest in this area. Most people still believe that games can attract the attention, be effective and have place in the field of education [45].

What is now needed to do is:

1. research to show why learning based on games is efficient and effective.
2. development of practical suggestions on how games can be integrated into the learning process to maximize the potential of learning.

Unfortunately, we are not well prepared to give adequate instructions for making educational games because most recent research was focused on the propagation of the fact that games can be effective for learning, rather than for explaining why and which factors affect this.

Another problem is that until now, educational games were developed by people from academia, so even if they were good in educational sphere, they were not as good when it comes to games. Therefore, the basic tendencies of development should be a connection between pedagogy and designing games, in order to achieve successful educational games.

We can identify three ways of game development:

1. students make educational games
2. educators and / or game designers make educational games for the education of students
3. integration of commercial games in the classroom

All three approaches have advantages and disadvantages. In the first case, when students are engaged in developing the game, problem is that they are not professionally trained to design games, and the time they have available during the semester is limited. On the other hand, there is a positive effect on the students because they learn while they are making the educational game. In this way it is possible to realize the simple types of games that cover smaller parts of the curriculum.

The problem of the second approach is that if educators work alone, without the game designers they do not have enough professional knowledge, or resources, to make a game that can be compared with commercial games. On the other hand, it can be expected that the commercial companies will not be involved in the business of development of educational games until they can be proven as a profitable market. A third approach is the best from the standpoint of costs and benefits, but there is a problem of selection and integration of existing games into existing school curriculum [45].

Use of the media requires only that the media is integrated into the lecture. The integration of media, on the other hand, requires careful analysis of strengths and weaknesses of the media, and conformity with the strategy of education, methods and expected outcomes.

EDUTAINMENT

Most of the works that attempt to link the play and education are among the edutainment category.

Although the word is formed by merging the two words, education and entertainment (education and entertainment), the term is often used for each game that puts the focus on educational content. Basically it comes to the placement of official educational content (mostly elementary school programs) in an environment that resembles the game. From the point of designing games, these actions derive from educational content, which is later added to the logic of the game. Many authors believe that this is not good approach, and that it has negative consequences on the reputation of educational games [21,26,38,14]. This is because if the game is not well designed, it has no positive effect on motivation and engagement of players, so the effect on learning is not so positive at all [23].

Use of existing commercial games for training

On the other hand there are initiatives to use existing commercial games for educational purposes. Although in these games educational aspect is not taken into account during design, some of them have model and content rich enough to be used for education, if done properly. The two most famous examples of such games are SimCity and Civilization:

In the SimCity game, player has a role of a city mayor, and manages the development of the city. The work presented in [22] describes the experiences with this game, how it can be used for discussion on topics such as social dynamics and development. After the success of SimCity titles, many similar appeared which share the prefix 'Sim', with a focus on economic and practical problems of management in different environments. Such games are SimFarm and SimHealth used as a tool for education, as described in [41].

Civilization is a series of games, realized as simulation games, where players manage the development of entire worlds and infrastructure, military, research and scientific progress, which starts with an empty ground and ends with the developed world civilization [2].

Work of Barab and Squire [40] gives an overview of the experience with students who used the game in history class, and then analyzed and discussed the subject. These examples suggest that successful integration of commercial games in the process of education is possible. The basic advantage of this approach is low cost: the development of entirely new educational games that will be at par with commercial games is too high to be profitable, which makes access to the use of existing games very appealing [5]. On the other hand, there are limitations that may have a negative impact on educational potential. One of the main disadvantages is that these games are still designed for fun, without taking pedagogical and educational factors into account. Although realism and historical accuracy may contribute to the success of the game, every decision in which the party is threatened to be made in favor of fun is at the expense of education. Some of the concepts in these games are too simplistic and can lead to erroneous conclusions, as indicated by the papers presented in this section. Therefore, this approach should always be combined with the supervision of instructors, and frequent discussions.

Educational Games

After a short analysis of the previous two extreme approaches, we can conclude that none of them is optimal. The main factor for success is to achieve a balance between fun and learning in the model of game design [32]. Unfortunately, this is not an easy task. Design of the game is not an exact science, primarily because of the sophisticated nature of fun [23]. However, there are plenty of successful games that have managed to achieve a given goal, and that are presented to the players who are not interested in themes, motivate them to play the game to the end, and learn without being aware of it, simply by playing the game. Examples of these games belong to the wide range of games, from action shooter games to strategic and logic games. Here are some interesting examples: Monkey Wrench Conspiracy – first-person shooter intended to be a learning tool for the design. In the game, the player must construct its own weapons in the console that operates much like a software tool for that task. View given in [32] provides additional analysis of that game and the incredible results it achieved in terms of training as well as in advertising for a given software tool.

