DEVELOPMENT OF AN ELECTRONIC SCHOLAR NOTEBOOK FOR STUDENTS WITH SPECIAL NEEDS

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***Abstract* — The Salamanca Declaration promotes the integration of students with special needs in the regular education. To achieve this goal is fundamental to assist these students with different mechanisms some of which technology based. Students with motor difficulties face obstacles of diverse order like the execution of tasks that require handwriting (e.g. copies, dictations and worksheet resolution). Some of these students use portable computers equipped with text processors and rate enhancement systems that accelerate writing in the computer. However, our experience says that these tools are not enough. The management of the produced information has revealed itself a very challenging task for these children. Therefore we think that is of paramount importance the development of an application that helps students in the management of all produced information. This article reports the design of a digital scholar notebook that can constitute an effective alternative to its traditional counterpart.**

I. INTRODUCTION

The Salamanca Declaration, proclaimed by 92 countries and 25 non-governmental organizations, promotes the integration of children with special needs in regular education [1]. This vision is usually known as *Inclusive Education* or *Education for All*. In order to achieve this objective is fundamental to assist these students with a large range of supporting mechanisms, some of which, technology based.

Young students with motor difficulties face at this level a large number of obstacles. One of this is the accomplishment of tasks that depend on handwriting, such as copies and dictates. Therefore it is very common to advice the use of laptops with text processors and writing acceleration systems, such as Eugénio (Fig. 1), to these children.

Fig. 1: On-screen keyboard of Eugénio.

Eugénio was developed to assist people with communication difficulties. This system works on the Windows system and supports writing of messages in any application of this operative system. The user can choose the most appropriate application to his communication needs. Techniques were developed to support the interaction between our system and other applications.

The communication rate supported by these alternative forms is usually lower than the ones supported by natural methods. Therefore, Eugénio uses two writing acceleration techniques, which are word prediction and abbreviation expansion.

For people who cannot use a computer keyboard the system offers an on-screen keyboard. This component presents a matrix with the available characters. The selection of one of these characters can be done with a pointer device or with a set of switches and a scanning mechanism.

The components of the system can be configured so that it can be adapted to each person's needs [2].

Eugénio can be downloaded at (http://www.l2f.inesc.pt/~lco/eugenio).

However, we have verified that in most cases these tools are not enough. The management of all produced documents has revealed itself a complex task to the children. So in addition to computer access tools we think these children would benefit from using an information management tool.

Children use their paper notebooks to develop school activities and homework. To find out the most important activities children do in their notebooks, and hence the main tasks an electronic version must support, we developed a questionnaire to the teachers of the earlier grades of school. Fifteen teachers answered the questionnaire. In this questionnaire we asked four questions: (1) *What are the activities your students develop on a paper notebook?* (2) *What are*

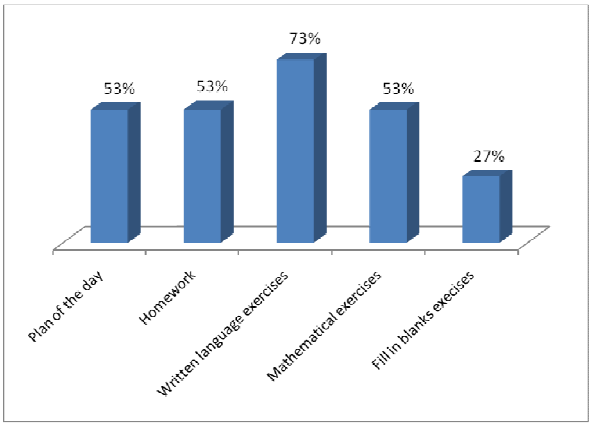

Fig. 2: Most common students tasks do at class time

the activities the teachers develops on a student's notebooks? (3) *What are the activities that parents must want to do on their son's scholar notebooks?* (4) *In an electronic scholar notebook what are the functionalities not present in its paper counterparts that you think would be useful?* Answers were written in a list format. Fig 2 depicts a graphic with the most common tasks students do at class time.

The written tasks performed by children can be classified according to its speed and precision levels [3]. Generally all academic tasks demand a high level of precision. Note taking can be an exception because it´s for student own use. However speed demands for note taking are very high. The other tasks speed requisites are more moderate. Table in Fig. 3 characterizes each task according to these two requisites.

II. Note Taking

Note taking is an activity that requires high speed. Students can be assisted in the accomplishment of this task by different means, which can be grouped in three categories: (1) note taking performed by the student himself. In this category we can find systems like laptops with text processors and writing accelerating systems (Fig. 1) and portable text processors [4]; (2) Note taking performed by assistants or colleagues. Schools usually have special programs to help students with disabilities, especially in the note taking area. The notes are collected by colleagues or special assistants and latter on made available to the student in paper or digital format [5]; (3) Note taking performed by automatic systems. In this category we find the speech to text systems, sound recording, sound and image recording through web-cams. This information is then made available to students through a digital support, local network or web site [6].

