# An Integrated Learning Environment for reinforcing secondary school education

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*Abstract:* - This paper presents an integrated learning environment for reinforcing secondary school education. The underlying philosophy of this integrated learning environment is that it gives teachers the ability to compose and develop lessons and learning applications through reusing pre-development components and multimedia information, setting the teacher in the center of the teaching process using the new technology. The environment has been development using the visual basic and delphi programming language as well as dynamic HTML, Java and SQL. This integrated learning environment is implemented within the project: "Development of Innovative Systems and Applications in education, through the use of high-end multimedia technology and computer networks", a project between National Technical University of Athens and Geitonas School.

*Key-Words:* - Innovative system, teacher-centred approach, educational multimedia courseware, reusable material. *IMACS/IEEE CSCC'99 Proceedings*, Pages:1761-1766

### **1** Introduction

During the last decade we witness a rapid and uncontrolled penetration of modern technology into every aspect of everyday life. Information has become the most important element of the technological pyramid, mainly due to the vast development of the Internet. We are approaching a point where everything will be done by distance in the name of convenience, timesaving and energy saving. Eventually, education could not resist to the attractiveness of the new technological features. Numerous authoring/teaching tools have introduced a new teaching method based on the concept of distance learning combined with limitless access to information recourses [2]. However these tools are either too open, providing more data than the student and the teacher can handle, or too close not allowing the teacher to decide upon the content of the education he provides. In any case the teacher is thrust aside from the teaching process and transformed into a passive observer. On the contrary the new technological features, such as the WWW, multimedia, databases should reinforce the teacher's role and place him in the center of the educational process. The most important, yet innovative feature of the teaching environment presented here is, that it is teacher-oriented, and teacher-dependant. With the help of modern programming languages (Visual Basic, Delphi, Java, HTML) and a flexible database system, it provides the teacher with an integrated environment, from the beginning of the teaching process (the creation of a course) to the very end (the evaluation of the student).

This integrated learning environment is implemented within the framework of "Development of Innovative Systems and Applications in education, through the use of high-end multimedia technology and computer networks", a project which is partially funded by the European Commission's Operational Programme for Research and Technology II (Subprogramme 2, SYN, Co-Financing Programme). This project covers both the pedagogical as well as the technological aspect of the educational process, an element that can guarantee in advance its positive contribution to some degree. In this paper we will:

- describe the problem that our environment has to deal with,
- present the general design and architecture of the proposed learning environment (Fig.1),
- give a detailed description of the individual elements that make up the integrated system.
- mention the users and how they relate with each other.

## 2 **Problem Formulation**

Great talk is made nowadays about the need of a radical reformation in the area of education. With the development of educational software, a new model has been introduced, giving the student the opportunity to tailor his study to his own needs (Heterogeneous process) [3].

The modern perception is distance learning through a network-oriented environment. The student accesses a virtual web-based classroom, from his computer, via a web-browser. This perception provides flexibility in the learning material that is offered, convenience in use and active participation from the student part, as personal investigation is acquired [5]. Collaboration among the students is also applicable with the introduction of a web-based learning model, via e-mail and chat-rooms, for example.

Technology should equip the teacher with the necessary tools to take advantage of the new technological innovations. Thus, the lack of an environment designed upon the needs of the teacher becomes apparent. An environment that will be teacher-centred and will reinforce the role of the teacher in the learning process, by allowing him to embody the special requirements of the students into the general pedagogical methodology that he must follow.

It is extremely painful and difficult to establish the exact specifications that a learning tool should meet [6]. What is sure though, is that a very good and accurate design, based on widely accepted educational beliefs, that makes proper use of the modern technological innovations, has all the potentials to produce an environment that can achieve its predetermined goals.

## **3** Problem Solution

The development of the learning environment we propose was carried out in several steps. After stating the goals, a careful analysis was made before the implementation of the system.