Virtual Leader [1] - game with a focus on learning advanced management. The game consists of a number of scenarios, representing different meetings at different levels and different subjects. The player can follow the participants at the meeting, their mood, and the ideas proposed and being discussed. The aim of the player is to present participants' ideas on how to be accepted and that the morale of other participants is not compromised.

Virtual UTM [46] - the player takes the role of the rector of the university, with a mission to lead the entire university, including budget management, staff, quality of teaching, research and other activities.

On the other hand, despite the existence of such successful titles, many other initiatives have not led to successful implementation of educational games. A major problem is the high costs of developing games, and the problem of finding a balance between fun and learning, so the game is fun, interesting and educational at the same time.

Another possible approach would be the modifications of existing commercial games in order to improve their educational value [34]. Although this approach would drastically reduce development costs, the problem of finding a suitable game design for education still remains. If the original game is engine specific, then it is a limiting factor for educational upgrading. On the other hand, when we utilize a generic engine (basically provides only low-level operations), technical requirements for development are high. Although the reduction of costs and technical requirements of educational games is desirable, recommendation is to use engine made specifically for the creation of educational games, which increases their pedagogical value, allowing educators to develop educational games. Such engines should be able to support creation of certain genre of games, which were described using domain-specific language developed for a particular genre. Given that these languages are specific for the domain, they would be easy to use and would allow educators to create and maintain their own educational games.

Hence, we promote the use of known approaches to the development of software engineering for developing software, which will allow easy creation and maintenance of educational games. The first step is to determine the pedagogical features essential for the development of engine and educational games [30].

GAMES AND HUMAN BRAIN

Some authors argue that if the children spend a lot of time playing games while growing up, it changes the structure of their brain. According to Carsten and Beck [8]: "Time spent with the games while growing up led to the fact that their brains are differently connected than brains of people who did not play the games well enough." Similarly, [32] argues that "the vast changes in the development of technologies in the last thirty years, of which video games are an important part, led to a dramatic and discontinuous changes the way people think, learn and process information ... The change is so great that young people today have, according to the intellectual style and preferences, a different brain than their parents and older generation".

GAMES AND TYPES OF INTELLIGENCE

It is known that different people learn in different ways and at different pace. Research shows that learning style is inherited. Some people visualize things when they think about them; others are more oriented to the description of words. While one group of people mostly use logic, others are more likely to rely on intuition. It is known that IQ is distributed according to a bell-shaped distribution, as is also well known that IQ tests do not measure all forms of intelligence. [20] says that in fact there are seven forms of intelligence, as follows:

1. Linguistic
2. Logical-mathematical
3. Bodily-kinetic
4. Spatial
5. Musical
6. Interpersonal
7. Intrapersonal (directed inward, self-motivation)

Different people will be interested in different types of games because of differences in their natural talents. We should not forget that people will not solve puzzles which they perceive as confusing and

are not well known and explained clearly. Greater probability is that they will choose the issues they think are likely to be solved.

People with bodily-kinetic intelligence will gravitate toward sports, while those with linguistic will end up solving a crossword or Scrabble.

The balance between motivation and learning

Aim of game-based learning is to provide an environment that is both fun and which enables the achievement of learning goals. [27,28] have identified four motivational factors in games:

1. Challenge: the structure of the game must be neither too simple nor too complicated
2. Control: A player must have a sense of manageability that may affect the outcome of the game
3. Curiosity: for example, opportunities to explore the world in the game can lead to unexpected outcomes
4. Fantasy: the perception of participation in the imagined world.

The main challenge when designing educational games is the realization of a balance between factors that stimulate the motivation to play in a way that does not harm the learning process. Games or simulations can easily distract players in the way that is counterproductive for learning. For example, games that have a fast logic do not leave time for reflection. Games or simulations that have a very detailed and realistic visualization and audio effects can lead to memory overload of the players. Also, games or simulations with rich worlds, can lead to significant activities of the players, but with very little learning. The solution lies in the careful selection of motivational elements in the game in a way that they support and not interfere with the basic psychological mechanism of learning. Nicole Lazzaro has conducted research looking at people when they play games, based on which he has found four groups of emotions that the players show in their facial expression: hard to have fun, easy entertaining, altered state, and human factors [25].

When we successfully resolve the issue given to us, we stimulate the brain with a dose of satisfaction [23]. If the inflow of new problems slows down, pleasure will disappear and can induce boredom. If the inflow of new problems increases above our capacity, we will not feel the satisfaction, as we will be unable to make progress.

