A COOPERATIVE PROJECT FOR ELECTRICAL ENGINEERING EDUCATION AT UNESP – SÃO PAULO STATE UNIVERSITY

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ABSTRACT - UNESP – São Paulo State University is a successful experiment of the Multicampus University in Brazil, maintaining intense and diversified education activities in the most developed state of the Federation, the São Paulo State.

The multicampus structure, that consist of fifteen university campuses and two advanced ones, and the geographical distribution throughout the State of São Paulo has permitted UNESP to realize an experiment in the decentralization of high quality public education. In the area of engineering education, this University has three Engineering Colleges located at the cities, Guaratinguetá, Bauru and Ilha Solteira.

The three Electrical Departments at the campuses Guaratinguetá, Bauru and Ilha Solteira, have been in a permanent process of transformation, constantly improvement of engineering education. In this environment, these departments started in march/1997, a cooperative project for electrical engineering education improvement at UNESP.

This paper presents describes the project The Development of Multimedia Tools for the Engineering Education and Diffusion, that has been developed by partnership of the three Electrical Engineering Departments of the UNESP, since march/1997. The IBM Brazil has sponsored this project (AKAMATSU, 1996).

INTRODUCTION

In the search of synergy and optimization of material and human resources, the three Departments of Electrical Engineering of the UNESP initiated in March 1997 a joint project with the intention to introduce improvements, through the use of new technologies, in its courses of Electrical Engineering (AKAMATSU, 1997). This project is being developed in the scope of the UNESP, a multicampus university, and the three departments involved are located in the following campus Guaratinguetá, Bauru and Ilha Solteira. The distances among these cities are around some hundred of kilometers. In reason of the decentralization of this project, it has a General Coordinator, and each participant department of the project has a Regional Coordinator. These coordinators are responsible for the integration of the works and the management of the execution of the partnership between the departments.

Today, to work in partnership is a necessity in the modern world, where the material and human resources are scarce and with demands each time bigger for better products and services. The university education cannot be outside of this scope and needs to give an answer to the these requirements. An example in this area is the NSF - National Science Foundation in USA. These foundation finances projects of research in the engineering education, such as the Engineering Education Coalitions (NSF, 1998). They are eight coalitions, where each one of them counts approximately on eight universities or colleges, working in partnership to stimulate the creation of comprehensive, systemic models will be reform of undergraduate engineering education.

The general objective of the project is to develop research with the basic concern to use the resources of computer science and telecommunication in the planning, execution and evaluation of the education of Engineering in the UNESP, through the partnership of its three departments. The specific objectives of this project are:

(a) qualification of teaching staff interested in the development of new forms of education “in loco” and in long-distance, based on systems of computerized information, with resources multimedia and that they allow to the integration and interaction of the diverse courses of Electrical Engineering of the UNESP; and,

(b) development of education, through the creation of didactic modules, that cover topical and diversified contents of science and technology.

These objectives will be attacked in four different fronts of work:

(a) creation of an environment of multimedia, based on tools of authorship (authoring kits) with adequacy to: exploration of theoretical concepts, graphical animation of natural phenomena, graphical animation of the equipment functioning, and, systems and visualization of industrial processes,

(b) adequacy of the databases multimedia for the access of the education modules, through the net of communication, for different pupils of the campi of the UNESP, beyond professors, researchers and professors of other institutions,
The main goal to be reached to the end of the project, it means after 24 months, is the development of new didactic modules, using multimedia tools, relative to the following subjects: Electrical Materials, Equipment, and, Generation, Transmission and Distribution Systems. The idea is to allow that these modules can be accessed by different students of the campi of the UNESP. As qualitative goals, it will be looked to enable professors in the use of tools and techniques to creation of modules of multimedia education, as well as the learning of these techniques for undergraduate and graduate students. It is also a goal of this project the diffusion of the knowledge gotten in the project for other undergraduate and graduate courses in Exact Sciences and same other areas of education of the UNESP, as well as for other institutions of education and research and for companies.