#### **3.1** Objectives of the system

The most important parameter for the success of a software application is to state as clear as possible the objectives you want to accomplish [6], [4]. A well-declared set of goals that is reconsidered and re-evaluated throughout the design and implementation process keeps the software developer, within his initial specifications [3]. The objectives of our integrated learning environment, as stated in the beginning of the development are cited below:

- To reinforce the teacher by providing him with an integrated environment designed especially for him (teacher-oriented)
- To provide an attractive presentation of the teaching content with the use of hypertext format and multimedia enhancements
- To prompt for the active participation of the student through the use of the Internet and the interactivity of the interface
- To prompt for the collaboration between the teacher and the student, through asynchronous web-based applications (e-mail) and among the



students through synchronous communication (chat-rooms).

Fig.1 Architecture of the Environment

### **3.2** Design of the environment

The environment presented places the teacher in the centre of the educational process. He uses a windowed application developed in Visual Basic, to compose the learning courses, as well as the evaluation tests. The final product is a set of HTML pages (nodes) enriched with Java Applets and multimedia components, linked with each other in order to form a graph. HTML format offers platform independence through TCP-IP Communication Protocol. A SQL Database integrates the environment by holding the students' records.



Fig. 2 Development Cycle

In Fig. 2, the development cycle of the environment is presented. The prime concept was to design a teacher-oriented environment. The System Analysis phase was based on the needs and suggestions of the teachers, the guidelines of the Greek pedagogical institute and the hardware equipment. All these established the Specification Requirements for the System Design phase. During the System Design, we decided upon the use of the programming languages, the communication protocols, the modules of the system, the logical flowchart, and the choice of the database subsystem. After the completion of the System Design, the Programming phase started, based on the Design Description. It is important to mention the existence of a Confirmation procedure that controls the flow, providing feedback whenever the product of a completed phase does not meet the desired requirements.

In the environment proposed, great emphasis was given to the use of multimedia components, which contain more information than conventional text. Thus, HTML format was selected for presenting the learning material, as it offers a combination of text, image, sound and video, as well as flexible navigation.

#### 3.3 Implementation

The tools that we used for the implementation of the system were chosen to fulfil the requirements of the prime concept. The individual components of the environment form three distinct areas.

The Development Area includes the main application. There is an authoring tool that produces courses in Hypertext format [10], [8]. Although any HTML editor could be used, we decided to develop a new one, which anyone with no programming experience can operate. It is a windowed application written in Delphi language. Delphi is a modern Object Oriented Programming Language (OOPL) that provides a friendly user interface and was most suitable for the occasion as it is light and fast [12]. The HTML files produced at this point are saved individually for later use.

The whole process is monitored and conducted by the main application, which is developed in Visual Basic. There is also a Test Developer that composes interactive tests. These tests are either used for the comprehension of a specific learning material or for the evaluation of the students after the learning process is over. In the first case the tests intervene between different sections of the learning material and represent the questions that a teacher would pose during a conventional course.



Fig.3 Development Scenario

Thus, depending on the answer given, each student is either guided to the next level of the lesson, or directed back to a previous level to refresh his knowledge. In the second case the creation of the tests is the same, but now the test are gathered together as a set, in a single HTML page. The student has to answer all the questions of a set, and his grade is decided according to the score, which he achieves.

The system has the ability to monitor and evaluate the effort of the student, by keeping track of the date, the score, the time required for the completion of each test. These parameters are kept in the database subsystem.

The tests are actually Java Applets presented inside an HTML frame. This approach makes the implementation platform independent. The use of Java Applets was decided for a couple of very important reasons. Java is a modern and powerful OOPL, offering great usability through a Graphical User Interface (GUI), speed, and security. Java also provides security to both the developer and the user of the software.

One of the innovative characteristics of the proposed environment is the development of a database subsystem that accomplishes several tasks. Firstly it contains the records of all the students participating in the learning process. Secondly it serves as a data storage device. Questions and answers can be retrieved in a random or specific way. The records of the students contain all the necessary data for their evaluation, controlled by the main application. The use of a SQL database makes the remote access fast, easy and secure. More to that, the Microsoft SQL database offers great administrative functions written in Visual Basic [11], [7].

