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ELearn: A collaborative educational virtual environment

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Abstract: *Virtual Learning Environments (VLEs) that support collaboration is one of the new technologies that show great interest, concerning the innovative methods that gain ground in every aspect of educational procedure. In this paper, we present ELearn, a collaborative virtual learning environment for teaching e-commerce that has been developed using Active Worlds. We have constructed a virtual school using an environment that integrates the appearance of the virtual world, the web pages that are connected with specific objects in the world and the capability of synchronous chat among the users. Collaboration and interaction were two of the most significant matters taken under consideration, due to their important role in educational procedure. An evaluation of the environment is also included, with regards to specific criteria that we have developed for evaluating VLEs.*

KEYWORDS: COLLABORATIVE VIRTUAL ENVIRONMENTS, EDUCATIONAL PROCEDURE, VIRTUAL REALITY.

1. Introduction

The evolving growth that occurs in network and communication technologies leads to their enhanced usage in many and different aspects of human activity. One of the technologies that show great interest is Collaborative Virtual Learning Environments, which is used in various aspects, such as tele-education. Virtual Learning Environments (VLEs) [1], are learning management software systems composed of computer-mediated communication software and on-line methods of delivering course material. The implementation of innovative pedagogical practices is a response to the social needs for educational change [2]. Participants are experiencing new ways of learning and communicating with teachers by organizing the learning environment in a different way, based on several technological innovations.

2. A short description of the tools that were used for the lessons development.

ELearn was the name of the virtual world that has been developed at the University of Macedonia (Thessaloniki, Greece), with the purpose of teaching some of the basic aspects of electronic commerce.

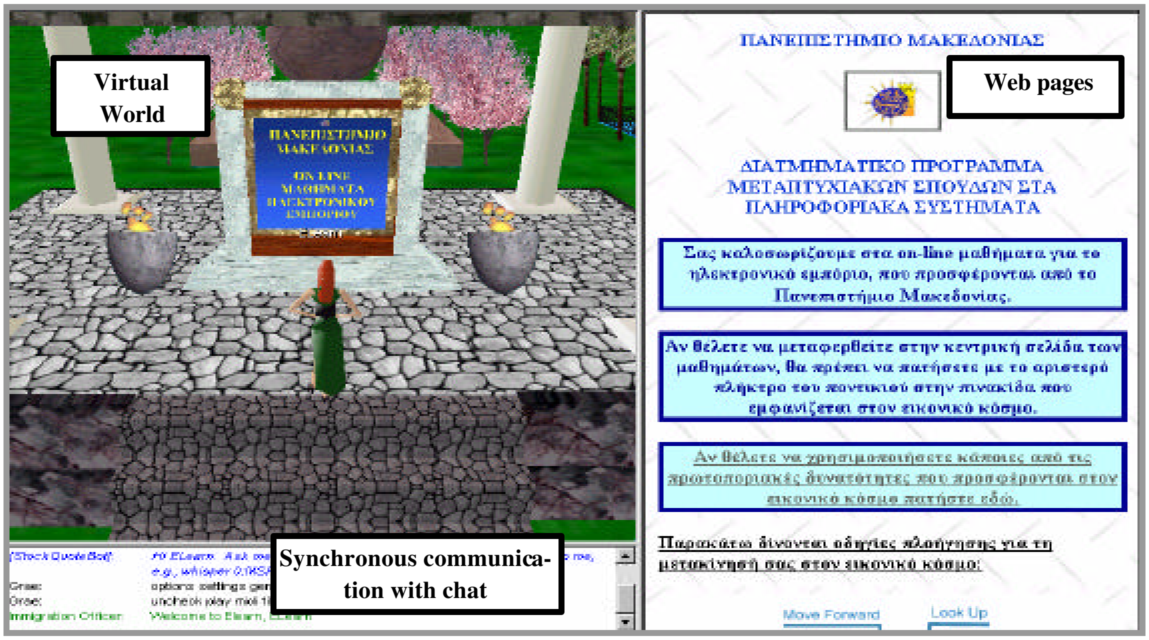
Active Worlds [3]-[5] environment has been used for the development of the lessons, using virtual reality. This environment integrates at the same window, the appearance of the virtual world, the web pages[1] that are connected with particular incidents regarding the virtual environment and even the prospect of synchronous chat among the users (Picture 1).

