A learning platform for the introduction of Remote Sensing principles and applications in Higher Education.

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Abstract

The goal of this study is to present the development of a learning platform as a tool for the instruction of Remote Sensing at a University level. The platform allows students who have access to use the learning material that has been created for the Remote Sensing course and to perform main processing procedures using the ERDAS Imagine Software and following step-by step instructions. The platform has been designed so as to include pedagogic principles. The learning activities for the students follow the Scientific Method steps, while collaborative practices are very well-supported by the nature of the tool itself. A holistic approach of the thematic area is attempted and students may access interesting links with resources and news and use a forum or the e-mail to exchange views on the course with fellow students or instructors. The platform has undergone a rather thorough formative evaluation by a group of students of the Physics Department of the University of Athens. Existing indices were incorporated in the evaluation framework, while others were created in order to assess the platform's effectiveness and potential usability, from its technological, scientific and pedagogical aspect. The scores achieved indicated that the platform may be integrated in a blended learning environment in an effective way. It may enhance the students' learning processes as a more diversified and flexible tool and provide efficient ways to communicate knowledge to students and facilitate more in depth understanding of Remote Sensing principles.

Keywords: learning platform, remote sensing, blended learning, collaborative learning

Introduction

Over the past decade there is a number of driving forces in Higher Education worldwide to use online technology in order to support teaching and learning. Information and Communication Technologies (ICT) enhanced environments provide excellent tools and mechanisms to deal with the higher education challenges, especially, those technologies related to E-learning platforms and virtual campuses (Gonzalez et al., 2007).

E-learning is defined "as the use of any of the new technologies or applications in the service of learning or learner support" (Laurillard, 2005).

E-Learning can be used as an effective resource to shift the emphasis from the tutor to the student and creating personalized learning paths. The Personalized Learning model is being recognized as a flexible, multi-faceted, and individualized approach to learning in education today. This is to a great extent due to the fact that education research confirms beyond doubt that not all students learn successfully at the same pace, in the same style and manner, with the same approach, on the same path and in the same environment.

Moreover, E-learning facilitates the application of collaborative learning practices. Collaborative learning has been shown to engage learners in knowledge sharing, to provide support, where learners can depend upon another, negotiate and manage their own learning needs (Tu, 2004).

Significant changes are taking place in Higher Education Institutions with respect to the introduction and growth of E-learning practices. However, while some universities have achieved considerable benefit in the adoption of E-learning (Meredith and Newton, 2004), others are still struggling to realize the attainment of the minimal education value (Marshall and Mitchell, 2002).

While the ostensible aim is to use e-learning to improve the quality of the learning experience for students, the drivers of change are numerous, and learning quality ranks poorly in relation to most of them (Laurillard, 2005).

Extensive research emphasizes on issues that have emerged as several Higher Education Institutions adopt E-learning in their teaching and learning processes. These issues include:

Understanding of the technology and pedagogy integration for learning to take place effectively (Govindasamy 2002; Engelbrecht 2003)(p.352).

Systematic and credible e-Learning evaluations (Omwenga and Rodrigues, 2006). (p356).

Following the paradigm shift from teacher centeredness to student centerdeness (Sherry and Wilson 1997).

A major challenge with E-learning applications is to learn from past and current practices and to design frameworks that may support a critical mass of educators to 'effectively use technology beyond the transmission of knowledge to transactional learning in support of collaborative, co-construction of knowledge' (Redmond & Lock, 2006).

The purpose of this paper is to present the framework for the design, development, pilot implementation and formative evaluation of an electronic platform for the instruction of Remote Sensing basic principles and application in Higher Education. The purpose of the project was to create a flexible and effective learning environment that enables access to an abundance of information and expertise and that has the potential to promote learning in the field of Remote Sensing.

The concept

Students who take the Remote Sensing Course struggle and often fail to understand basic concepts of the technique. This is mainly due to the fact that emphasis is put on the theoretical instruction with a serious absence of practice, that is, absence of training, while the education is of high quality.

Moreover, the learning material used is not 'tailored' to the specific needs of the students. As a result, beginners are often overwhelmed and find the process quite complex and hard to follow.

The widespread use of the Internet has been a catalyst in the course of events in Higher Education, since it is a facility that has opened up a whole new world of easy to use technology that gives students and instructors the possibility to communicate, investigate and learn.

Computer – assisted learning approaches seem to be very promising and suitable to assist Remote Sensing lecturers in their effort to better meet the learners' needs. At the same time, this approach offers students the possibility to critically appraise and utilize new technologies' potentials in order to acquire knowledge. Remote Sensing by its nature utilizes technology so as to process data and produce information and knowledge concerning the impact of human activities on the environment, which is of course need e in order to make informed decisions. More specifically, digital image processing allows scientists to manipulate and analyze image data so as to reveal information that may not be immediately recognizable in their original form.

In this study the idea was to create and evaluate a learning platform for the instruction of Remote Sensing Principles to University students that have no precious background on the subject.