State of flow (Flow)

It represents the time that most of the players are referring to as "being in the zone". One of mostly cited academic definitions is one given as Csikszentmihalyi's concept of 'flow' (flow), where flow - is a condition in which the player enters when experiencing an absolute concentration on the task (physical, mental or both), so he loses sense of time and the outside world [12].

Lazzaro [25] calls this phenomenon 'hard fun' (hard fun).

This condition is not achieved very often, but when it happens it is a great experience. The problem is to precisely match the challenges and the capabilities of the player, which is a very difficult task.

If they had been in this kind of situation, the players usually ascertained "This was really fun." If it was not the case, they would say: "... it was fun" but with less enthusiasm. It does not mean that there is no fun if there is no entry into this condition. So the fun is not a state of flow. The state of flow can also be experienced in many situations that are not fun.

Evaluation and verification of knowledge

Thibault also talks about the need for constructing a framework to test the learning through play, based on cognitive psychology, design, games, machine learning, neurobiology and theories of education. Until a unique methodology comes, which will be widely accepted, we will require the presence of people in the process of testing knowledge. Full automation of the test cannot be expected before that [43].

Currently, the knowledge verification is reduced to the traditional ways of testing and self-checking which is given to the player before and after playing the game. On the other hand, video games have

the potential to change the way of how we perform tests [39]. Utilizing the games as a tool for testing knowledge, necessity to use conventional tests will be reduced, since knowledge verification will be integrated in the course of the game. Lecturer, or the software itself, will be able to determine whether a student understood some of the material or not, based on the behavior of the players. This is the direction in which we should go in the future.

ACCEPTANCE BY THE TEACHER

The differences between the new generation, which Prensky calls the "Digital Native", and the older generation that is called "Digital Immigrant" is the source of many problems for the application of games and new technologies in the classroom in general [33,15].

Most of the experience that today's teachers have with the technology is reduced to word processing, database, presentation software, and possibly work with multimedia and the recording and broadcasting video. Given that teachers in class use technologies which they know how to manage, it becomes clear why the use of games in the classroom is not represented to a greater extent.

GENDER DIFFERENCES

Historically, toys and games were always different for boys and girls. Although boys and girls play together, and often play the same game, the way of enjoying the game is very different. If we analyze the way of playing, we can try to find out how male and female brains are engaged while playing. There is a clear difference in playing style as well as in toys which boys and girls traditionally use. The reason for these differences may be in the way the brain works, and the different roles they play in society. In any case, the observed differences are part of today's culture and should be explored further.

Many popular board games have proven to be neutral in terms of sex. Also, the first electronic games, like Pong, are equally suitable for both genders. [42]. However, girls and boys are usually divided into groups, in order to play different games [44].

Barbie (Barbie) is one of the most popular toys for girls, often the number one choice when it comes to gifts for the holidays [31]. Identification with Barbie is a common phenomenon and Dress up Barbie dolls for different occasions are an important activity during the play [24]. Later, shopping for many women is the sequel to Barbie dolls. Indeed, the shopping centers are initially made keeping in mind the female consumers [37].

One of the most popular and best-selling games, The Sims, is also a rare game that is played more by females [16]. For many females, the relationship between playing The Sims and Barbie is very strong. Creating a character, equipping houses with furniture, paintings and editing situations are the same tasks.

One of the arguments often cited in relation to females and video games is that females are not willing to devote so much time playing. According to a study conducted at high school, girls spend only 6% of their time playing games, while boys spend 38% of their time. [6,36].

In a study conducted by [4], the presented results indicate that the time spent on playing games decreases during the first and second years of secondary school, although boys are still playing an average of 6 hours per week, while for girls playing time falls to 2 hours per week.

While it is clear that there are individual differences, numerous studies confirm that there are differences between the sexes in the context of learning, thinking and playing. [3,17,19,44]. On the other hand, individual differences may be stronger than gender differences [19]. In order to better understand the differences between the sexes, it is necessary to understand how the brain works.

Today, the brain can be seen in greater detail, using magnetic resonance imaging. The brain is influenced by hormones from birth. [17] found differences in how male and female brains collect, process and use information. With more neural fibers, the female brain is connected in a way that helps women detect small changes and differences in the emotions of others. Women have more active frontal part of their

brains and are quicker to master the language, and are considered to have higher verbal ability. Females also interact more with others using the language. Women are better at executing multiple parallel tasks [17].

Men are oriented towards the visual, and their ability to cope in the space proved to be better than for most women. They also proved to be better at abstract thinking. Men better remember the simple information [17]. All this gives men an advantage in playing video games. The boys were able to talk for hours about the skills of characters from video games, details of the game to be compared to each other. Above all, boys are more aggressive than girls and more oriented towards the goal. They are mainly focused on one thing at a time [17].

