ADVANCES IN TECHNOLOGY-BASED EDUCATION: TOWARDS A KNOWLEDGE BASED SOCIETY

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J.Mesa González

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Information and communication technologies for special needed persons: A case study with a student with cerebral paralysis

P. Condado, F. Tomaz, H. Shahbazkia and F.G. Lobo
{pcondado, ftomaz, hshah, flobo}@ualg.pt
ADEEC-FCT, Faculdade de Ciências e Tecnologia.
Universidade do Algarve. Campus de Gambelas, 8000 Faro, Portugal

Abstract

Communication and education are tied together. Education implies communication, and communication implies exchange of ideas between at least two persons. In the case of special needed persons, there are a number of obstacles that must be surpassed in order to have a more effective communication, and therefore, a more effective education.

In this paper, we show that information and communication technologies can have a profound impact in the education and development of special needed persons. To demonstrate this idea we address a case study involving Paulo, a student with a deficiency caused by the beginning of a cerebral paralysis at childbirth. The paper makes an historical description of Paulo's academic life, from primary school through the completion of the university degree in Informatics at the University of Algarve, Portugal. Along the way, we describe the various technologies that have helped Paulo to improve his communication skills in the classroom. From the mechanical typewriter to the utilization of text processors, from the Logo programming language to the utilization of a text-to-speech synthesizer, Paulo was exposed to a range of technologies that helped him to overcome his deficiency.

The most important lesson of this paper, however, is that while describing Paulo's story, we are not only demonstrating that information and communication technologies can help to integrate people with special needs in society, but also that these technologies, when properly used, can help to draw attention and motivate other students to technology and education.

1 Introduction

Education starts at home when children are still too young to go to school. Many families, perhaps because of ignorance, treat special needed persons as incapable. These families do not try to obtain information about the specific deficiencies and the end result sometimes are bizarre situations such as children being arrested by their own parents at home, not giving them any chance of having a good education and of being integrated in society. It is precisely the ignorance of these families that sometimes hinders the development and communication capacities of the deficient child, simply because they ignore or do not speak with the child in a normal way.

Luckily, Paulo had a family that was well aware of his problem and did not treat him as retarded, or as someone that did not understand anything about what was being told to him. On the contrary, Paulo's family members always spoke with him in a regular way and stimulated him to discover and explore the surrounding world. Paulo's family found information about his deficiency at the *Associação Portuguesa de Paralisia Cerebral* (APPC) [1], the Portuguese Cerebral Paralysis Association.

It is important to stress the role of the family for two fundamental reasons. The first one is that many families are not as well informed and dedicated as Paulo's family was. The second

one is that there is still a lot of misconceptions which are spread out through society (at least in Portugal) regarding people with deficiencies.

The next section describes Paulo's entrance in elementary school and the information and communication technologies (ICTs) that were available to him there. It also describes some of the barriers that his family had to overcome in order to have Paulo accepted at a regular school.

2 Elementary school

Paulo's mother registered him in the local primary school as soon as he completed the required age to start school, just like it happens to all the kids of the same age. However, soon after that, his mother was "advised" by people of that school to move him out of the school and transfer him to another one for special needed people. But Paulo's mother did not do that. She knew about a law that said that people with deficiencies could be accepted at regular schools, and she used that to fight back and to keep Paulo at the school. Moreover, she demanded a *Team of Special Education* (TSE) to follow Paulo as was depicted by law.

The attitude of the people who advised Paulo's mother reveals lack of knowledge about cerebral paralysis and is an example of some of the misconceptions that we talked about earlier in the paper. It could have been caused by lack of communication between the school and other institutions, or because of lack of preparation of the school staff (including teachers) to handle students with cerebral paralysis.

During the first year, Paulo's calligraphy was not very perceivable, and therefore the school made available a mechanical typewriter to him. This machine was the first technological equipment that Paulo used to surpass his difficulty in writing caused by his deficiency. He had to wait for some time for the mechanical typewriter though, perhaps because of some bureaucratic process. Throughout primary school, Paulo did the same school assignments as any other student, with the exception that he always used the typewriter and the other students used paper and pencil.

At the time, during the eighties, Paulo's class was fortunate to participate in the MINERVA project [6], a national initiative that started in 1985 and whose main objective was to introduce information and communication technologies at schools, making them available to teachers and students. This project made the use of computers in classrooms a reality, allowing Paulo and his colleagues to explore this new technology.

Paulo loved the experience that he had with the ICTs of the MINERVA Project. Especially, he enjoyed a lot to work with the Logo software, something that he thought to be a drawing program but that in fact is a programming language especially targeted for children.

Logo was invented in the late sixties by Seymour Papert [3, 4]. Logo provides an environment which is suitable for exploring new worlds. Influenced by his work with Jean Piaget, Papert designed Logo with children in mind and with the philosophy that people (and children in particular) learn best when they can experiment and learn from their own mistakes [3].

From an operational point of view, Logo has a turtle that lives in a bidimensional space. The turtle obeys to commands to move around the screen and leaves a trace while it is moving around (see figure 1).

