

# E-Study: A Learning Environment

D. KAROLIDIS, A. MORONIS, P. PRENTAKIS, J. RAMPIAS, M. SAMARAKOU

Department of Energy Technology  
Technological Educational Institution of Athens  
17, Ag. Spyridonos Egaleo, GR12210  
GREECE

<http://www.et.teiath.gr>

*Abstract:* - The work presented in this paper discusses the supported forms of the communication tools and the adaptation framework of an asynchronous communication tool in the context of a web-based learning environment, named e-Study (elektroniki spoudi). The purpose of this environment is to support the needs of both instructors and students by means of up to date information regarding developments in the cognitive domain, co-operation, tutorials, “hands on” practice in terms of simulated experiments, access to digital libraries and generally any field related information sources. Moreover, it provides support for distance, collaborative learning and at the same time takes under consideration educational requirements of its users. The learning environment e-Study is based on the e-class platform developed by GUNET and uses reliable open-source components. This system can be used for the development of services that allows the educational collaboration between students and instructors with dynamic content and asynchronous dialogue introduction. For this purpose extra features have been added to the system, in order to assist certain laboratory exercises conduction in a modern and more efficient way. The benefits of such undertaking are multiple. Clearly, communication and interaction between instructors and learners are enhanced, thus raising the quality of the learning process while at the same time ensuring the proliferation of knowledge in general.

*Key-Words:* - eclass, learning environment, PHP, Javascript, dynamic web pages, open-source code

## 1 Introduction

It is widely accepted that the use of technology in the educational process at any level of education and in particular that of higher, should play a vital role as a supporting mechanism towards knowledge acquisition and more generally in the learning process [1]. Nowadays the evolution of new technologies has changed the standards of education. New changes and challenges take place in educational institutions. The use of Internet provides an efficient tool to support educational activities, like laboratory work, bibliography acquisition, communication requirements, etc.

Recent research in Cognitive Science advances our understanding of human learning and knowledge acquisition and gives the opportunity to formulate principles for the design of new and innovative technology-based learning environments. It is nowadays argued that a computer-based learning environment, needs to enhance a more active and constructive process of learning, stimulating students to make a maximum use of their own cognitive potential [3, 5]. In some cases, technology and in particular the use of Internet for education purposes, results in information excess that can in turn cause mental

overload. Therefore, it is of uppermost importance to provide means for avoiding such overloading, while at the same time ensuring that the required by the users' information will be available at their request.

In this work, the authors present a learning environment called e-Study under which an integrated environment will support specific information tools, virtual books, collaboration amongst its users, exploration and evolution based upon the WWW and Internet.

The implemented learning environment e-Study has inherited all the features of e-class platform and the main idea of the adaptivity lies in the provision of those communication tools that facilitate/support and promote student's activity. Using the tools provided by e-class the corresponding modules are registered /stored in the form of lectures which are accompanied with Example Tutorials solved proposed Tutorials and multiple choice questions.

Furthermore, a subsystem is build which comprises special hardware and software to collect and handle real-time data, considering selected critical operational 'on-field' parameters of industrial installations, which will be available to students during lab-classes. Another subsystem is

implemented to store the results of the multiple choice questions which are answered by the students at the end of each laboratory tutorial. At the end of each module the results of the laboratory tutorials of each student are registered /stored, so the final result can be sent to the student by e-mail or alternatively by SMS. The evaluation subsystem of the platform has also been added to the system.

## 2 Objectives

The purpose of the proposed learning environment is to offer support for the needs of the following user categories:

### 2.1 Instructors

**Information on the curriculum and the teaching strategies:** The expert tutoring group of every involved University or other Institution will have the opportunity to provide information in its network site, presenting the entire spectrum of the relevant scientific activities that take place in the particular institution with respect to the knowledge domain in question. This information can be structured and linked in a meaningful way, offering the visitors of the site effective horizontal or deep down access on any relevant subject explored, e.g. information on the topics of the curriculum of graduate courses, teaching and educational aspects, areas of interest and research, but also extended linked information on a specific subject from graduate/ postgraduate level to basic research on this subject. Proposed reference links to other sites may also be included.