The main application also constructs the layout of the learning process by combining the components produced in the HTML Editor and the Test Developer. The output is a series of HTML pages linked together in the appropriate way. A scenario of the development process is shown in Fig.3.

The developed courses are presented to the students. The Presentation Area can be any Intranet or the Internet. A web-browser is the only tool that the student will need to access the Presentation Area, as long as he has authentication to do so. Since many users of the environment may connect to the network server simultaneously, the processing power of a web-based task must be transferred to the client side, as most of the PCs nowadays are fast and powerful. So, they can execute heavy tasks without overloading the server and the network as well. This can be achieved with the use of Java applets as mentioned above.

Finally, the communication between the teacher and the students, as well as among the students themselves, takes place within the Collaboration Area. The environment uses the communication facilities provided by the network and offers both asynchronous and synchronous collaboration, through e-mail and chat-rooms [1].

The three virtual areas presented in this section form our integrated learning environment as shown in Fig.4.



Fig.4 Application topology

#### **3.4** Users of the environment

The users who will benefit from the environment described in this paper are the teachers, the students and the educational institute:

- The teachers will be given the opportunity to use their scientific knowledge and experience in order to compose and develop the learning course. The educational material has the 'signature' of each teacher, i.e. it is formed according to the beliefs and methods of each one. Besides, they will be able to approach the students, by e-mails and chat-rooms, and discuss about subjects, which can not be discussed in classroom for several reasons. Finally the teachers will acquire themselves dynamic knowledge and information provided by the Internet, which will be up-to-date, in contrast to the static information found in books which quickly becomes obsolete.
- The students will participate in an interactive educational course, by using their personal exploration, judgement and experience. They will avoid the passive memorisation of long uninteresting texts, which is a characteristic of the conventional education since the material developed by the environment proposed, can be enriched with sounds, images and videos, containing large amounts of information, compacted and presented in such a way that the students will think they play some kind of game. It is important to mention that the collaboration between the students and the teacher and among the students as well , will transform the conventional classroom, where knowledge was transmitted in one way, in a small educational society where knowledge is shared, discussed and evolves [3], [9].
- Since the rhythm of the technological evolution, is rapid nowadays, the educational institute must use the technology in all the levels of the education, in order to enhance it with the features of this evolution. Using the technological advantages, the institute can easily plan, develop or modify the strategy for the educational courses. Finally, the goal of an educational institute must be to spread the knowledge to all people, whether they live in a city or in a small village, and the environment presented here can help the institute to achieve this goal.

# 4. Conclusions

We are growing in a world where information plays the most important role. Information Systems are an essential element of every company, organisation, or institute that wants to be affective and competitive. The education could not stay untouched by the rapid change [10]. However, the education in its conventional form cannot satisfy the growing demand for producing, storing, and transmitting information. The general and irreversible tendency nowadays is towards networked hypermedia systems and a universal information society.

In this paper we have presented a learning environment that intends to reinforce the role of the teacher in the development and implementation of a networked, web-based learning environment. An environment that is easy to use, still providing powerful and innovative capabilities in an integrated set. Timal and spatial constraints, created by everyday life, are easily overcome and knowledge is offered quickly and easily any time, in any place. The teacher remains the protagonist in the learning process, and his role is now more important than ever. Technology has the obligation to equip him with the necessary tools to fulfil these expectations. The whole project is cill in the implementation

The whole project is still in the implementation phase. Two demonstrators, targeted in History and Biology, will then be applied to validate the effectiveness of the system. The demonstrators will develop multimedia-enhanced courses following novel pedagogical methodologies, and will be presented via an Intranet. After having been evaluated in practice, the environment can be used as a web-based learning environment over the Internet. However success lies in the approval by the teaching society that should adopt new technology through the use of educational software, designed for the first time programmer.

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