**BASIS OF THE PROJECT**

The idea of educational software is not new. The first versions of software of this sort had been conceived in the decade of 70. Recently, with the development and dissemination of computer science, also of the multimedia, the educational use of software gained new perspective and new courage. The application field is extensive, and if used well, it can decisively contribute for the significant learning of contents of different disciplines of the Engineering courses.

The effectiveness of the computer in education still receives many critical ones that, in great measure, they elapse of the not satisfactory quality of software. With the arrival of the multimedia, educational the possibilities to enrich software had increased enormously, what also it implies bigger responsibilities. The multimedia is not a product, it is a technology of resources. Currently, with relatively low investments it is possible to explore the programming techniques that allow to combine graphical images and sounds in one interactive and friendly environment. These characteristics, associates to the possibility of incorporation of routines of digital simulation of physical phenomena, make of these powerful systems instruments of support to education.

Beyond the conceptions most elementary software engineering, in the development of programs multimedia, the work in team is essential to interdisciplinary. Or either, interaction of programmers and specialists in the specific contents (engineering, physics, chemistry etc.) with professionals of the education areas, psychology and communication. It is evidenced necessity of adaptation of the conventional methods of education and transference of knowledge to the new technological realities, as the computer science and the integration of diverse educational centers and research, linked in nets. This necessity will have to lead to the development of more progressive tools of education. For in such a way, it is being proposal a new methodology of education.

The propagation of the knowledge technician, and its leveling for all the groups inside of the university, can be guaranteed through the conception of a common vehicle of spreading, having the multimedia as stimulate element for the learning. The development of such vehicle would fortify the university in its function of formation of human resources, in a more efficient and competitive way, would facilitate the update of professors in the diverse areas and would supply the technological infrastructure the training in different levels, being able to be used to advantage, still in activities of university extension involving, in a general way, the society, and particularly, the private sector.

The nets of communication of data influence in the development of the studies through the establishment of connector links between the people, exactly physically distant, allowing to the exchange of information and the development of cooperative works. Therefore, they favor the access to a great number of specialists, spread in the diverse regions, without necessity of displacement on the part of the consultants.

In addition, the use of a vehicle multimedia and nets of communication becomes the acquisition of the knowledge most attractive, with better level of absorption and retention, besides becoming it significantly faster. In general, the following general benefits to be listed:

(a) availability - the system would be to the disposal of the interested student in the education modules, allowing the attainment of the knowledge without the conventional restrictions of time of use and rigid schedule,

(b) didactic complement - lessons given in classroom could be complemented, in level of exercises and projects, with professors’ aid,

(c) long-distance education - consultations to the professors, exactly pertaining to other University units, could be made through the communication net,

(d) bank of information - it would also be formed, accessible in all the University and for the private sector and society, in a general way (cultural schools, libraries, centers) through contributions of its specialists,

(e) stimulation to the learning - through audiovisual resources, the learning is stimulated significantly,

(f) synergy and standardization de contents - contribution for a basic resume standard in these courses, increasing qualitative and quantitative synergy among the departments and providing improvements of Engineering education,

(g) technological qualification - to the long one of the considered program, internally abilities in the related areas will be developed, in accord with the world-wide trend for superior education,
(h) partnerships and interactions - cooperative
works between different centers, extending perspective
in programs of university extension,

(i) link between courses - promotion of the
interaction accomplishes between the Engineering and
the areas of Education, Communication and Computer
science, and,

(j) methodology of education - creation of a
new methodology of education and training of human
resources of the companies, that will allow to
qualification in large scale of the current ones and the
future professionals, assisting and deciding some
relative questions of the unemployment.

METHODOLOGY OF THE PROJECT

The work has been developed in stages involving
researches, professors, undergraduate and graduate
students. The following stages must be accomplish:

(a) Pedagogical qualification of the researchers
in resources multimedia and techniques: This first
stage of the project has the purpose to enable the
involved elements in the project.

(b) Development of basic methodology for the
use of authorship tools: This stage is being carried
through the development of basic methodology for the
use of the tools of authorship of systems multimedia
and systems of generation of hypertexts, that will be
used in the elaboration of education modules. The
undergraduate and graduate students are being
introduced in the use of these tools

(c) Development and implementation of
Multimedia Modules for Education “in loco” and
long-distance: The involved university units are
developing referring modules of education to the areas
of concentration of the professors crowded there. The
idea is to get a bigger specter of covering amongst the
areas of engineering education. In this stage, the
responsible ones for the development of the education
modules are assisted by specialists in communication
and computer science of the UNESP.