The objectives of the study were:

The development of the learning material to the detail required.

The design and the establishment of the learning platform.

The adoption of an appropriate scientific approach and the inclusion of pedagogy.

The preparation of the formative evaluation tools.

The implementation of the formative evaluation in order to get the first feedback by the students.

Critical issues for all course of action were that:

The subject content for Remote Sensing is state of the art and maintained up-to -date.

The platform functions without problems across all users.

The design principles are appropriate to the needs of the users and are clearly able to support pedagogic issues.

Practical principles such as individualization, collaborative learning, interactivity, shared experiences, activities for learner reflection and quality scientific information have been adopted throughout the study.

The evaluation process was considered to be one of the main elements of the study, since it was expected to give interesting outcomes that would allow to assess its progress, correct errors and support the strategies that prove to be appropriate.

The learning platform

The platform has three main characteristics:

Web-based architecture (the learning tool may be accessed by using the web browser, without installing other software to the computer).

Modular organization of the material (allows to import / export courses and adaptation of training paths to specific learning needs).

Portability (the platform has the possibility to work correctly independent of the computer and the operating system on which it runs).

The learning platform's website was created with the Active Server Pages (ASP) technology and more specifically with the ASP.Net 2.0 Microsoft version, with the use of the Microsoft Visual Studio 2005 development platform. The programming language that supports these pages is Visual Basic's 2005 edition.

Characteristics such as the 'masterpages' have been introduced in the ASP.Net 2.0 version, through which, the maintenance of the uniformity of the site's pages is facilitated. Another important element is the simplification of the user creation and administration process.

The personal data of the users (for example the usernames and passwords that they use to access the site) are saved in a Microsoft SQL Server or in the freeware MSDN version which is included in Microsoft Office 2003 (Image 1).

The site may be installed in a Microsoft Windows Server or a Microsoft Windows XP Professional operating system. The Internet Information Server (IIS) version 5.0 (or more recent) and the Net Framework 2.0 must be installed as well.

The main elements of the platform are:

The remote sensing material (Image 2).

Interesting links with resources for the technique.

A forum where students may be able to exchange views.

E-mail contact with the course's instructor and fellow students.

News (deadlines –results etc. and seminars-conferences etc.).

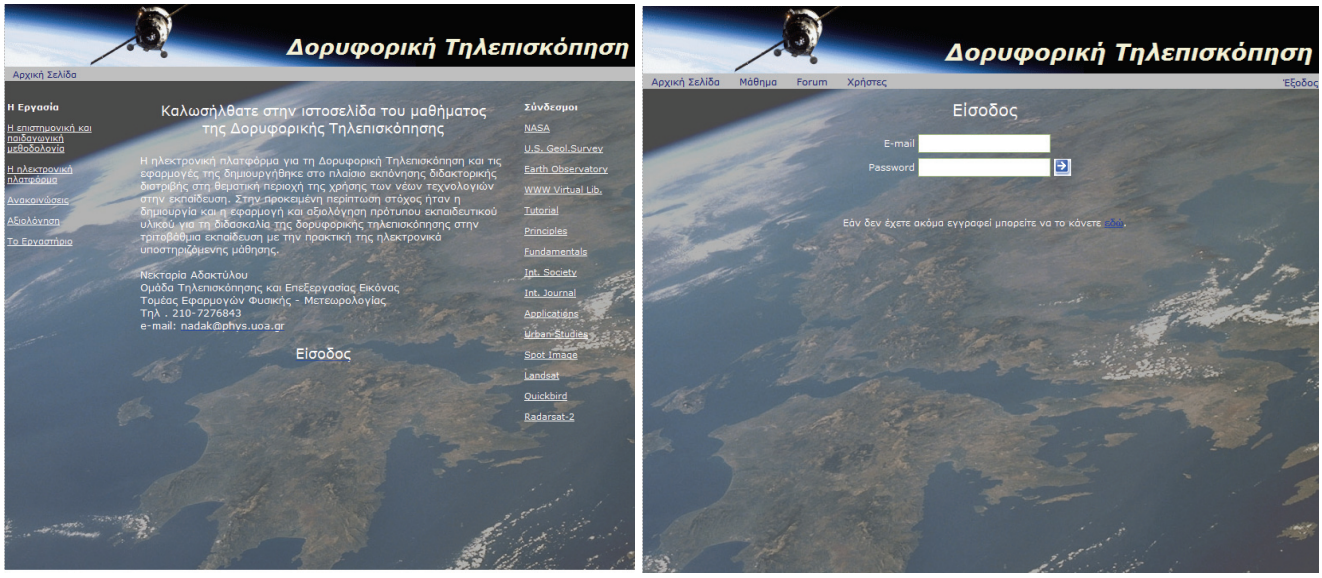


Image 1. Users have to obtain usernames and passwords in order to access the content of the platform.

