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Computer games in the function of developing initial mathematical concepts

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Abstract: *Since modern civilization flows move towards the information society, the computer has become a central medium of our everyday life. The computer is an integral part of childhood, for the children who grow up in the 21st century and it increasingly finds application in the process of learning and games. The paper describes characteristics and educational value of computer games for children, as possibility of their use in the development of initial mathematical concepts. Also, the paper describes some sites that contain lots of interesting games that can be in the function of developing initial mathematical concepts. There are some useful links to web sites with diverse and interesting games.*

Keywords: *computer, computer games, initial mathematical concepts*

1. INTRODUCTION

The rapid development of science influenced the innovation of the education. Computers have become inseparable means of modern teaching. Due to its positive influence on knowledge acquisition the computer is more often used even in preschool institutions and it has a significant role in the process of the development of mathematical notions. Research has shown that preschoolers learn best and most efficiently by playing games. Through games it is possible to transform different patterns of children's behavior and encourage new models which contributes to further development of potentials. In connection to this, with the foal of modernizing preschool activities, more and more preschool teachers are trying to explain appropriate notions through computer games. Since learning process on preschool level is dominated by learning through sensory and motoric experience, teaching children of this age demands total practical and cognitive activity which is also set as the basic condition for development of mathematical notions. This condition is greatly met by computer games, thanks to multimedia content and the possibility of interactive work.

1.1. Child's play and its educational values

Child's play is as old as humanity itself. It has always been pivotal and most important activity in children's lives. First thought on child's play are found in the oldest philosophers and pedagogues.

Since child's play is a very complex activity witch is still being examined, in literature we find many of her definitions. So Topličić (1996: 104) sees play as a "spontaneous and creative activity without practical or utilitarian goal which resembles art" .Minić (2012)

points out that child's play can be seen as a basic form of child's activities through which it most naturally and most freely satisfies its needs for movement and action. More precisely, play is a "conscious activity which shows a type of relation of a preschooler to things and notions in reality "(Mitrović 1980,according to: Minić, 2012: 77). This and other definitions of play point out the fact that spontaneity , creativity and free activity of a child in which the process of the play itself is more important than the results, characteristics which set play apart from other activities which are a part of a child's life. The most important characteristics of each game is child's enjoyment in it and its sense of satisfaction.

In literature we often find a statement that play represents a specific way of learning for preschoolers. Though play child learns, discovers itself and the world by experimenting with various materials, sounds and means, it solves problems in a specific rational and intrinsic way, it understands spatial relations and causal connections. Play creates interests, it activates attention and will and in so doing enables learning process and makes a child organized and focused. Play also influences regular growth and development of motoric, emotional, cognitive, social and speech abilities. It also stimulates the development of perception, creativity and aesthetic perception in children. Learning through play entails fiction, contrivance and research, during which a child freely creates a situation that is under its control, which it understands and which makes it feel safe. In so doing, through play, a child turns formed experience into knowledge. Assimilation of a child's experience into personal view of the world represents a preparation of the child for later accommodation to that world (Pijaže and Inhelder, according to: Kopas-Vukašinović, 2006: 183).

Play is a strong educational means for through it a student simultaneously expresses and develops his or her feelings, learns to respect the rules, develops cooperative and competitive spirit, it affirms himself or herself, expresses his or her opinion, develops a sense of security and individuality and he or she strengthens confidence.

"Upbringing through games represents the most suitable way of upbringing, especially in younger ages" (Kamenov, 1997: 8). Due to the before stated and because of numerous advantages play has a special place in educational work with children.

1.2. Computer games

Modern society is characterized by significant changes in all its areas, and especially in the field of education. Therewith, contents which occupy children's free time have significantly changed and the changes have influenced child games, which are now significantly different than before.