Task	Precision Requisites	Speed Requisites
Note taking	Low	High
Dictates	High	Medium
Compositions	High	Low
Worksheets	High	Low
Homework	High	Low

Fig. 3: Writing demands on different tasks.

All these approaches have advantages and disadvantages. Sometimes the solution is a combination of these three modalities.

The Schools which we have been working with, usually adopt method 2. Notes are taken by special teachers that assist the student in the class. Sometimes if the special teacher is not present notes are taken by a colleague. Some teachers also deliver extra notes to students as compensation to their writing difficulties. This process of note taking is functional however the student role is too much passive. With this system we try to exploit the advantages of being the students taking their own notes.

When a student writes his own notes he engages in a process of key topics selection. Doing this helps the student to start getting a better understanding of the contents during class time as well as makes study at home easier.

Automatic systems [7] are very valuable because they help students that can´t write their own notes, but

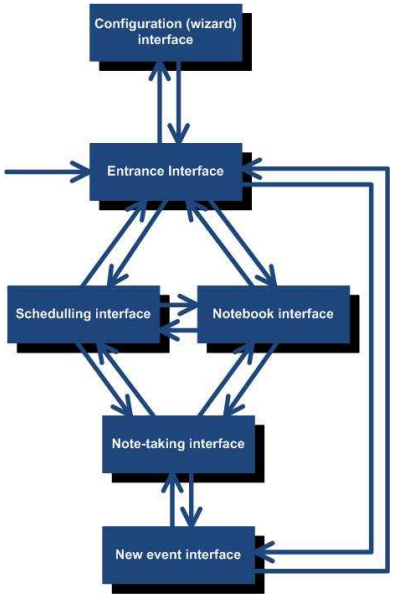

Fig. 4: CE-e navigation diagram

they are far from collecting notes like humans, they simply save everything. These note taking systems can have a negative impact on study time, because students can feel lost with a large amount of information.

The use of notes taken by some else can also be a problem because the selection of the main topics, the writing style and summarize criteria, are very different from one person to another. If a student has to study by someone else notes will probably waste a great amount of time trying to extract the useful information.

The CE-e project purpose is to develop a tool, to help students to create and to manage their own notes, using reasonable amounts of time. In order to accomplish these objectives this tool must be simple and easy to use. Fig. 4 shows the navigation diagram of the system, with five interfaces and a configuration wizard. The student enters the program and starts working in the *Entrance Interface*. In this interface the user can check the scheduled events for the next days (e.g. a written test or a assignment delivery). Then he must choose the most appropriate way to work with his notes. He can choose a week view, and will be working on the *Scheduling Interface* or a Notebook view and will have at his disposal all subjects in the *Notebook Interface*. Selecting a subject in any of these interfaces will direct the user to the *Note-taking Interface*. In this interface the user can work with his notes.

IV. System Users

The main users of this software will be children, teenagers or even adults, from the first school years

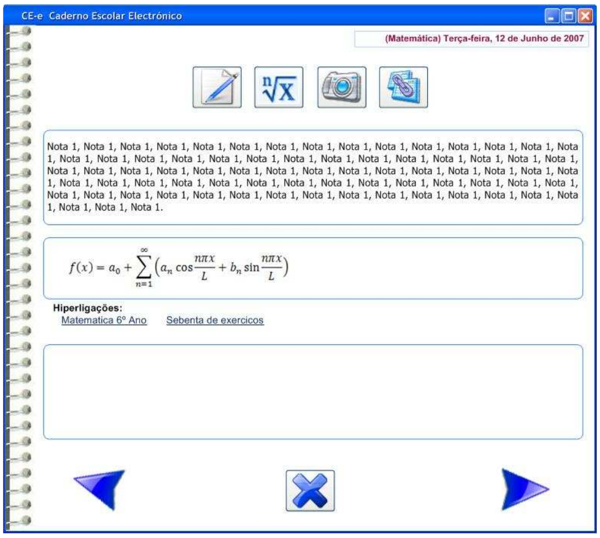

Fig. 5: CE-e note taking interface.

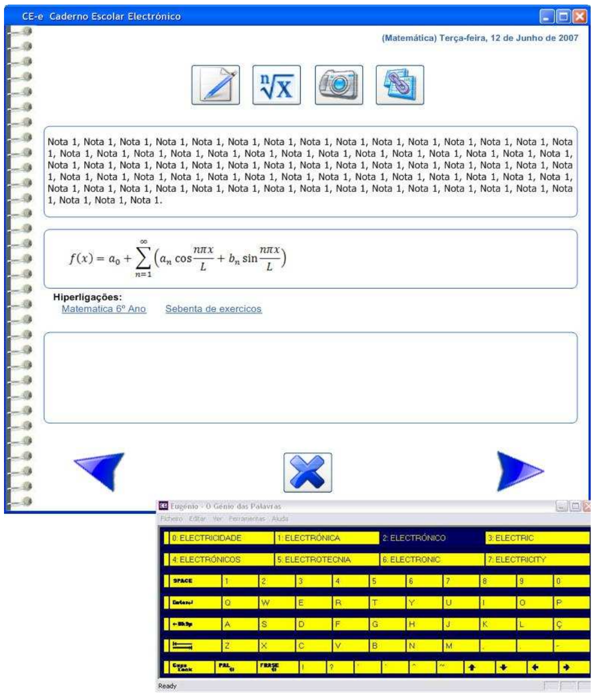

Fig. 6: CE-e note taking interface with the Eugénio System.

until university. The system can be used by regular students, perhaps with poor organization skills, or special students with cognitive or motor difficulties. The users should be familiarized with some words of the written language.

