EDUCATIONAL SOFTWARE FOR CHILDREN WITH CEREBRAL PALSY (A CASE STUDY)

K. Zdravkova

Institute of Informatics, Fac. Nat. Sciences, Sts Cyril & Methodius University
Arhimedova b.b., PO Box 162, 1000 Skopje, Macedonia
keti@ii.edu.mk

Abstract: Children with Cerebral Palsy have severe problems with the motor skills, i.e. with their walking, talking and motor control. Although their mental capabilities might be unaffected by the CP, their communication skills are limited. This paper presents gives a review of the Cerebral Palsy (CP) and of the potential usage of educational software that helps the full integration of children with different disabilities. Particular attention is paid to the specific experience with the implementation of different conventional educational programs that introduce the numbers and basic mathematical operations. The study was made with an eight-year old girl born with spastic CP. This paper presents the results of the study.

Keywords: Educational Software for children with special needs

1 Introduction

Children with Cerebral Palsy (CP) have damage to the area of the brain that controls muscle tone. This damage is caused by an injury to the brain near the time of birth. As a result, children with CP have severe problems with the motor skills, i.e. with their walking, talking and motor control. Although their mental capabilities might be unaffected by the CP, their communication skills, such as talking, using sign language, or using a communication aid are limited. Therefore, children with CP are as a rule treated as retarded [2].

According to the current laws in Macedonia, disabled children and the children with retarded mental development, have to go to ordinary schools. The main objective is that they have to integrate into the society. To achieve this difficult goal, children with CP must go to different kinds of therapy. Usually, the first therapy they experience is the physical therapy. It helps them walk, and use the wheelchair. In better cases the therapy helps them stand, or go through the stairs. In parallel with the physical therapy, older children go to so-called occupational therapy. Here they learn how to use their arms, hand and upper body. That is important particularly because almost all children with CP always depend on the wheelchair and manipulate it only with their arms.

However, the most important therapy for a real incorporation into the society is the speech and language therapy. Unfortunately, some children with CP will never talk because they are not able to control the muscles needed for speech. Therefore, they have to learn alternative ways of communication. One potential solution is writing, which is enhanced by the occupational therapy. The second one is the use of special communication aids, including the computer. Computers are one of the recommended tools for the recreational one, which is very most important for the psychological stability of these children.

2 Educational use of computers for children with Cerebral Palsy

One of the main goals of the modern society is the full integration of disabled children in all areas. The education is not an exemption. Therefore, these children are no longer isolated in special schools. They learn together with the children of their age. Although some of their schoolmates like teasing them, other accept them as they are.

There are different disabilities that must be taken into account while making educational tools for disabled children. Some of the disabilities are almost invisible, such as the colour blindness, or the cognitive and the learning disabilities. They can be solved with minor interventions in the conventional educational tools. Whenever the senses are hurt, educational tools based on alternative senses are of great help. For example, there are many Web sites for people with sight disability [2], and many programs for children with dexterity [1]. Unfortunately, none of these tools can be effectively used when a child suffers of CP.

A great achievement of the modern information technology is the specially designed wearable computer for children with learning disabilities (Fig. 1.). The computer is built by the Xybernaut Company. Its main goal is to **give voice** to children with learning disabilities. The children suffering from autism, CP or physical disabilities can also use it. Its great value is that normal children accept well, both the computer and the child that uses it.

Fig. 1: Xybernaut computer is constructed for children with different learning disabilities

The first advantage of Xybernaut computer is its touch-screen display. It enables simple manipulation, which is one of the hardest problems for the children with CP. The computer goes together with portable speakers. Thank to this improvement, children that can't speak at all, or children that can't articulate the words correctly can simply choose the word they would like to pronounce and then the computer pronounces it instead. With no doubt, this is their easiest way to communicate with the others. The computer has been tested at several schools in the US with promising results. This special computer shows that the information technology can play an important role in the education of disabled people. This idea has now gained general recognition. There are many educational projects throughout the world that deal with different disabilities [4, 5]. In the most of them, information and communication technology (ICT) is the main educational tool (Fig. 2).

Fig. 2: Assistive Technology helps people with special needs and the professionals who work with them

For example, Assistive Technology, Inc. (http://www.assistivetech.com/) provides hardware and software solutions for people with special needs. They offer augmentative communication devices, speech-generating devices, assessment software and services.

On the Microsoft conference in March 2003, there was an interesting news: "Macromedia recently announced that it has built accessibility support into both its Macromedia Flash MX development software and Macromedia Flash Player 6 -- both fully compatible with Windows XP. The player includes support for Microsoft Active Accessibility (MSAA), which enables people with disabilities to interact with Macromedia Flash content and applications using accessibility aids such as screen readers -- devices that use synthesized speech to read aloud text messages that describe what a blind or low-vision user is unable to see on a computer screen or Web site".