The ASP language was used in order to achieve the lessons administration [6]. In cases, where an application is used by a group of users, it is necessary to develop a strong administration tool. In the first page of such a tool, the opportunity of choosing any of the offered functions must be given. In such a case the following functions must be considered: the opportunity of adding - removing users (students, teachers) and even changing some of their elements, such as their address or phone number. Only the lessons' administrator is entitled of using the above. On the other hand, a user should have the ability of searching and finding information concerning the teachers or the students.

The web pages that are integrated in the Active Worlds environment have been created with the use of Microsoft Front Page 2000. The first page, having the role of a starter page, includes the following: Lesson map, Search, Information, On line enrollment, Administration, Communication and On line lessons of Electronic Commerce, which is the main page, concerning the lessons' development.

[1] Internet Explorer has been used for the development of the web pages.

- The **Lesson Map choice** consists of the contents of the two chapters that have been created regarding electronic commerce.
- The **Search choice** concerns the searching for information lying in the lesson pages.
- The **Information choice** includes elements of general interest, concerning the lessons.
- The **On line enrollment choice**, gives to a future student the opportunity to enroll for the lessons and also to a future teacher the opportunity of joining the teachers' team, with the objective of helping in the lessons construction.



Picture 1.: The integrated environment, which was used for the lessons development.

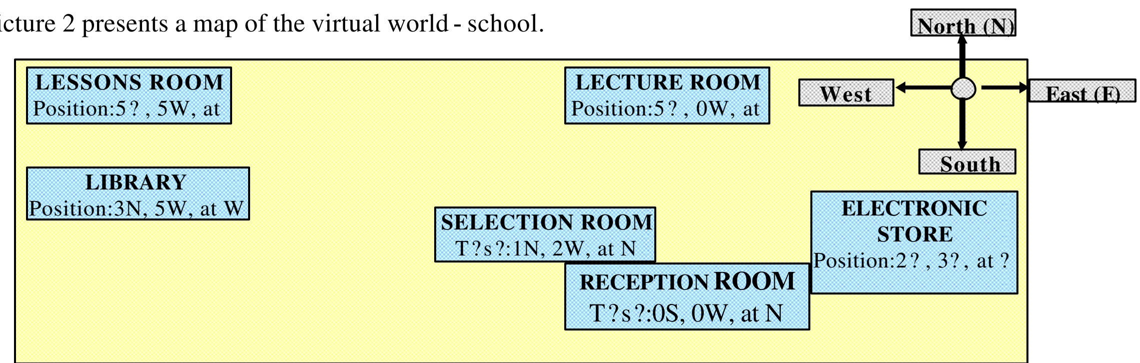
- The **Administration choice** gives the opportunity of administrating the lessons (adding, deleting and changing information concerning students and teachers by the administrator - a password is necessary - and searching student - teacher - information - something accessible by any user-).
- The **Communication choice**, offers to any user the opportunity to communicate with the administrator by sending email and ask specific questions or make certain remarks.
- The **On line lessons of Electronic Commerce choice** leads to the central page concerning the lessons development. From this page, someone can choose any of the following choices:
  - ⇒ **Introduction:** it includes general information about electronic commerce.
  - ⇒ **Contents:** it includes the content of the lessons.
  - ⇒ **Chapter 1:** this chapter consists of four paragraphs with text, images and navigation links. The contents include information about the World Wide Web, definitions of electronic commerce, the necessity and the advantages and disadvantages of its usage.
  - ⇒ **Chapter 2:** as in the first chapter, there are also four paragraphs and consist of text, images, tables and navigation links. Specifically, the paragraphs refer to the market research that should be done before the construction of an e-store, the strategic planning which proceeds, the right presentation in the world wide web and the final stage of actual making the on line store. Additionally, in the fourth paragraph, two videos are included, as examples of two on line electronic stores.
  - ⇒ **Glossary:** it consists of some basic terms in alphabetical order, concerning the electronic commerce lessons.
  - ⇒ **Help:** it includes information on how the user can get help, through email to either the administrator or any of the teachers or students.
  - ⇒ **Exercises:** in order to make the application more educational, two tests are included, corresponding to the first and second chapter of the lessons. These tests consist of exercises, where the student can type the answer to the appropriate orthogonal frame and also of multiple-choice questions, where the student must choose the right answer from a group of choices.

