DESARROLLO DE SOFTWARE PARA ENSEÑAR

Dante Alves Medeiros Filho y Jorge Pimentel Cintra

1. Introduction

The development of educational software is a complex task and involves many factors. Some are linked to the educational process and others to interface and implementation aspects. The preparation of educational software aims at the transmission of information so that previously established objectives may be reached. Some have only to deliver a message; others are employed for teaching and learning. It is interesting to analyze that all software developed for educational aims is organized and planned to transmit systemized information and thus characterizing an instructional process. When undertaken in an organized, planned and systemized form, the development of educational software is a true pedagogical task.

2. The use of Computers in Teaching

The use of computers in teaching has given rise to discussions on the teaching process and learning in all areas. Research has developed the integration of computers in teaching and computers are used by teachers and students in every way supported by the different teaching systems and learning theories [1]. It is interesting to note that this research work promotes debates on didactic, pedagogical and even epistemological problems when the computer is integrated in the teaching and learning processes [9]. Some educators are of the opinion that the employment of new technologies, including computers, will cause important changes in present day pedagogical paradigms [6]. Others think that in the long run the introduction of new technologies in education will not bring any important changes. The new technologies will merely serve as tools or subsidiary resources and will not go beyond conservative innovations [3]. The employment of computers in a systemic way is made through software. They may be specific for teaching and learning or they may be applications used to help the teacher or the student in his job. Valente [10] states that educational software may be classified into three great categories according to their employment: teaching with the computer as a help; learning by discovering and educational tools. Needless to say, there are other forms in which the use of computers in education may be classified [10].

3. The Development of Educational Software

The aim of organizing and systemizing the development of educational software is to form adequate strategies to help in the teaching process and in apprenticeship towards a betterment of information transmission [8]. The elaboration of educational software is a very complex task because it involves multidisciplinary knowledge in education and computer science [2]:

- knowledge of apprenticeship theories by which learning strategies are known;
- knowledge of instruction theories such as those analyzed by Skinner, Gagné, Ausubel, Brunner and others;
- content knowledge to be transmitted by the educational software; the ways to organize and systemize it according to the instructional model adopted;
- evaluation method to see whether assets in software employment justify its use;
- knowledge of the instructional model and its instructional strategies which involve didactic and pedagogical factors;
- knowledge of computer science for choice of adequate tools for the development of project;
- knowledge of computer science for the execution of the project.

Such knowledge needs a multidisciplinary team for the development of educational software. For its execution the following stages are necessary:

- definition of instructional aims;
- definition of the public in view;
- choice of instructional model to be employed;
- choice of instructional strategies;
- planning of communication interface;
- implementation;
- evaluation.

4. Development Stages of Educational Software

A. *Definition of instructional aims*

Instructional aims specify knowledge, abilities and capacities which should be acquired with the employment of the software to be developed. As much as possible aims should be formulated as future results and thus making control and evaluation easier. Contents are the objective basis of instruction. The instructional objectives will affect the choice of the instructional and strategic model.

B. *Definition of the public in view*

The public in view are the people who will use or will make use of the educational software. They may be called users, apprentices, students etc. Their characteristics determine the didactic transmission of contents and instructional strategies.

C. Choice of instructional model to be employed

The instructional model is a systematic process by which teaching necessities and aims are analyzed. From these analyses activities and resources are selected and developed to reach the aims proposed and procedures are developed to evaluate apprenticeship and revise instruction. The instructional model will determine the type of interactivity between the user and the software.

D. Choice of instructional strategies

Instructional strategies are the didactic and pedagogical plans for content presentation [7]. They include the users' characteristics, the instructional aims, the choice of strategies and content characteristics. These components are interrelated through didactic and pedagogical factors and through factors related to communication interface.

Didactic and pedagogical factors:

- o subject;
- o instructional model;
- o subsidiary strategies and resources;
- o didactic and pedagogical translation of subject according to users' characteristics;
- o theoretical basis that organizes knowledge according to instructional model to be adopted and that defines methodology for the execution of above;
- o instructional aims;
- o characteristics of the public in view;
- o learning environment.

Communication Interface Factors

- o motivation: text, images, sound and animation quality should motivate the program user;
- o navigation: it should be friendly, easy and intuitive;
- o help: program should offer a help service to user;

- o allowing network use;
- o foreseeing the possibility of personalization;
- o interactivity;
- o formalizing icons common to other program.

E. Planning of Communication Interface and its Implementation

Implementation of communication interface implies the choice of proper tools for its development. At present various system called "author systems" are available which make easier the integration of images, sounds, texts, animations and videos. The choice of tools should make easy the development and maintenance processes.