**Collaboration with other instructors:** Instructors have the opportunity to provide their own expert knowledge in the site and structure it according to their personal educational experience [2, 4]. They can also include past examination papers, questions to be answered, exercises and problems to be solved, subjects to be further studied, areas for research activity and so on, including appropriate links to relevant information, based on the expert's knowledge and educational experience, (theory, worked out examples and solutions, modelled experiment simulations, animation, video clips, photos, bibliography, reference to specific topics in other sites, etc.), aiming to support and guide the user's effort through the learning process.

A fruitful interaction can be obtained with other instructors, through the access on this material, leading to an on-line, dynamically obtainable, perception of the relevant work done by other colleagues.

**Collaboration with students:** By having access to the pages prepared by the instructors, the students should be able to create their work-group with their own answers and solutions to proposed problems, but also with questions and inquiries related to their work. This can lead to an enlightening interaction with the instructors giving them a useful feedback in order to organise more effectively their educational work.

### 2.2 Students

**Beneficial use of alternative knowledge sources:** The students will gain access to various different sources of information related to the knowledge domain (apart from those already available in the Internet). Expert's knowledge educationally structured, as described above, will be available in every involved site, properly linked to a variety of other information sources from plain text or hypertext to hypermedia material. Moreover the students will have access to work carried out, and, information collected and questions and inquiries to be answered all this material provided by other students, obtaining this way a more comprehensive and conscious understanding of their difficulties - which is a positive step towards the handling and therapy of their mistakes and misconceptions.

**Self-instruction:** It is attempted, through the structure and linking of the information, to help the user become actively engaged in learning and situating or anchoring instruction in this environment.

Scenarios proposed by the instructors, or constructed by work-groups or single students, make it possible for the user to learn to generate problem solving goals, find relevant information and become engaged in justified decision making.

**Motivation:** Guided motivation can be granted to students, enabling them to propose alternative solutions to problems collect and link information on selected subjects.

**Collaboration with other students:** By having access to material exported by other students, students can interact with each other stimulating their personal activity, propose their own solutions and links, get more conscious of personal inquires and questions, and gradually structure their knowledge in a more effective way. This process provides feedback with respect to a better contribution for the educational objectives of collaborative work.

**Collaboration with the Instructors:** Electronic mail integrated within this environment, although it is static and passive, can however be effective and assist in students' educational activities, like

submission of personal work, instructional feedback, clarifications and answers to their questions and arising problems, etc., in a sense that students may request advice at any time, without requiring the tutors presence.

Through such sessions, students can clarify their misunderstandings, obtain a wider perspective on the domain under study through their colleagues' participation in the session.

### 3 The Learning Environment

The architecture (see Fig. 1) allows participants to access the system through an Internet browser, e.g. Netscape or Internet Explorer.

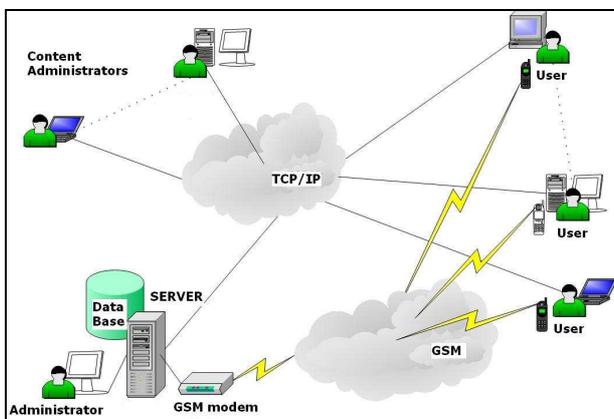


Fig. 1: The system architecture

E-Study has inherited all the features of e-class platform:

- **The user categories:** There are three user categories. *The instructors* deal with the content import, management and activation of their courses. The instructors can create numerous courses, manage the student course registration, and create forums and self-evaluation tests. *Students* focus on specific courses and course notification. They can register all permitted courses and use all of their features. User accounts are dynamically created. The *system administrator* is concerned with the system parameterization, proper operation, installation and maintenance of the network gate. In addition he is responsible for statistics management, instructor account creation and user account supervising, and database optimization.
- **The course categories:** There are three course categories. *Open courses* are courses that everyone can access with or without registration on the system. *Open registered*

*courses* are courses that require student registration. Finally, *close courses* require student registration but course access has to be authenticated by the responsible instructor.

Courses can be easily created and supported by the responsible instructors and without the need of specific qualifications. Thus, structural course presentation is established.