Macedonia is among very few countries where ICT doesn't support the education of disabled children at all. Several organizations, such as Polio Plus and Cerebri, try to help these children and their parents. In absence of constant financial support, these organizations can't provide new educational tools, particularly not computers and educational software. Hopefully, parents of these helpless children usually dedicate their lives to help them, so whatever the society can't provide is made available within the family.

The rest of this paper presents the specific experience with the implementation of computer and different conventional educational programs that introduce the numbers and basic mathematical operations. The study was made with an eight-year old girl born with CP, and with her normal twin sister. The results of both children are presented and compared.

3 Educational Software usage

Little V. was born with a spastic Cerebral Palsy, which means that her muscles are involuntarily strongly contracted. The spasm on her left side is slighter, so she manages to use her left hand.

After several years of intensive training, she is still not capable of speaking clearly, although her family understands her well. She regularly works with different therapists. Her mother thought her to recognize all letters of the alphabet, but she can still neither read, nor write. At the moment, she goes to a kindergarten, and the pedagogues expect her to start writing soon.

But, V. is very confident with the computers. She gained her first experience in a small playground where she spent the most of the time by the computer. Afterwards, she was learning Word intensively with her next-door neighbour. Little V. is still very impressed by this program, mainly because she is not capable of reading and writing. On the other hand, she recognizes all letters and knows how do they combine to form a simple word. As far as her neighbour doesn't understand her speech, she is searching for the letters at the keyboard, and she establishes a better communication.

But, in order to get to this level, several problems had to be solved. As first, Little V. was not capable of sitting alone because her muscles were not strong enough. In an absence of a special chair, she was sitting on the knees of the neighbour. The second problem was that she was left-handed. She invented a very effective solution: whenever she wanted to approach to the right side, she was pushing her right hand with the left one, and then she was just pressing the key with the finger. But, the third problems remained unsolved. In spite of all her efforts she has never become capable of dragging the mouse. She has managed many times to get to the right initial position, but whenever she pressed the button, the position was lost. In several situations she managed to start dragging, but she was never able to press the button and move the hand simultaneously.

This fact disappointed little V. a lot. During several months she's been refusing to use the mouse. As far as she is very ambitious she couldn't stand the defeat and she decided not to use the computer any more. The stage lasted almost one year. During this period she started playing and visiting her twin sister's schoolmates. One of their regular activities was the computer. While other children were playing, she was sitting on the bed blocked with pillows and she was watching carefully. At first, she was showing no interest to join the others. After several weeks of focused examination, she became more interested. She started laughing whenever other children managed to beat the computer.

Once again, little V. decided to try using the computer. Knowing her frustrations and her talents, the choice was now different. Little V. has very good mathematical skills. In many occasions they are above average. Therefore, mathematical games attracted her a lot. At the beginning, she was just watching other children playing and she was learning the rules of the games. Afterwhile, she decided to play alone. Three different CDs were offered to her: MathStudio, Numbers [6], and little Monkey Stevche [7].

The first game other children recommended was MathStudio. MathStudio is a game suitable for children from 6 to 10 years and children like to play it very much. Little V. liked that game very much, so the choice was made.

Although MathStudio impressed her very much, little V. was not capable of dealing with the dynamic replacement of the screens. Whatever she decided to pick was running away, so she couldn't catch it. Usually, V. is very persistent, but in this case, her feelings were hurt more than ever. She refused to try the game once again. Fortunately, she was ready to try something else.

Numbers had much bigger success. In this game, the links are very big, and even a considerable deviation leads to the desired goal. For example, any part of the binoculars at Fig 3a is a link. Furthermore, there is very few dragging that finishes in a big area. For example, the animals from Fig 3b have to be moved from the upper field to one of part of the garden. Small problem were flying birds that carry the numbers (Fig 3b), but in several attempts she was capable of catching them. V. had two main remarks about this game:

- I don't like this tiny female voice that imitates children voices
- I don't like games for toddlers

Fig. 3: Numbers are technically completely applicable

These two arguments in addition to the fact that everything was in English discouraged her from playing the game longer. It is very important that she felt very confident with the game and she was very proud for solving all the obstacles alone.

The last game she tried was the small game Monkey Stevche (Fig 4a and 4b). The first thing she liked a lot was the small monkey jumping over the numbers. She was laughing whenever the monkey was on its head. She also approved the voice of young

boy Stefan who was reading the text. What was more important, she could understand everything without an interpreter, because everything was spoken in Macedonian. The thing that she liked the most were the sounds of a train made by the voices of Stefan and his uncle, the developer of the project.