Since modern civilization courses move in the direction of information society, computer has become central medium of our everyday life, so for children who are growing in the 21st century computer represents an integral part of their childhood. The use of computers in preschool age mostly boils down to play and pastime, which are exactly the ways in which preschoolers learn most efficiently. With greater availability of computers and with the ease of their use comes the development of computer programs for children and thus the possibilities for their use become ever greater. Multimedia content and the possibility of interactive work which those programs offer contributes to a more efficient acquisition of content which need to be mastered. Currently there are many programs in the form of fun and yet educational character.

Research indicates positive effects of educational computer games on a child's psycho-

motoric development. Children through educational games learn in a simple and interactive way, they develop their intellectual potential, problem solving skills and abilities to find their way in a new situations, they gain a sense of competency and confidence, develop perception and motoric skills. Educational and general computer games incite explorative spirit, creativity, memory and logical deduction in children.

As a key factor for children's use of computer games adaptability if content to her age and involvement of adults in this process impose themselves. It is important for the child to use only software and games adapted to its age, which for age of up to six is exclusively educational software in which a child can draw, paint, design various things, learns letters, numbers and other notions.

If a computer game has afore set pedagogical goal in the sense of developing some skill, abilities, useful habits or new knowledge, it, as any other game with that kind of characteristics, represents a didactic game. Thus, with controlled use, computer can be effectively used as a didactic means (Bajić and Lukić, 2014). Having this in mind, the modern educator is expected to use a computer, among other means, in his work as a didactic-game means.

1.3. Computer games in function of the development of elementary mathematical notions

By browsing through the offers of computer games online, we have found a wide variety of free online games for all ages which can be used for the development of elementary mathematical notions. Adequate educational computer games, apart from requiring of children to notice objects, also demand activating of certain thought operations during their solving. Namely, this accessible games turn learning mathematics into fun, through them the children will forget that they are actually learning, and this will help them to love this subject. In the text that follows we will focus on some of the educational games and in short describe those which can help in the process of learning mathematical notions.

Site **Kindergarten math** which can be find at the internet address http://www.ixl.com/math/kindergarten (Picture 1.) contains many interesting computer games suitable for children of various ages. The games meant for preschoolers are grouped in thematic wholes with different levels of complexity. So games from the area of geometry are based on recognition and naming the forms have to levels of complexity. In the first level are tasks which solely require that a child recognizes the given form or to mark one of the three offered. The second level is somewhat more complex and in it are multiple choice tasks which makes them more demanding for the child. There are also games which demand that children recognize objects from everyday surroundings and answer questions related to similarity to a geometrical figure or a body. Group of games *Positions* helps the development of spatial orientation in children by asking children to mark objects which are in, on, outside, below, above, next to, left, right… In the group of games named *Sorting, ordering and classifying* asks the children to group and perform logical operations of classification and serration of objects according to color, shape or both color and shape. These are the operations which must precede work with numbers. The group of games named *Comparing* gives children insight into quantitative relations between sets, they join elements of one to elements of another set and in that way develop set relations more or less equally. By playing games in the area of (*Numbers and counting*), children develop the notion of number, join numbers to appropriate sets, learn to count forwards and backwards, developed number relations smaller than, bigger than.