#### 3.1 Course Material

By the use of tools provided by e-Study the corresponding modules are registered /stored in the lecture form and are accompanied with thorough-paced solved Exercises, proposed Tutorials and self-evaluation tests.

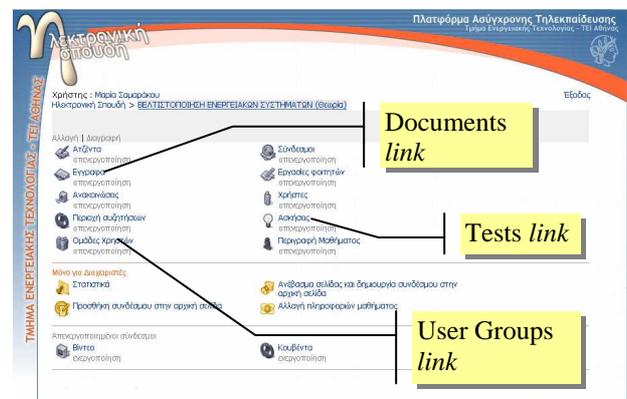


Fig. 2: Course elements

The responsible instructors support the creation, storage and presentation of their electronic courses. This process is implemented by the course tool "Documents" (see fig. 2).

#### 3.2 Student registration in laboratorial courses

The platform provides a tool that allows the creation of "User Groups" (see fig.2). With this tool, the user groups are registered in the lecture form by the responsible instructor based on the laboratories teaching schedules and the maximum possible lab capacity (see fig. 3). This tool is available to students for their online course registration.

#### 3.3 Self-Evaluation Tests

In addition, based on the pre-constructed subsystem "Tests", every course has been appended with several self-evaluation tests by the responsible instructor (see fig.2).

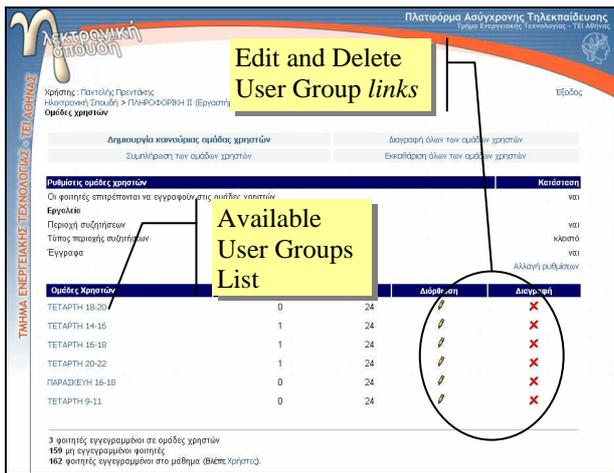


Fig. 3: User Groups

## 4 Additional subsystems

The following additional subsystems are integrated in the learning environment.

### 4.1 Description of a measurement and communication subsystem

This system includes the following units:

- *Powermeters*
- *Web-based communications platform*
- *Central Server and Terminals*
- *Dedicated software to acquire and process real-time data*

*Powermeters* are electronic instruments based on microprocessors which allow the measurement, recording and monitoring of basic electric and energy quantities in real time. Measuring data are displayed at the instrument front side panels, or can be accessed in real-time through available communications ports. In the second case, powermeters operate together with a remote host computer as part of a local network.

The installation of a selected number of powermeters in main and secondary distribution boards, in industrial plants or other large electricity consumers, allows keeping full track of essential electric parameters. The analysis of these results constitutes the basic stage in any energy management program, which can increase efficiency and reduce operation and maintenance costs.

The *Communications Platform* is an integrated central unit, which serves the interconnection of powermeters through a network and ensures communication with them. In this way, remote recording and storage of real time data coming from all powermeters is made automatically, in the

most efficient way. For this purpose, the unit comprises of standard communications ports such as RS-422/485 and Ethernet LAN. The RS-422/485 port may be used to set up a local bus (Modbus) where all powermeters will be connected. This network is controlled by a remote host computer which is used to track and record all data. The Ethernet LAN port provides the capability of setting up a local network of computers, in order to make all powermeter data remotely available not only to the host, but to all terminals of the network, which may be located at different places. In addition, the communications platform employs a telephone line plug, which in combination with a built-in TCP-IP server makes all data accessible through the World Wide Web while. At the same time, full remote control of the powermeters is also possible.

