An Approach for Interactive Educational Software in a Classroom Setting

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This paper presents a systematic set of activities related to the ergonomic analysis process of interactive educational software in a classroom setting. It uses the User Interface Design (1991-1999 Interface Systems International) with the aim of developing an ergonomic model for Human Computer Interaction (HCI) in the context of interactive educational software. The model should be adaptable to any kind of user and evolutive, i.e., the model should be able to switch to more advanced concepts once the user has learned the previous ones.

Keywords: User Interfaces; Interactive Educational Software.

1. Introduction

The starting point of the present project was a research work we had previously carried out, to assess the educational software existing in the Portuguese market and analyze the modifications that would have to be introduced in order to meet the requirements of the users of the 1st cycle of Basic Education. The aim of this study is to examine the cognitive, pedagogical, didactical, emotional and interactive features as well as the programmatic contents. As a result of the research we concluded that some missing points existed in all the features referred to and, most importantly, that all the existing software do not accept the introduction or the modification of any programmatic content, neither do they consider the evolutive aspects of the user's learning process.

The users may become unmotivated not because they failed to answer the questions correctly, but because the software is repetitive. Therefore we propose a new model of Educational Software, which we will designate as Interactive Educational Software Model.

The development of an Interactive Educational Software Model implies the incorporation of a learning theory. In addition, the theories of interaction with the user, as suggested by Nonnan [1], Abowd & Beale [3] and Squire [5], point out the importance for the user, to have an integrated understanding of the system, including an intellectual representation of it.

According to Squire [5], the combination of the external psychology theory and the internal psychology theory plus the representation of the system would result in a rather complex model. However, he adds, "this is not surprising, since the learning process is also a complex one, and in addition to this, a cognitive artifact, such as the Interactive Educational Software, associated to the learning environment, makes this complexity more evident".

The identification by Norman[1] of two views about the use of a cognitive artifact – the view of the system and the personal view – gives us a notion of this complexity. In the view of the system, the artifact, in this case the Interactive Educational Software somehow contributes to an improvement of the cognitive performance. In this context, cognition is shared by the user and the software, which in theory could reduce the difficulties in the accomplishment of any task. In the personal view, the delegation of some activities on the software, associated to the user's need to learn new concepts and incentives make the Human-Computer Interaction a more complex process.

According to Hiratsuka [1996], citing Richard[6] and Falzon [6], " the concept of software adapted to the human needs has to consider two aspects. The first is its adaptation to the general psychological characteristics of the human beings, in working contexts. The presentation of the information in the screen should therefore be adequate, avoiding any difficulties in the visual perception and/or in its use. The second is the adjustment of the information and of the dialogue to the dynamics of the user' actions.

The second aspect is directly related to the idea of the human-machine interaction as a way of improving efficiency in the development of one's activities and interpersonal realizations

The model we propose considers all the above mentioned aspects, and the process of the User's Interface Design - 1991-1999 Interface Systems International, as shown in Fig. 1, will form the basis for

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the development of a tool which, in turn, will be assessed by a population. In this case, it is the population comprising the1st cycle pupils of School nº2 of Beja. In the course of the project a new population had to be considered – that of the teachers - which was justified by the fact that, according to Varela de Freitas [8], "a teacher's action is only valuable if it produces some learning effects on the pupils. Learning is no longer just a matter of acquiring knowledge, but rather of acquiring the necessary tools to continue the process of life long learning".