F. Evaluation

Evaluation should follow all the phases of development of the educational software. Through it one knows whether aims have been reached. Evaluation pinpoints difficulties or developments so that the task may be re-orientated. Evaluation may be interpreted as an analysis of the material produced. Since the development of educational software is a complex task, its evaluation is not a non-consequential problem. Evaluation that follows the software development phase is called "formative evaluation". It picks up information on possible faults at this phase and seeks alternatives to correct them. Evaluation undertaken at the end of the process with the finished product is called "summing evaluation". There are other approaches to evaluate the production of educational software. [8] suggests three evaluation levels, or rather, product, user and context orientated. Dorrego [4] suggests that evaluation should be done in each phase that makes up the development of educational software by means of answers to the following:

- o What is being evaluated ?
- o Who evaluates ?
- o What are the procedures and instruments for evaluation ?
- o How are results analyzed ?
- o What decisions are taken from resulted ?

5. Formative Evaluation of Educational Software

Formative evaluation is part and parcel of the development of educational software. It pinpoints mistakes for correction in the development phase. Since the production of educational software has educational and implementation factors, it is important to enhance evaluation in two groups.

A. Evaluation Involving Educational Factors

What is being evaluated ?

- at content level: motivation, feedback, suitability, quality and interactivity;
- suitability of product to instructional aims;
- integration capacity with other didactic and pedagogical resources;
- instructional strategies, preference to cooperative, active and significant apprenticeship; use of images, sounds, animation and videos;
- possibility of team work;
- successful integration of different types of languages (iconic, verbal etc.);
- enhancement of reflection and of criticism with regard to subject.

Who evaluates ?

- teachers;
- educational personnel;
- pedagogues;
- specialists in education and educational computer science.

What are the procedures and instruments for evaluation ?

- observations;
- experiments;
- register of occurrences and events;
- questionnaires;
- interviews;
- simulation of process functioning.

How are results analyzed ?

- By discussions with specialists;
- Comparison between existing standards or previous conjectures.

What decisions are taken from results ?

- change of instructional strategies;
- modification of instructional and resource methods.

A. Technical Factors Linked to Interface and Implementation

What is evaluated ?

- Interactivity;

- Attractiveness;
- Intuition
- Necessity of training for employment;
- Icon formalization with other software and systems;
- Sound, image, animation and video qualities;
- Clear commands and information;
- Proper size of icons, texts, figures, animation and videos;
- Synchronization of images, sounds, videos and texts;
- Employment of three-dimension images and videos;
- User's handbook;
- Navigation help system;
- Navigation control;
- Network connections;
- Independence of hardware.

Who evaluates ?

- Teachers;
- Pedagogues;
- Specialists in educational computer science.

What are the procedures and instruments for evaluation ?

- Observation, questionnaires, interviews;
- Experimentation;
- Simulation.

How are results analyzed ?

- Through discussions among multidisciplinary team members;
- Comparison of results with patterns, previous conjectures or theories.

What decisions may be taken from results ?

- Changes to achieve better communication interface.

6. Conclusion

The development of educational software is a complex task involving knowledge in different areas of knowledge and should be undertaken by a multidisciplinary team. The formative evaluation throughout the production

process is fundamental for the product's final quality. The form of evaluation comprises two types of evaluation: a product-centered evaluation and a user-centered one. Different from the great number of studies based on evaluations through observations and experiments comparing results of apprenticeship of traditional methods with software use, this type of evaluation is directed towards the apprenticeship final result and doesn't enhance evaluation at interaction, motivation and other levels. Evaluation ought to be a systematic process so that the real contribution of the development of software under certain conditions on teaching and apprenticeship may be verified. It should be enhanced that the development of software is a pedagogical, and thus a teaching task, even though many are employed with an apprenticeship approach.

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RESUMEN

La utilización de softwares educativos, está siendo mui explorada no proceso de enseñanza y aprendizaje. Los estudios para su desarrollo son así necesarios. El objetivo de este trabajo es analizar los factores que involucram el desarrollo de software educativo, mostrando los componentes que integram su produción, relaciones y formas de evaluación

PALABRAS CLAVE:

Desarrollo, Software Educativo, Evaluación, Enseñanza Y Aprendizaje

ABSTRACT

The employment of educational software is at present highly explored in classes and in the teaching. Studies for its development are thus necessary. The aim of this paper is to analyze the factors that involve the development of educational software while showing their integrating components, interrelationships and forms of evaluation.

KEY WORDS:

Development, Educational Software, Valuation, Teaching And Learning