Starting from this general characterization, we can separate the users into 3 groups, according to their physical difficulties: (1) Users that can use a normal computer keyboard for writing; (2) Users that write in the computer with an on-screen keyboard with a pointing device; (3) Users that write in the computer with an on-screen keyboard and a scanning system.

Our system is being designed to meet these user's needs.

The users of the first group are able to use a standard computer keyboard and a pointing device, will use the CE-e interface to perform their writing tasks and organize their documents. Fig. 5 depicts a first prototype of the application screen where students enter their notes. These notes can consist of plain text, mathematical formulas, images or links to other documents.

The users of the second group are unable to use a standard keyboard, will have to use another tool to assist them with the writing tasks in the CE-e system. That tool can be the Eugénio because this system can

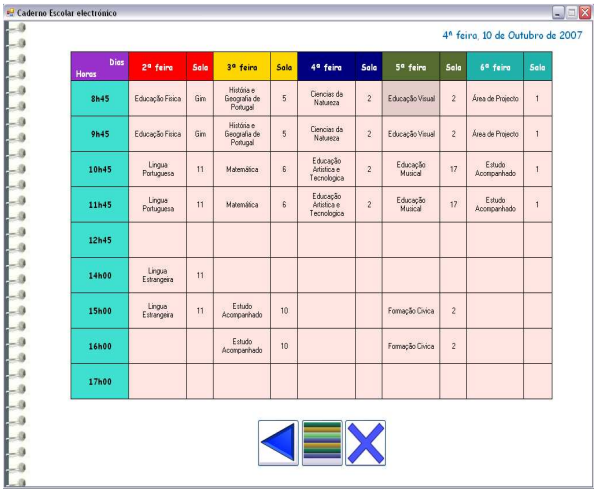

Fig. 7: CE-e scheduling interface.

Fig. 9: Note-taking interface – After evaluation

work with any application of MS Windows (Fig. 6). The users of this group can perform their writing tasks with Eugénio and a pointing device, such as a standard mouse.

The users of the third group, the ones with greater motor difficulties, will have at their disposal the same interface that the users of group 2 but with a scanning access.

Besides these main users, teachers and parents are considered the secondary users. These users will use the CE-e system only in certain specific tasks. These tasks can be the correction of certain activities, like compositions or dictates. These users can also just consult the notebook.

Fig. 8: CE-e notebook view.

IV. System Requisites

Like we have described the Electronic Scholar Notebook intends to be an effective support to students in the organization of the several activities that evolve the production of written material and also facilitating the access to all study elements in digital format. In order to achieve these objectives CE-e should present the following characteristics: (1) Assist the student in all writing activities in classroom context; (2) Assist the accomplishment of these activities spending times comparable to traditional forms; (3) Offer a writing acceleration technique or make use of an external one; (4) Allow a easy access to previously developed activities; (5) Support hyperlinks to several electronic study elements; (6) Facilitate the contact with the teachers.

IV. System Prototypes

Based on our 10 years experience participating in the assessment team of Cerebral Palsy Center of Beja, as well as using the questionnaires results we started developing some system prototypes. These prototypes (Fig. 5 and Fig. 6) were simple storyboards, with no functionality, but proved to be a very valuable tool for collecting user's first impressions about the system, as well to promote the discussion between the development team members.

Using this feedback we started developing a high fidelity prototype that is almost finished. This prototype verifies all stated requisites and incorporates the results from our discussion with the users.

Figures 7 and 8 present respectively the scheduling interfaces and the notebook view interface of this high fidelity prototype. These interfaces facilitate respectively the access to the week scheduling and to the student's several disciplines. The student just has to select the right discipline in one of these views and start working.

The note taking interface prototype (figure 5) was refined using user's feedback and evolved to the interface shown in figure 9. This interface is critical to the success of the system so we are engaged in turning it simple and usable.

This functional prototype is being developed using .NET environment with C# language and XML technology.

V. Future Work

This article describes the work done during the system analysis and prototype design. At the time we have developed a complete functional prototype.

We are going to start using the system with two students that are integrated in two different regular schools of Beja region. One of these students is a child with cerebral palsy that attends the 9º grade and has some difficulties in the production legible handwriting. The other student is a child with a neurodegenerative disease that attends the 10º grade and has extreme difficulties in handwriting.

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