DISABILITY YOUNG CHILDREN LEARNING PROCESS SUPPORTED WITH MULTIMEDIA SOFTWARE: CASE STUDY

Micaela Esteves, Filipe Pinto
School of Technology and Management, Polytechnic Institute of Leiria, Portugal

Audrey Silva, Ana Duarte
Computer Science Department lab
School of Technology and Management, Polytechnic Institute of Leiria, Portugal

Keywords: Multimedia, disability, human-computer interaction, users with special needs, learning.

Abstract: Throughout technological resources, learning methods have achieved more affective and user-friendly results than in traditional ways, even when the target audience are young children with special needs. Addressing the usability, this paper introduces software directed to young children less than 13 years old with special needs at vision and sound levels. This application intents to explain the definition, the origin and the way it works of some actual electronic devices used in their quotidian, like television, telephone, electricity or personal computer. Along this paper, all the work developed under pedagogical guidelines specially directed to young children with disability it is presented and also the analysis, programming and testing phases are explained."Disabled persons have the inherent right to respect for their human dignity (…) whatever the origin, nature and seriousness of their handicaps and disabilities, have the same fundamental rights as their fellow-citizens…." (Declaration on the Rights of Disabled Persons, United Nations resolution December 1975).

1 INTRODUCTION

Contemporary society has been developing around technological realities. Education in particular, although its role in technology development hasn't still achieved its own benefit.

Some studies about assessment of impact on information technologies (IT) in education demonstrates that it encourages creative thinking, the ability to problem-solving and persistence in the pursuit of objectives (Azevedo, 1997; Verenikina et. al, 2003). Some researchers also support that IT encourage children, in particular, to use different sensory channels, representing substantial gains in terms of learning effectiveness, retention and understanding of the subjects exposed (Azevedo, 1997; Verenikina et. al, 2003;Moore, 2007).

Regarding the learning motivation, compared with traditional methods, IT increases the availability and encouragement for learning in children in general and it is also, associated with the technological curiosity causing greater interest in those contents (Lethbridge *et al.*, 2007). Nevertheless, multimedia resources usage provides a greater adaptability to different styles of learning regardless their level or skill in information technology, providing in the user a greater involvement in the learning process (McCormick, 2001; Lethbridge *et al.*, 2007).

Technological effect has made its own contribution to the motivation of any user not only because "the motivation is one of the most positive contributions of the computer" (Reeves *et. al*,2002; Debra, 2004), but also because all set of images, animation and sound effects stimulates the user's interest (young-child), leading him/her to exploration and discovery (McElligott, 2004). Technology can actually help children to acquire self confidence, allowing them through repetition of the success, providing answers based on the actions; never be impatient and always forgiving and allowing the child to learn at his/her own pace and rhythm (McCormick,2001).

Although their common availability, technological resources as pedagogical tools at Portuguese schools are still scarce or sparse, namely to the students with

special needs. Among others reasons, this stems from the gap between social and market needs and Portuguese software market or even scientific research are applied to this field.

In this context, the work that we developed aimed the completion or at least reduce the referred gap in area of software tailored to the issue. After an exhaustive search along databases software and surveys oriented or conducted by teachers or researchers in this field, we didn't find any software in Portuguese market with similar objectives to those that we have proposed in this project.

Citing the main director of a national research centre for children with special needs: "there isn't, at national level, available in the market, software within the theme proposed" (Sousa, 2006). This statement is more impressive if we consider young children with less than 13 years old, who besides their natural limitations can't use or gain advantage from IT or even share all the fascinating issues that IT suggest on them. In Portugal, in 1999, the tax of population with some disability was fixed at 9,16%, within those, 135 500 were blind and 115 000 were deafs, estimating then, that in 2020 almost 20% of the Portuguese population will suffer some kind of disability (Godinho, 1999).

This paper is structured as following: in this introductory section, we address the main theory studies that support this kind of projects. In the following section, we introduce the education for disabilities young-children's software following the experimental work with all corresponding programming and testing phases. We end this article with the discussion results and addressing the future work.

2 SOFTWARE DEVELOPED

According to the previous studies (McElligott, 2004; Archambault, 2005), the software programming and planning was developed in the following stages:

- Contents and structure selection;
- Technology selection;
- Interface design;
- System Components;
- Programming;
- Tests interaction;
- Distribution and feedback register.

To support this research, there were needed two kinds of groups: knowledge experts (composed with 9 teachers from first and second education cycles) and user groups, composed by 11 elements with

three types of young children users: deaf, blind and without disability.

2.1 Contents and Structure Selection

Despite the gap in the market of software, to propose one multimedia application for young children that covers their curiosity amongst their quotidian technological devices it was a difficult task. First, we visited and interviewed some teachers and registered their opinions. Therefore, with the first results, we interviewed some young children in order to check and validate the initial ideas that came from the teachers group. With the cross table, we visited again the teachers group and closed the cycle. It was proposed one list of contents with one structure like this:

- Community: electricity
- Home device: TV
- Personal use: telephone
- Technology: computer

2.2 Technology Selection

Although the spread use of programming languages and tools to develop multimedia contents, we considered that the Director from Macromedia would be the best option that we could take. Due to our timing as well the heterogeneity of the research group that solution represents the best selection both by their available documentation and the export facility (allows running the application almost in every kind of computers).