(d) Integration and use of the Modules for
Education: This stage has still not been initiated. It
will have to be developed the integration of the
different modules of education through the net of
computers. Then, they will be carried through special
courses “in loco” and long-distance, in reduced scale,
restricted to some groups of students of the different
university units. So that, it has evaluation and

eventual corrections of the modules and its forms of
access. In a last phase, these modules will have to be
tested in a special program, under normal conditions
of use.

CURRENT INFRASTRUCTURE
LABORATORIAL

As each Department of Electrical Engineering involved
in the project one will make responsible for the
development of Didactic Modules of Education, two
types of laboratories exist currently. The Laboratory of
Multimedia for creation of education modules, one for
each involved Department, and the Laboratory of
Users for students.

The Laboratories of Multimedia counts on
seven PC's Pentium multimedia and adequate
peripherals to the development of the education
modules multimedia. These PCs support the
acquisition and exhibition of video in real time,
through an interface of net with high performance.
These laboratories count on scanner colorful for
creation of the static frames of the modules, and color
printer and laser printer. They also possess software
necessary for the development of didactic multimedia
modules, for example, the ToolBook®. At the
moment, the didactic laboratories of computer science
of the involved units in the project are available for
application of the modules in concrete situation of
education and learning with accompaniment and
control of the experience. Also, they are connected to
the Internet, to serve as an instrument of support to
the learning of the students.

PARTIAL RESULTS OF THE PROJECT

Four prototypes of didactic modules have been
developed using the software of Toolbook (BROWN,
1992; ASYMETRIC, 1994). This software, from
Asymetrix, is an environment for authorship to
develop multimedia. It makes the metaphor of the
book for the creation of an application. The following
topics had been boarded in the prototypes: electric
conductors, high-voltage techniques, cellular mobile
communication systems, and electrical circuits. These
modules has explored resources of audio, video,
animation, and hypertext. Below some examples of
screens of the developed didactic modules are shown
(GOTO and SANTOS, 1997).
4.1 ASPECTOS GERAIS

O termo "condutor" (ou simplificadamente condutor) é usado para referir-se ao material que transporta a corrente elétrica. Os fios e cabos, que definiremos adiante, são os tipos mais comuns de condutores.

O cobre e o alumínio são os dois metais mais usados na fabricação dos condutores elétricos. Ao longo dos anos o cobre tem sido o mais utilizado, sobretudo em condutores.
CARACTERÍSTICAS GERAIS DOS CONDUTORES ELÉTRICOS

O COBRE E SUAS LIGAS

ESTUDO ESPECÍFICO DE MATERIAIS CONDUTORES

Cobre (a) e suas ligas

O cobre apresenta as vantagens a seguir: que lhe dão tempo de destaque entre os demais condutores:

(a) Pequeno eletroquímico. Eventual a prata tem valor inferior, porém o seu elevado preço não permite o seu uso em quantidades grandes.

(b) Características mecânicas favoráveis.

MÓDULO DIDÁTICO EM MULTIMÍDIA
TÉCNICAS DE ALTA TENSÃO

TRABALHO DE GRADUAÇÃO APRESENTADO NA FACULDADE DE ENGENHARIA DE GUARATINGUETÁ, UNESP

Autor: Marcelo Monteiro da Silva
Declarações: James de Almeida

Decembro de 1997
CONCLUSIONS

The biggest target of this project is the creation of a methodology of education using new technologies. This methodology can be applied to some areas of the knowledge, being able to be used for formal education and also for training of employees of companies.

At moment, the works developed for the participant departments of the project are promising. Therefore, some significant results of the work in partnership have been accomplish. After the end of all proposed project stages expects to promote a diffusion of the knowledge through the many involved Electrical Engineering courses and, also, for other areas of knowledge. The implication of approach is the creation of courses of training for different professors of the UNESP and the new modules of multimedia education, as in the technology used for its development.

REFERENCES