⇒ **Library:** it includes sites concerning electronic commerce in a structured way so the users can find information regarding their interests.
⇒ **Discussion Board:** it is a tool that can enhance collaborative learning. It can be used for creating discussions among interested users.
⇒ **Virtual Chat:** it also enhances collaborative learning. It can be used for synchronous chat between the participants.

For the conjunction of all the tools that concern the development of the lessons, the Active Worlds environment has been used [3]-[5], [7], [8]. The Active Worlds environment helps the user to create a virtual world and visit a number of other worlds available.

3. ELearn: A Virtual World of Electronic Commerce. Description.

Picture 2 presents a map of the virtual world - school.



<u>**Picture 2:**</u> A map of the virtual school[2].

<u>There are six spaces to the virtual world:</u> the reception room, the selection room, the lessons room, the library, the lecture room and the electronic store.

- **The reception room:** it contains an ancient temple with a sign placed at the center, which is welcoming the user. Additionally, at the chat window, the following massage appears: «WELCOME TO THE WORLD OF ECOMMERCE!» and a corresponding sound is listened.
- **The selection room:** it is connected with a web page that is also the main page of the lessons and includes the following choices: Lessons Map, Search, Information, On line Enrollment, Lessons Administration, Communication and On line lessons of Electronic Commerce, which is the central page that refers to the development of the lessons. Each of the previous choices corresponds to an object at the selection room. If someone presses with the left mouse button on an object, a corresponding web page will appear.
- **Lessons room:** it includes objects with signs, that each one of them is connected to a web page that contains information according to the specific topic of interest. The topics that are included are the following: Introduction, Contents, Chapter 1, Chapter 2, Glossary, Help, Exercises, Library, Discussion Board and Virtual Chat.
- **Library:** it includes sections filled with books. Each object that contains books is divided in three sections. In the first section, a sign is placed that informs the user for the contents of the next two sections. If the user left clicks on a section, he will be able to inspect the information that corresponds to that particular choice, at the web page window.
- **Lecture room:** the basic objects of the lecture room are the signs, the computer desks and the projection board. Every sign contains a paragraph title, from the first or the second chapter, concerning electronic commerce. If the user presses with the left mouse button to a sign, a web page concerning the correspondent paragraph will appear. If the user's avatar collides to a sign, a narration, concerning the subject will begin. Apart from the signs that are relevant to the paragraphs, there is one additional sign that refers to an example of an electronic store and two more signs, one for the use of the Discussion Board and the other for the Virtual Chat.

At the left side of the lecture room, there are **desks with computers**. If the user approaches a computer with the mouse pointer, an explanatory sign will appear that gives information on what will happen if a computer is pressed. The **projec-**

[2] This map refers to the position of each room at the virtual school, according to the north, south, east and west coordinates and to the direction of the avatar, the first time he/she visits the particular room.

tion board is located on the center of the room in front of the desks (picture 3). In the lecture room, two lectures are attended, concerning electronic commerce. The projection board is used for the slides change that concerns the lectures.

- **The electronic store:** it is an example of an electronic store that is located to the virtual world with the purpose of giving to the students the opportunity to understand how an electronic store is constructed in the «real» world. The store that is described offers cars, motorcycles and bicycles.

Picture 3: An aspect of the lecture room, where the basic objects are being viewed.

The Active Worlds environment offers the opportunity of using a Software Development Kit (SDK) [9]-[12], that allows the programmers to develop applications that can interact with the virtual world's environment. The most common type of application for the SDK is a bot.[3] Three (3) bots exist at the virtual world.