2.3 Interface Design

During this stage, we developed and presented to both groups some different kinds of screen layouts. Each one of these proposes were substantially different from each other. We tested colours, schemas, mouse cursor pointing face, font types and desktop presentation layout.

As a result of the meetings with both groups the interface selected was this:

- Simple to read, with clear, big and simple type fonts;
- Simple to use, with large areas to the selection and with both possibilities: mouse and keyboard;
- Best contrast rate, with colours selection that makes visible all the items and information in the screen;

▪ With more attractive character which has big eyes and wide mouth, it is smiling and whose body is composed by the elements under study.

2.4 System Components

After all the above steps that were defined the system components are:

▪ On-line Dictionary of used terms, that will help the user to understand better the concepts presented;

▪ Main navigation buttons allow in any time the user to select the main general functions like: close the active window, activate the help, printer and systems options;

▪ Play screen where the theme animation and activities are presented;

▪ Main text window which is used to show the text information relative to current theme selected;

▪ Remote control: basic quick access unit that drives the to main system options, like sounds, movie controls or theme selection;

▪ Dynamic menus were the theme titles as well the application navigation structure are showed. There are several and different kinds of menus, like shown in figure 1:
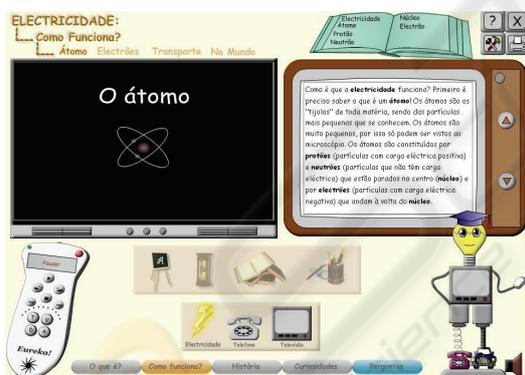

Figure 1: Application screen shoot.

▪ Chronological time line which reflects the relative time between inventions or even between invention milestones;

▪ Mascot main character used to establish some user friendship with the user and that intents to be both an animated main menu and the narrator of the application stories.

2.5 Programming

Multimedia programming task was one the most time consuming phases of this project. Thus,

considering this project as a system with a complete set of modules like (Verenikina, 2003; Archambault, 2005):

2.5.1 Application Interface

As stated before, the interface was considered as one of the most important aspects to motivate the user and therefore the application usage. Indeed the programming was developed to control and present all options in any time that was required. For instance, when we in the electricity theme we had to present options like: historical electricity time line; electricity main characteristics or bulb lamp animations library;

Considering the relation between user and application, based on the mascot narration action, was needed to study and implement some mouth movements in order to gain some mascot movement credibility.

Another credibility issue was the character movement that was used to illustrate for example Thomas Watson walk movement. To aim this objective, we analysed frame-by-frame on real human walk video in order to capture significant leg human movements that were needed to reflect in the character.

2.5.2 User's Interaction

In this issue, we considered all the programming tasks related to the devices used to interact with the application.

As it was previously referred, this application targeted disabled young children with less than 13 years old. Therefore, the main general application concerned to user's interaction, covers the following aspects (Archambault, 2005;Smith *et. al*, 2005):

▪ Easy to use, through basic menus with simple keyboard, click-action combination or even with touch-screen option for those that have this kind of monitors;

▪ Easy to learn due to their clear interface, all the objects presented inside the play area are actionable and therefore conduct the user to the theme or the subject that we want to go.

▪ Quick access to main functions, the application has content menu to all themes and subjects.

▪ User friendly is assured by the nature of the application as well by the mascot that reacts to their interaction.

Regarding each kind of special needs, there are several classes of requirements according to their user's disability:

- *Blind users:* According with to their blindness nature, blind users need can be understood in two classes: If the user is blind from birth, that he/she represents that he probably doesn't have any idea about screen limits or how does the mouse works; In other hand, if the user became blind several years after his/her birth, he/she probably would have some experience of real world like the limits or some devices that move depending their arm movement (e.g., mouse). Having this scenario in mind, we developed the application interaction towards blind from birth users' limitation. That is, all the application can be explored with keyboard keys combination and all options for actions can be therefore activated with special keys e.g., F1 – Help index, F2 – main menu,… Notice the fact that all the referred options also have sound-based legends.
- *Deaf users:* Deaf users have a similar behaviour to those that don't have any limitation. The main difference remains in the fact that these users need special legends to every available action. Another important remark is the fact that they need a special attention to some words which they must be accomplished in a word/image dictionary, providing a better comprehension.

2.5.3 Outputs

In this project, we considered three kinds of output devices: the screen, the printer and speakers.