A second network will be placed in Measurement Systems Laboratory, at the premises of Energy Technology Department of T.E.I. of Athens. This network will comprise a *Central Server* with *dedicated software to acquire and process real-time data* and a number of *terminals* operated by the students. The communication of this lab-network with the distant on-site measuring system will be possible through the *communications platform* and a common telephone line. In this way the students (users) will have full remote access of real data and control of the powermeters via internet during classes. The whole Measurement System Setup is shown in fig. 4.

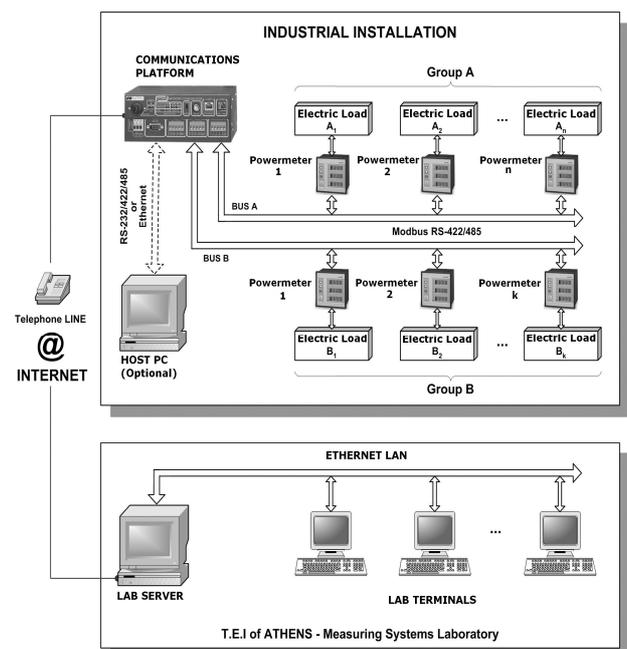


Fig. 4: Measurement System Setup

## 4.2 Examinations through the web

An examination subsystem has also been implemented to provide secure automated examinations by the instructor in charge.

The platform has been enhanced with the capability to add an additional course tool named “Exams”. With this tool, the instructor can create multiple choice evaluation tests. These tests are activated when the instructor wishes to perform an exam.

When the student finishes the examination or the available time runs out, the final grade is posted and inserted in the MySQL database and by then it is available to the course instructor. Then the student selects a test for a certain course in order to take the examination.

Furthermore, the student selects in which way he will receive the grade notification (email or sms). The notification takes place dynamically when the course instructor allows it.

The control and reliability of the whole procedure relies on the use of specific computers (the ip addresses are identified dynamically according to a static address list, e.g. computer lab).

## 4.3 Evaluation subsystem

An evaluation subsystem has been implemented. This subsystem is based on question-and-answer screens for two basic modules:

- system evaluation
- didactics evaluation

Each module combines graduated multiple choices and questions to answer (reaching a total of 21 questions).

First module includes questions that concern the style and functionality of the platform. In the second module the questions concern its instructive utilization.

ΤΕΙ Αθήνας  
Σχολή Τεχνολογιών Εφαρμογών  
Τμήμα Ενέργειας Τεχνολογίας

Σε θέλουμε να συμπληρώσετε την αξιολόγηση της πλατφόρμας Ηλεκτρονικής Σπουδής, ώστε να μας βοηθήσετε να τη βελτιώσουμε.  
Αφού τα στοιχεία που ζητάμε υποχρεωτικά θέλουμε να ανανεώτε το φύλο, το εξάμηνο σπουδών και τη συχνότητα επικοινωνίας.

Όνομα:

Επίνομο:

Αριθμός Μητρώου:

Φύλο:  Άρρεν  Θήλυ

Εξάμηνο:

Πόσο συχνά χρησιμοποιείτε την Ηλεκτρονική Σπουδής:  0-5  6-15  16-30  31-50  50 και πάνω

User Registration Area

Evaluation starting button

Fig. 5: Evaluation subsystem form

In this perspective, users, anonymous or not, can evaluate the platform. As a result, system administrators can draw useful conclusions about further development of the platform.