The first bot is named **Teacher** (Picture 4) and it is built for the purpose of helping the students during their navigation to the virtual world. The user can ask the teacher various questions concerning electronic commerce. The subjects that the teacher could be asked for, appear at the chat box, once the user types Help. A real teacher may manipulate the Teacher bot and therefore a discussion could be build between the teacher and some other users, based on any subject concerning the lessons. The teacher can also examine the students by asking them questions unknown to them. Additionally, a student can «whisper»[4] to the teacher and become recognized only by him.

The second bot is named **Salesman** and it appears whenever another user (avatar) enters the e-store. The salesman can give information concerning the products that are offered in the electronic store and advise the user of how he/she might fill an order form. The salesman can be used with the same way as the teacher.

[3] A bot is typically an avatar that inhabits a virtual world and interacts with users. It is driven by a computer program, instead of a human being (citizen or tourist).
[4] A whisper is a chat massage sent directly to another user. When one whispers, the recipient is the only person who can hear what he says.

Picture 4: The teacher and the student coexist in the virtual world.

The third bot is named **Lecturer** and has the capability to give lectures, in the Lecture room (picture 5). The Lecturer can synchronize text spoken by the bot with changes in objects or .jpg images. Therefore, a virtual «slide show» can be created. The Lecturer's bot communicates by normal chat, but its more powerful feature is the ability to whisper to the avatars that are located in the lecture room. As a result, any other avatar that exists in another room of the virtual store, for example the electronic store, will not identify the Lecturer.

Picture 5: A lecture, as it develops in the lecture room.

4. Discussion

The evaluation of collaborative VLEs is not a simple task [13]. Without a descriptive model of the ideal collaborative learning process, we cannot easily find indicators (either qualitative or quantitative) that will tell us whether effective learning is taking place. Additionally, on the level of evaluation criteria, the criteria themselves need to be changed and adapted according to new findings and new constrains that result from system development. Therefore, formative evaluation needs to be performed on four levels simultaneously: **the pedagogical - psychological level, the technical - functional level, the organizational - economical level and the social - cultural level.** [14].

The **pedagogical - psychological level** includes all the criteria, referring to the learning process itself. For example, criteria such as support of different didactic methodologies, how to represent and modify knowledge, tools to define learning goals, or support for different roles (learners, trainers, tutors) need to be assessed at this level. The **technical - functional level** includes criteria that refer to the proper functioning of a concrete system, e.g., criteria such as stability, required bandwidth, interface design, e.t.c. The **organizational - economical level** deals with aspects of organizational context and constraints, e.g. how efficient and cost effective are computer supported learning processes compared to traditional ways of training. Finally, the **social - cultural level** evaluates how a system fits into the overall learning culture and how its users from a motivational and emotional point of view accept it. A model of evaluating collaborative virtual learning environments has been developed [15] - [18], based on the previous factors. Table 1 includes the evaluation criteria at the first column and some comments concerning the ELearn environment at the second.

5. Future work

The development of software, that is build on collaborative virtual environments could be proven extremely useful in the educational procedure. The current research and commercial interest in developing CVEs that support rich social interaction in densely populated virtual worlds is an ambitious goal, one that requires addressing a variety of technical challenges [19].

Based on future growth, the conjunction of virtual environments with databases that are continuously enriched with new elements in order to be synchronous is an interest aspect [20]. Another capability that is of great interest is teleimmersion that integrates the technology concerning collaborative virtual environments with audio and videoconference and other computer power demanding, technical capacities. Also, the addition of smart behavior to the system with the usage of intelligent agents is something worth of studying. Pedagogical agents are of great importance and can be used in collaborative virtual environments, as they are represented with a character (avatar), or a specific object (for example, a book).

The ongoing research involving VLEs is worthwhile, considering that the networking of multi - participant, collaborative virtual environments appears to represent a significant trend for future applications [17].