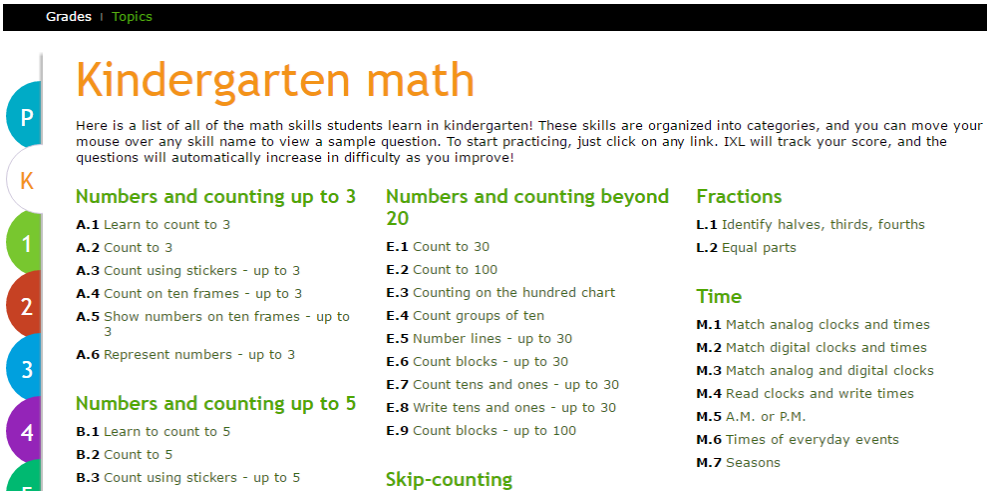

Figure 1. *Appearance of Kindergarten math*

One of the more significant projects which enables the creation of virtual environment for learning mathematics is **National Library of Virtual Manipulatives** (NLVM). Project NLVM was started in 1999. with the goal of developing a unique virtual library of interactive objects and mathematic tutorials, mostly in the form of applets. On the internet address http://nlvm.usu.edu there are thematically sorted games for all ages of preschoolers and school children. Some of the encompassed areas are numbers and operations with numbers, geometry and measurement. In certain games the child learns colors and shapes by sorting virtual blocks. In some games the child can make a new form out of the given forms. For example, in the game named *Pentominoes* child using 12 different virtually manipulative objects makes two or three congruent figures. Similarly, the game *Pattern blocks* is excellent for creation and description of patterns. Children need to make the given geometrical shape by combining various geometrical shapes. In the game *Turtle Geometry* child explores numbers, shapes and logic by independently programing turtle's movement. *Geoboard* is a game in which children through virtual erasers draw geometrical figures in a set scheme or arbitrary (on their own, independently). The game *Time-match clocks* asks the children to show the correct time on the clock. In his way children learn how to use it.

Huge offer of interesting educational games can be found on the site dobreigre.com, which is at the internet address http://www.dobreigre.com/. On the site there are various memory games, games which encourage children to distinguish between geometrical figures and colors, puzzles, counting games etc. Among others, these games help train mental abilities of memory, perception and concentration. AN example of one such game is *Small-big fish*, which enables the acquisition of notions bigger, smaller and equal. At the beginning of the game on the screen there is a small fish, which can be fed by fish of its own size or smaller. After a certain time the fish gets larger. If the player tries to feed the fish with a bigger one, the bigger one eats the smaller one. In that way children form the notion of size through game and fun.

Apart from afore stated, we recommend also the following websites on which there are plenty of educational games which are useful for development and practice of mathematical notions:

- http://www.igrezadecu.rs/Edukativne-igrice/
- http://www.primarygames.com/games.php
- http://www.arcademics.com/
- http://www.coolmath-games.com/
- http://www.kidsmathgamesonline.com/

As a limiting factor of the described computer games we can list that a significant number of them are in English. This is why a child needs and older co-player, mainly educator, who must know foreign language and be next to the child so as to help during the game. However, this does not lessen the significance of the mentioned games. On the contrary, the accompanying sound effects help the child to hear a question in English and this can be a starting point for language learning.

2. CONCLUSION

Having in mind the large interest of children for computers and usefulness of educational games, the modern preschool institution is tasked to apply computers as didactic-game means. In order for the use of computers, educational computer games that is, to come to life in our preschool institutions, certain conditions are necessary regarding technical, hardware, software and staff demands, as well as in the domain of the didactic-methodic organization of activities, including the choice of methods and forms of work. Therefore, the modern educator must elaborate the realization of the set pedagogical goal by using educational computer games, adjusting the game content with the characteristics of preschoolers. Only under that condition can the use of educational computer games in the educational work with preschoolers be fruitful.

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