All these differences come into play when boys and girls play games and learn. So girls prefer to solve problems by concluding, through discussion and reflection. The boys prefer a visually stimulating environment where they can learn. Men also like the competition and race against time [17]. Most boys prefer to learn new material through the method of trial and error. Try, and if they guess the answer they go further, and if not, they try until they hit it. Eventually they will remember the correct answer, in order to progress further through the game. Girls, on the other hand, spend some time analyzing the issues, thinking about them and in consultation with their tutor and colleagues. When they finish with the question, girls know the matter, but progress slower than men through the game. Thus, tests with multiple choice questions are much easier for boys than for girls, due to the different approaches [17]. Boys are more prone to guessing, while girls prefer to know the correct answer before they mark it. One more thing, girls are disrupted by the noise and disturbance from the environment when they learn something new.

To be effective, the game must have elements that are appropriate for both sexes. But this is not an easy task. It is especially difficult to design games for women, since the software is not yet sophisticated enough to match the female brain, which processes data simultaneously and is excellent in communication and thinking.

Games and older

A study conducted by Cramer revealed that the elderly in their sixties or seventies can improve their cognitive function by playing strategic video games, such as nation-building and conquering territory. This is one of the first such studies, which confirmed the positive impact on cognitive abilities, even those that are not used in the game [10]. The author is most interested in whether the training conducted by playing video games can improve cognitive skills used in everyday life. They chose to play "Raising the nation" (Rise of Nations) that allows players to build worlds, food and employing people, maintaining an army and conquering new territories. The results have shown that this type of training improves the ability of participants, as measured by different assays. Compared to the control group, the players have become better and faster in switching from one task to another. Working memory has also significantly improved and it also positively affected reasoning abilities. To a lesser extent, the players have shown better short-term memory and visual memory, as well as identification of objects. Training video game had no effect on the ability of remembering lists of words, numbers, or the ability of giving certain answers. One of the conclusions was that the effect was similar to the effect of drug - more training leads to greater prosperity. The general conclusion is that playing certain video games can certainly help the elderly to maintain cognitive and mental abilities.

Conclusion

There are many open questions on the application of games in education. Van Eck [45] pointed out that research should explain why educational games are effective, and provide practical guidance on how educational games should be successfully implemented with the aim of maximizing the educational potential. In addition to research in the filed of educational games, he pointed out the problem of how to operate different types of games and how that affects learning. For example, simple card games can be good for pattern recognition and connecting concepts, and adventure games, on the other hand, promote access to test hypotheses and solving problems.

Further research, in order to promote the use of games in education, should address the following issues:

1. how to design educational games in order to achieve better learning effect
2. development tools for the automation of the educative game production
3. propose methods and techniques in order to test the knowledge and skills acquired through educational games.

Several research teams have recently made a number of experiments and analyzed the results, in order to test the effectiveness of the usage of games and simulations for learning, but there are no clear and common findings, except one: the need to implement better and more qualitative research.

Hays [18] has found over 270 papers on the application of games in education, but only 48 of them include any empirical data. His conclusion is that "empirical research on the effectiveness of games for education is very fragmented, full of poorly defined terms and methodological flaws. Some games provide an effective solution for certain tasks under certain circumstances, but the results can not be generalized to other games or educational software".

There is still no unimpeachable evidence of the efficiency of games in the classroom, as well as for educational games compared with traditional methods. Eric Klopfer, a professor at MIT says that the question: "Are games educational?" is set too wide. It is clear that some games are educational, while some are not. Investigations are still at an early stage, but some studies are promising and demonstrate the potential benefits of applying games in education.

Another problem that occurs in most of the existing educational games is the lack of thematic portability. The essence of the problem is that the complete knowledge of the whole system and games is intertwined and inextricably linked only to one specific game. Development of new games requires the development of an entirely new system and collection of knowledge related to the new area. Research question is how to enable knowledge portability between games.

From the foregoing, our proposal is to develop a unified framework for development of educational games, which will define the methods, techniques and tools for production of educational games.

Developing such a framework requires a multidisciplinary approach and cooperation between scientific disciplines, such as psychology, computer science, and human-computer interaction.

Single framework for development should resolve most of these problems, and identify systemic approach to educational games, which would reconcile the different roles of the participants in this process. Method development should define the process of development that will include the creation of educational content, design and logic games, as well as the development of software systems, using the experience gained in each of these areas independently, in such a way as to allow the creation of effective educational games.

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