## 5 Implementation Requirements and Specifications

The implemented system is based on Windows 2000 Server and uses Apache Web Server and dynamic PHP web pages that communicate interactively with existing MySQL databases [6, 7]. The learning environment e-Study is based on the e-class platform developed by GUNET [8]. The e-class platform based on the Claroline system [9]. Claroline is an Open Source software package which allows teacher (professor, lecturer...) to create, administer and add to his/her courses through the web and supports the documents publishing in any format (Word, PDF, HTML, Video...), forums discussion, links management, student groups creation, exercises composition, agenda with tasks and deadlines and announcement lists. In the present work, the greatest part of the additional subsystems code has been written in PHP. The PHP code has been used to gather data and produce the dynamic content of pages [10].

Furthermore, the system uses the NowSMS Gateway tool for sending SMS notification messages to students. The Now SMS Gateway is a tool for the development of SMS Push applications [11]. The gateway supports the transmission of SMS via one or more GSM modems (or GSM telephones that are connected through a serial or a USB port in a PC), or above TCP/IP connections using SMPP (Short Message Peer to Peer) [12], UCP/EMI (Universal Computer Protocol/ External Machine Interface) and/or HTTP protocols. It supports Unicode formats (UTF-8), allowing the extension to multilingual environments.

## 6 Conclusions

Internet based support for educational needs can be seen from three different perspectives. The first relies on the user's ability to access information. The second, as an integrated interface for distance learning. Finally, the third supplements the conventional classroom by combining the immense quality and spectrum of information within the WWW, and the interactive capabilities of Web clients. The proposed learning environment presented here incorporates all three perspectives in higher education.

Though the evaluation subsystem is running during this academic semester and there not results to be discussed, generally we can say:

This framework is based upon cognitive principles enhancing effective learning and knowledge acquisition, such as:

- Exploration, achieved by the hierarchical structure of the proposed framework and its multi-site aspect.
- Collaboration obtained through the dynamic access on educational material.
- Adaptation of the instruction through the proper organisation of the information in terms of appropriate links and the use of specific goal-oriented criteria.
- Situated learning through the ability to acquire knowledge through the study of “real word” conditions and phenomena.

Under the proposed infrastructure users are able to share views and opinions, interact and collaborate with each other, become informed of latest developments in the field of study, participate in a constantly evolving environment and, generally, become active members of a large-scale electronic university. For this “university” to be successfully realised, interdisciplinary collaboration amongst the people that comprise it, is necessary, particularly that of staff members. In truth it is their motivation and efforts that will render such endeavour successful.

#### *Acknowledgments*

This work is co-funded by 75% from E.U. and 25% from the Greek Government under the framework of the Education and Initial Vocational Training Program – "Upgrading of Undergraduate Curricula of Technological Educational Institution of Athens" (APPS program-T.E.I, of Athens).

#### *References*

- [1] Barrie, J.M., Presti, D.E., The World Wide Web as an Instructional Tool. *Science*, vol. 274, 1996, pp. 371-372.
- [2] Cafolla, R., Knee, R., Designing World Wide Web Sites: an Instructional Design Perspective. In *Technology and Communications: Catalyst for Educational Change, Proceedings of the Thirteenth International Conference on Technology and Education*, New Orleans, Louisiana, vol. 1, 1996, pp.181-183.

- [3] De Corte, E., Toward the integration of computers in powerful learning environments. In S. Vosniadou, E. De Corte and H. Mandl (Eds.), *Technology-Based Learning Environments*, Psychological and Educational Foundations. *NATO ASI Series F*, Berlin: Springer-Verlag, vol. 137, 1994, pp. 19-25..
- [4] Foster, M., Montanheiro, L., The Internationalisation of Teaching and Learning through the use of On-Line Technology Links. In *Technology and Communications: Catalyst for Educational Change, Proceedings of the Thirteenth International Conference on Technology and Education*, New Orleans, Louisiana. vol. 1, 1996, pp. 52-54.
- [5] Soloway, E. Ways of seeing. *Communications of the ACM*, vol. 37, No. 2, 1994, pp. 15-20.
- [6] Apache HTTP Server Project.  
<http://httpd.apache.org>
- [7] MySQL Developer Zone.  
<http://www.mysql.com>
- [8] Greek Universities Net.  
<http://www.gunet.gr>
- [9] Caroline Open Source e-Learning.  
<http://www.claroline.net>
- [10] PHP Net.  
<http://www.php.net>
- [11] Home of the Now SMS/MMS Gateway.  
<http://www.nowsms.com>
- [12] SMS Forum.  
<http://www.smpp.org>