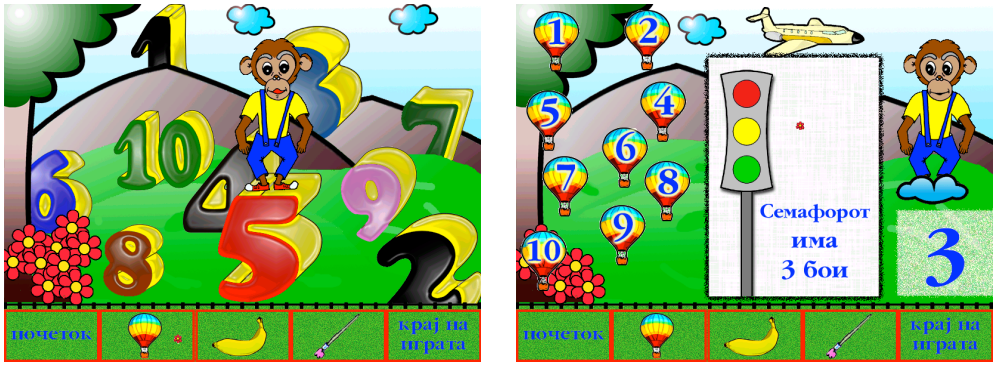

Fig. 4: The game has no details and the links are very big

After the presentation of the numbers (Fig 4b), she was encouraged to play more. For the memory game she started with the first level with 6 numbers (Fig 5a). In the first attempt she was better than her twin sister, so she insisted to go to the highest level with all numbers. In all attempts, she was the winner. Whenever her sister made a mistake, she was showing her sister the same sad grimace as the monkey (Fig 5a). Now, her sister refused to play.

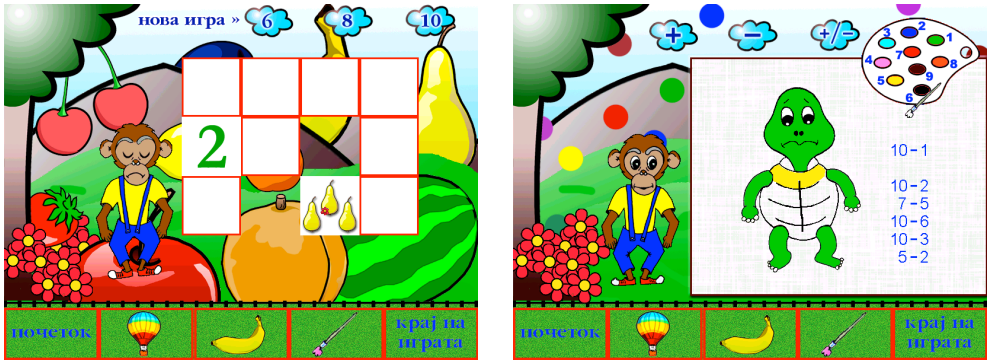

Fig. 5: Although the game is navigated with the mouse, there is no need of dragging

Little V. carried on with small arithmetical games. The games consist of painting the equation with the colour that corresponds to the result. Then, a part of a small animal appears on the screen. She first managed to make the girafe after correctly solving all additions. She also managed to draw the turtle (Fig 5b). Even the last game where after several correct additions and subtractions a small rabbit was made was a success. In every new attempt she was pushing her right hand with the left one faster and

faster and she was happily laughing. What is the most important, she was no longer refusing the mouse, because the button had to be clicked only. When her mother came to take her back home, she refused to leave. She has finally agreed, after the strong promise that she would play the game next day.

Several weeks ago, little V. received the most beautiful gift, a PC notebook. Now, she can play the games that she likes without disturbing others. She sits in her wheelchair with the notebook on her knees. As far as her legs are long, the notebook is not moving a lot.

All the games she has ever liked are here. She can now play even the games that include dragging, because instead of the frustrating mouse, her notebook has a trackball. Little V. is happy and she feels equal with other children. Now, the only problem is to find more and more educational games that she likes.

4 Conclusion

Little V. is one of many children with the same problem in our country. Very few of them have the opportunity to be accepted by other children. Little V. is an exception, mainly because she is growing together with her twin sister and her friends.

One thing is more than important. Even if the conventional educational software can't help this wonderful girl a lot, she is simply impressed by it. It is very probable that modified hardware and adapted educational software will be a real release both for her and for her parents who have dedicated their lives to her welfare.

5 References

1. *Intellitools*: http://www.intellitools.com/
2. Kelly's page: www.people.virginia.edu/~smb4v/tutorials/cp/kelly_s_page/kelly_s_page.html
3. *Magnifiers*: http://www.magnifiers.org/
4. *AT*: http://atto.buffalo.edu/registered/ATBasics/Populations/Blind/compaids.php
5. *Key Alt*: http://www.keyalt.com/
6. Interfact: *Play and Discover numbers*, Mustard 1999, ISBN 1-84164-389-0
7. Kostadinovski M, "Application of DelphiX in the development of mathematical educational software", *Graduation thesis, Institute of Informatics, University Ss. Cyril and Methodius, Skopje,* July 2002 (in Macedonian)