The commands given by the child in figure 1 are:

```
forward 100
right 90
forward 100
```

In addition to giving simple commands, Paulo learned other programming concepts such as iteration and procedures. The interesting thing, however, was that Paulo learned it in an

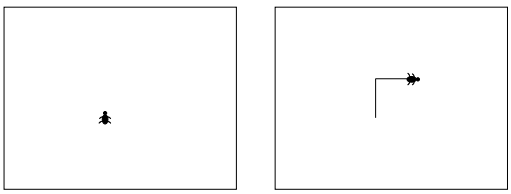

Figure 1: On the left, the turtle is in its initial position. On the right, the child has given some commands and the turtle moves to a new position.

unconscious way, without realizing that he was actually learning computer programming.

The MINERVA Project woke up Paulo's desire to work in some computer related activity for his professional life. That desire remained throughout all his academic life.

Paulo soon discovered that in addition to making drawings, Logo was an excellent communication media. He noticed that besides giving commands to the turtle, he could also write and send small messages to his colleagues and to the teacher, erasing and editing the messages in an easy way. This feature seemed fantastic to Paulo because he was used to work with a typewriter with ribbon which is not very practical when it comes to erasing and editing.

3 Middle school

During the first years of middle school, Paulo continued to use the typewriter to make his school activities. But he started to have problems with it because it took him a lot of time to correct errors and to follow the class. Therefore, he started to use hand writing whenever possible. After some time he started using a lab which had computer equipment. It had a computer with a text processor that Paulo could use to make tests and exams, and also had a small robot of the Logo turtle that interacted with software. There was another special needed student that used the lab. His name was Renato and his deficiency was more serious than Paulo's. Renanto did not speak in a perceivable way and could not move independently, which made his communication with the outside world much more complex.

During the final years of middle school, Paulo and Renato were awarded financial support to buy laptops. This technology allowed them to take the computer equipment to the classrooms all the time, and helped their communication with the outside world. Renato also received another technological aid, an electrical wheel chair, that allowed him to move without external aid, and therefore to be more independent in society.

The next section explores the ICTs that Paulo used in secondary school.

4 Secondary school

In secondary school, all students must choose an area that they want to study in case they want to attend university further on. Paulo had no trouble in that and chose Informatics, the area that he dreamed of since childhood. Paulo continued to use his laptop for almost all school activities. In this phase, he borrowed class notes from his colleagues because he could not type very fast. Paulo did not like to make exercises that involved symbols in the computer, preferring to do them by hand. Somehow, he found that it took him a lot of time to insert symbols for mathematical formulas using the computer software that he had available. Making these exercises by hand was much more practical and fast. Moreover, he felt more focused when doing them by hand. Worrying about searching and inserting symbols somehow interrupted the flow of his reasoning.

At the beginning of his 12th grade, Paulo upgraded his laptop so that it could support more modern programs, and to increase the speed of execution of certain tasks.

5 University

After finishing secondary school, Paulo entered University and chose to study a joint degree in Informatics and Business. There, he continued to use the laptop and other technological equipment that he was used to from secondary school.

He was pleasantly surprised when he found out that the university campus had special parking places for special needed people. Paulo never had any type of communication problems with his colleagues and professors. Most professors did not understand him very well at the beginning. But after the first couple of weeks, professors got used to the way he spoke.

Just like any other student, Paulo had to give a public presentation of his final degree project. Paulo decided to use a text-to-speech synthesizer so that everybody could understand him.

During the last few years, the technology related with the voice synthesis, as well as the associated computational resources, have advanced considerably [2]. The voice synthesizer used by Paulo was based on the Mbrola project [5]. Some modifications were made in the input/output interface of the system. The idea of using the speech synthesizer came from Hamid Shahbazkia, one of Paulo's professors, and was implemented in part by his colleague, Filipe Tomaz.

6 Future work

The use of a conventional computer allows voice synthesis, but it is not very practical due to lack of mobility. Because of that, we have used a compatible machine of a reduced size, a Toshiba Libretto, so that Paulo could carry it easily. This constitutes a small step for the immediate future: Wearable computing. In fact, there has been a number of research and technological advances [7, 8] that are making wearable computing a reality.

Paulo's academic life has not stopped here. He would like to do graduate studies and to investigate ways in which ICTs can be beneficial to help special needed people like him.

7 Conclusions

This article gave an historical perspective of the academic life of a student with cerebral paralysis, giving special emphasis to the role that information and communication technologies have played during his education. From the electrical typewriter and the word processor, passing through the Logo programming language, the daily use of laptops, and finishing up with the utilization of a speech synthesizer, Paulo had a chance to be interact with a wide range of ICTs which allowed him to communicate in a more efficient way.

When talking about the technologies that were used to improve Paulo's communication skills, we are not only demonstrating that these tools can help to integrate special needed persons in society, but also that these technologies, when properly used, can help to draw attention and to motivate other students to technology and education.

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