- The screen was considered simultaneously as an input and output device: the normal output function was treated regarding the usability and the user's interaction requirements. In order to use the screen as an input device, some routines were developed providing an easy user interaction with the touch screen.
- Regarding the printer, it was considered this device as one of the most interesting media to communicate the information with the blind users. Therefore, it is possible to the blind user to print the text information with a Braille printer.
- Sound and image requirements are assured by the speakers that allow the application to have sound-based legends. Speakers' function represents one of the most important application characteristic which is spoken narrative along it is used, namely to blind young children. The synchronization between

heard sound and available option was developed under the following items:

Every option available is sound-based described. This must be in-time and on contextualized, for instance, if one story is being told when the user presses some option associated key, their corresponded legend will be told at a different sound level or pronounce;

When the user presses sequentially the tab-key, the focus (sound legend), indicating the next option, goes along a sequential and ordered set of pre-defined options.

2.6 Tests Interaction

As soon as it was possible, we presented the very first application routines to our both group tests. Doing it we've tried to develop the application according to their expectative and needs. It was simultaneously an action research activity (we introduced new facts to the group test, having their feedback emitted after the recent experience which was already new to them) and a scientific research - we developed our research along the suggestions and needs pointed by the group test and therefore we tried to answer as better as we could to their expectative.

As soon as we found the application stable, we presented it to other users outside our group test. We found then that our past group test was already familiar with our project, having them omitting some other relevant aspects. That was the case of our blind users belonging to the test group –we've just noticed the huge difference from the user who is blind since the birth and the one become some time after.

3 CONCLUSIONS AND FUTURE WORK

This project incorporates different knowledge areas: information technologies; normal and disabled young children teaching.

Along this work, we presented how it was possible to combine both multimedia and teaching currents in order to aim an innovative learning system for disabled young children.

In order to achieve such objective we've started with two groups of test (one composed with teachers and the other by the disabled young children under 13 years old), developing with them all work of analysis (target characterization, user's interaction

requirements and audience skills) and first contact tests. In a second phase, with a stable application sample, we introduced a second users group that allowed then new insight about what was missed or omitted until and during the prototype phase.

The application covers the explanation of how it works, its history, curiosity and common questions, related to issues like: electricity; telephone, television and computer.

As results, we tested and therefore proved that the systems allow and support the disabled young children learning process in a way that they were motivated and when solicited to answer to some questions they did it well or even they play with the proposed knowledge activities inside the application.

As a final remark, we constructed a software application that is ready to be introduced in the Portuguese market and represents an important advantage in helping disabled young children learning process.

As future work and research to be developed, we point out new a target of disabled people like children with mental or motor problems, for whom there are already in the market special devices (e.g. pointing devices guided by the eye retinal or forearm support) aiding them to interact with applications like the one we produced. Other improvement to this application will be the introduction of new themes or even applications directed to babies.

REFERENCES

Archambault, D. and Olivier, D. 2005. How to make games for visually impaired children. In *Proceedings of the 2005 ACM SIGCHI international Conference on Advances in Computer Entertainment Technology* (Valencia, Spain, ACE '05, vol. 265. ACM, New York, 450-453.

Azevedo, B. 1997. Tópicos em Construção de Software Educacional. Estudo Dirigido.

Debra L. Smarkusky , Harold H. Smith. 2004. Team projects throughout the curriculum: course management, teaching initiatives and outreach, Journal of Computing Sciences in Colleges, v.19 n.5, p.119-129, May

Godinho, F. Internet para Necessidades Especiais, 1999

Hotayt, F.1978 *A Psicologia da Criança e do Adolescente*, Livraria Almedina, Coimbra

Lethbridge, T. C., Diaz-Herrera, J., LeBlanc, R. J., and Thompson, J. B. 2007. Improving software practice through education: Challenges and future trends. In *2007 Future of Software Engineering*. International Conference on Software Engineering. IEEE Computer Society, Washington, DC, 12-28.

McCormick, R. and Scrimshaw, P. 2001. Information and communications technology, knowledge and pedagogy. Education, Communication and Information 1 (1):37--57.

McElligott, J. and van Leeuwen, L. 2004. Designing sound tools and toys for blind and visually impaired children. In *Proceeding of the 2004 Conference on interaction Design and Children: Building A Community*. IDC '04. ACM, New York, NY, 65-72.

Moore, Rob 2007. Going critical: the problem of problematizing knowledge in education studies. Critical Studies in Education, 48 (1), 1750-8487.

Reeves, T., Baxter, P., and Jordan, C. 2002. Teaching computing courses - computer literacy, business microcomputer applications, and introduction to programming online utilizing webCT. *J. Comput. Small Coll.* 18, 1 (Oct. 2002), 290-300.

Sousa Celia, 2006 in revista perspectiva, lisboa, http://www.revistaperspectiva.info/index.php?option= com_content&task=view&id

Smith, S., Taylor, K., Green, T., Peterson, N., Garrety, C., Kremis, M., and Thompson, A. 2005. Using virtual reality tools in design and technical graphics curricula: An experience in learning. Engineering Design Graphics Journal, 69(1), 16--25.

Verenikina, I., Harris, P., and Lysaght, P. 2003. Child's play: computer games, theories of play and children's development. In *Proceedings of the international Federation For information Processing* J. Wright and J. Lowe, Eds. ACM International Conference Proc , vol. 98. Australian Computer Society, Darlinghurst, Australia, 99-106.