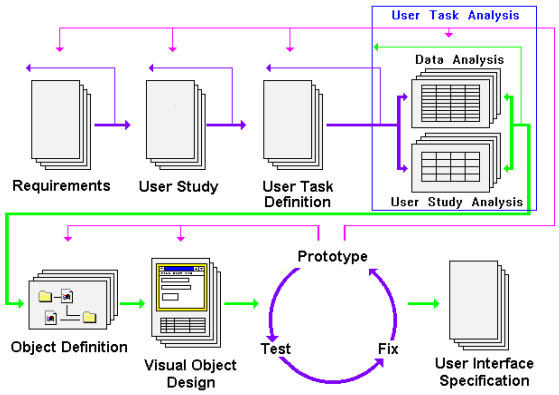

Figure 1– User's Interface Design process, 1991-1999 *Interface Systems International* Inc Last Modified: March 20

The article focuses strictly on the learner-related interactivity. We had, therefore, to consider attributes such as the level of education, age, computer literacy (of both learners and the teachers), physical capabilities, cognitive and other skills.
Currently the project comprehends two more schools – the first cycle school of *S. Matias* and the *Centro de Paralisia Cerebral de Beja.*
This article is organized in 6 sections: 1. Introduction; 2. An overall view of the project; 3. Description of the 1st phase; 4. Description of the 2nd phase; 5. Description of the 3rd phase; 6. Conclusion and future developments

2. Overall View of the Project

The process and model validation was conducted in three phases
The first one consisted of a human-machine interaction in which the necessary data for the respective interactions had to be identified. Basically, we conducted a needs analysis for the target population (first to fourth grade students). The following attributes were considered: educational level, age, computer literacy (students and teachers), physical capabilities, cognitive capabilities, and others (see Fig. 1, namely "Requirements, User Study, User Task Definition, User Task Analysis"). In the second phase, we defined the objectives for the User Interface Design. From the first two phases we got a specification for the user interface. This specification includes the specification of the applications and the object definitions, which contain the visual objects that will be presented to the learners and teachers (see Fig. 1).
The third phase builds upon the analysis and defines the student's and teacher's tasks. This way, we can verify which kind of user is going to execute each task. From this we get the requirements for each task.
After that these data are grouped, allowing the users to effectively use them. The defined tasks are directly related to the users' abilities.
It is important to note that the teacher defines the course contents taking into account the student and the themes presented in class. Thus, our work takes into account not only the end user but also the intermediate user - the teacher.

3. First Phase

In the first place it is import to refer that the main objective of this project is the learning process of the Portuguese language, and also that the UID model (see fig. 1) was followed in all the three phases
In this first phase, aimed at testing the human-machine interaction, we had to identify the necessary information for that interaction, gather and analyse information, and use the appropriate forms and methods of analysis and classification. Following the model presented above, we are in the field of *"*Requirements, User Study, User Task Definition, User Task Analysis". So we gathered all the information related to the selected class, to the learning needs, motivating factors and cognitive requirements.

3.1. School and class description

The present project was developed in the 1st Cycle School n. 2 of Beja, located in the civil parish of *S. João Baptista*, and included in *Agrupamento nº 2. de Beja – Mário Beirão* (presented in fig.2, below)

Fig. 2 – Photo of School n. 2 of Beja

Fig. 3. Photo of a classroom perspective

The population includes all the 20 six-year old pupils of the 1st year (see fig.3). In this classroom there are two pupils with special educational needs; integrated in the Special Educational Regime.
At the outset of the project the competences/learning abilities of the learners in terms of Portuguese language were the following.

- listen to instructions, stories, rigmaroles, dialogues ;
- speak clearly
- participate constructively in group discussions
- formulate requests, give orders and information
- report real experiences
- recognize words globally
- anticipate words through the context and the graphic format
- identify phonologically relevant graphic features
- copy their own texts and those of their colleagues

Based on principle of pedagogical differentiation, the project aims at the development of a motivating work for all children, which respects the differences in knowledge and allows a progressive mastery of the writing skills and an understanding of the its functionality.
The work in the area of the Portuguese language was based on the following references:

- Development of a work departing from the children's own meaningful experiences, so that they can express what they think, know and feel.
- The pupils report their experiences and write them down.
- The children's findings are valued, by exploring written and oral language

Following the note-taking activity, the written material is worked out collectively. The final text is read globally, then divided into units of meaning and some words are illustrated. Each learner gets one copy of

the final text, with which the pupils will gradually construct their own readers. The text is illustrated by its author and finally posted on the wall.
New findings occur rapidly and "similar pieces" and "familiar letters" are worked out. A list of words beginning with the same letter, for example, is organised and displayed so that it is copied to the exercise-book.
The project includes the production of texts written individually, in pairs or with the support of the teachers. These texts are read to the class everyday and then handed out to be worked out. In addition to the children's texts others from well known authors are also worked out, in the context of the classroom.
After gathering this information we proceed to the following phase.