Evaluation parameters	**ELearn environment**
a. Pedagogical - Psychological parameters	
a.1. Teaching theories (collaborative learning, adaptive, constractivistic or conceptual model of teaching).	Collaborative learning is supported with the inhabitancy of many avatars at the same virtual world and the use of synchronous chat. There is also the capability of using the discussion board and the virtual chat.
a.2. Organization of the teaching material (it refers to the purpose of teaching, the age of the students and the aims of learning).	The lessons were developed with the purpose of teaching the basic elements concerning electronic commerce to pre-graduate students . A further development of the content is necessary in order to expand the field of analysis.
a.2.1. Teacher tools (can teacher take part in the development of the lessons, is there any directions concerning teaching, can the students be graded on line, can the teacher make exercises, quizzes, e.t.c.).	The teacher can participate at the development of the lessons and give exercises or grade to the students on line. It is essential for the teacher to have some basic knowledge of the tools that must be used in order to use the environment, to make a new test, to communicate with another teacher or student, e.t.c..
a.2.2. Student tools (can the students use on line help, possess their own email, use discussion boards or virtual chat, use asynchronous or synchronous ways of communicating, have access to their grades, e.t.c.).	The environment supports collaborative learning and therefore the students can use both synchronous and asynchronous ways of communication. They also can get help (the bots are essential) concerning the lessons (a glossary and the contents of the lessons are available). Searching is also included in order for someone to find information concerning the theme of interest. More attention should be given at the monitoring of the students progress.
a.3. Evaluating of learning (can the student use the environment soon enough without the teacher's help, interact freely with the environment, use interactive tests, e.t.c.)	The usage and navigation at the environment is easy and pleasant, through the user's interface. The students can interact with the environment under certain constraints - for example, they cannot change the objects properties or build anywhere at the virtual world-. There are no interactive tests included at the time being.
b. Technical - Functional parameters	
b.1. Development characteristics (are there any multimedia elements supported - pictures, sound, video, e.t.c. -, can the software being used at different platforms - Unix, Windows NT -, can the software communicate with a database, e.t.c.).	Various multimedia elements are supported and the software can be used in different platforms as well. The capability of using the connectivity with a database was not examined.
b.2. Designing the interface (is the environment designed in a clear and interesting way, how cautious where the designers concerning the text, pictures and other multimedia elements that where used, is it possible to personalize the user with an avatar, do the environment support facial and body gestures, is immersion supported - with the use of special equipment (the stereoscopic helmet, the gloves) -, e.t.c..	There has been an effort of designing the interface with an interesting way, using common ways of interactivity with the environment (e.g. signs) but also provoking the student to explore and learn. The user can be personalized with an avatar, facial and body gestures are supported but immersion is not.
b.3. Support procedures (can the students and teachers be informed on the software usage, is there any technical support offered by the company, is the software and the sites being often updated, is there a satisfactory security, concerning the files transaction, are there any mirror sites, e.t.c.)	The students and the teacher can use help concerning the software usage and the technical requirements. The procedure of updating the contents and the security problem need more work. There are no any mirror sites.
b.4. Administration tools (are backup files supported, are there any tools that prevent unauthorized access to the server, is on line enrolling possible, is there a way of administrating the lessons - add, delete, update records -, e.t.c.)	It is possible for the lessons administrator to retain backup files of the virtual world, on line enrolling is possible and an administration tool is being developed. The security matter needs to be more analyzed and developed. Furthermore, the ability of adding, changing and deleting students and teachers is entitled only to the administrator.
c. Organizational - Economical parameters (is it possible for the organization to support server hosting, advertisement of the lessons, is there any pricing policy and on what terms the users are going to be charged, e.t.c.).	The lessons were developed at the University of Macedonia and therefore server hosting was supported. There wasn't any study made on advertisement and pricing policy.
d. Social - Cultural parameters (are the differences on religion, cultural development, language, age taken under consideration, e.t.c.)	The lessons are not related with religion but the development on the basis on different culture and language may be crucial for on line teaching. The language used was Greek because the lessons where addresses to Greek students, but the development on a different language might widen the prospects of the software usage.

Table 1: An evaluation of the ELearn environment.

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