4. Second Phase

In this stage, and according to the UID, we are in the area of object definition for the User Interface Design.
We then came upon the question of how to present the interactive software in an appealing way. After some research work, we decided to follow some points of the table below. (Only the points we followed will be presented here).

CONTROL	ANSWERS AND AIDS
Allow the user to establish his/her pace	Use the pointer instead of the keyboard whenever possible
Allow the user to control the sequence of the actions	Always appreciate the user's actions
Use menus as much as possible	Allow the user to correct his/her answers
Allow the user to adapt the program to his/her own needs	Give a positive feedback in case of error
	The feedback should be brief
	Aids should be precise and specific, easy to access in case of error
	Different aids to different users

Fig. 4. Table [7]

So that the learners could feel they were part of the project, they were asked about the animals which, in their opinion, better represented knowledge. The answer was unanimous.- "the owl". That led us to the development o f the software presentation as shown in fig. 5

Fig. 5 Presentation of the software

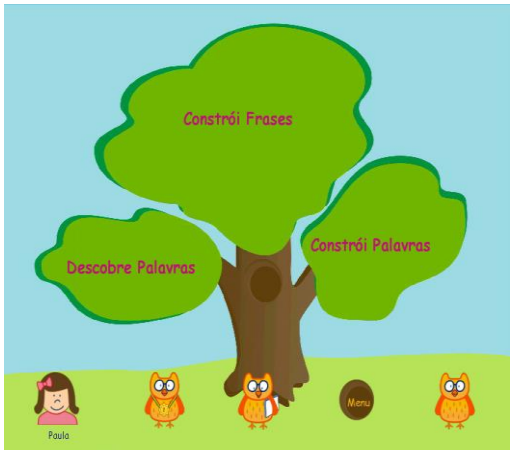

Fig.6 Presentation of the Games

5. Third Phase

This phase has somehow been developed simultaneously with the 2nd phase, because as modifications were introduced, they would readily be tested by the users.
The following changes were observed

1. changes in the number of games
2. changes in the colours
3. changes in the dialogues
4. changes in the size of the letter
5. changes in the design

With the introduction of these modifications, the software became more pleasant and stimulating for the users, thus contributing to maintain his/her interest in the game. So, the points previously selected in the above table (fig.4) and the UID model presented in the abstract were fully developed. It should be noted that other changes were introduced, yet they will not be focused here because they go beyond the scope of this paper.

6. Conclusion and future developments

The implementation of the present project has been very rewarding in various perspectives. The cooperation among the teaching staff, pupils and parents, programmers and designers has been remarkable, and it was a decisive factor for its success.
As the project progressed it was necessary to extend it to other schools, which showed interest in participating, in order to be able to assess their learners in terms of cognitive development and, at the same time, to compare this model with the traditional method. It has also been an important step for the present research work, since it allowed us to assess the impact of this experiment on new pupils and new teachers.
Thus, we have been able to verify that the human-computer interface is a useful tool to define and specify a human-computer relationship scheme as well as to find out how it should be developed in order to promote its use. The users (pupils and teachers) discuss the most effective ways of manipulating this interface to perform their tasks and, in face of that, the system designer had to analyse the functions that should be implemented and define how the computer should inform the users about the availability and utility of these functions.
The team of Interactive Software developers should therefore include specialists in human factors, 1st cycle teachers and pupils (of different classes and different schools).
The third phase is currently being implemented together with 2nd phase, since we are now in the testing stage of the interface and the learners' performance in the previously mentioned schools.

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