Simple tracking mechanisms such as attendance and total number of interactions with the virtual learning environment have been correlated with students' performance and may be helpful in supporting ways of increasing student engagement.

There have been several studies of possible links between attendance and performance (Colby 2004; Barrett at. al. 2007). There have also been studies where the total use of the virtual learning environment has been correlated to the students' performance. More specifically, Lally(2002) investigated the correlation between students' performance and their contributions to an on-line forum.

Students accessing the forum may acquire information on the course, announcements, exams, etc. or exchange views on learning activities either for each one of the students or for collaborative work (Image 3).

Collaborative experiences may be very well supported by the learning tool. The majority of studies conducted have shown that collaborative learning is efficient. However, this occurs under specific conditions, that usually have to do with:

The group composition

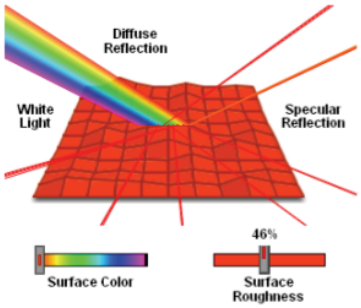
The task features

The communication media.

Small groups seem to function better than lager ones. Another important variable that has intensively studied is heterogeneity. Internet-based information and communication tools have an enormous potential with respect to heterogeneity: no infrastructure can better cross geographic, cultural and professional boundaries. Task features involve the environment in which the task has to be performed. In the case of computer-based tasks, software features may modify – and preferably improve - interactions among learners. Whatever task and group members have been selected, the collaboration may not work because the medium used for communication is not adequate. The fact that new

technologies offer possibilities such as: e-mail. Forum, chat, blogs, that facilitate team work to a great extent is considered to be of great importance.

ανακλαστήρες. Στην περιοχή των μικροκυμάτων, εντούτοις, κάποιοι γήϊνοι στόχοι είναι κατοπτρικοί ανακλαστήρες (Mather, 1997).



Σχήμα ...: Κατοπτρική (specular) και διάχυτη (diffuse) ανάκλαση της ακτινοβολίας .

Αλλάζοντας την τραχύτητα και το χρώμα της επιφάνειας, διαφοροποιείται η ανάκλαση. Αυτό μπορεί να διαπιστωθεί εποπτικά με τη χρήση εφαρμογής java στην ηλεκτρονική διεύθυνση που ακολουθεί.

http://www.mic-d.com/java/specular/

Image 2. The learning material contains links to animations and quizzes that facilitate the learning process.

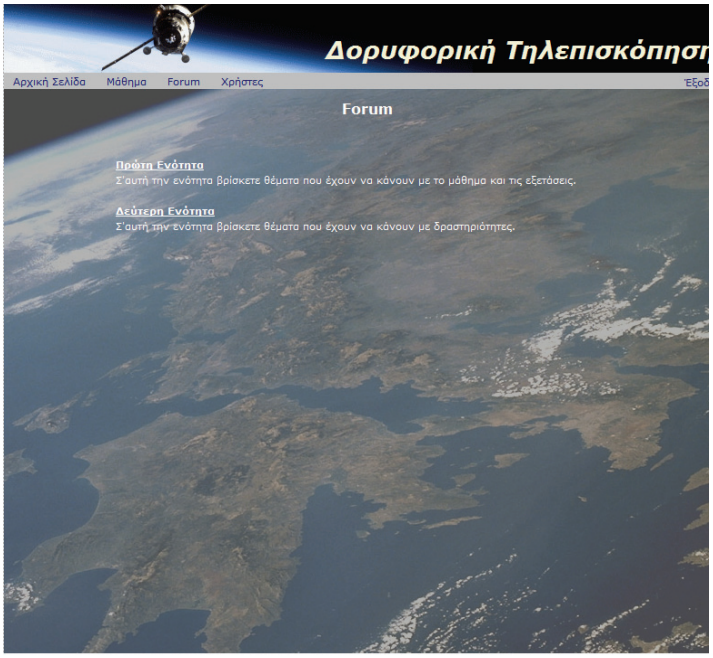


Image 3. The forum visitations may provide useful data to be correlated with students' performance.

Students participating in the formative evaluation process valued quite highly many of the interface elements offered by the platform with respect to their potential to support collaborative practices.

Using an electronic tool definitely has implications not only for the way students learn but also for the way that instructors assist students to learn. That is such an e-Learning approach requires students and teachers to be partners in innovation. Students' scores for the tutor's use of the learning platform were very high and reflected the effort of the study to create a friendly to use learning tool that may be quite efficient with the proper implementation in a classroom to achieve the goals set for the learners

The formative evaluation process

A single model for evaluating e-Learning is quite hard to define since learning technology still is a fairly new field. In this study a self-evaluation of the platform is took place before proceeding to the evaluation that was performed by the students.

A. Self-evaluation

During the first phase, a series of features that characterize the learning platform were considered in order to test the function and potential usability of the learning platform, both from its technological and pedagogical aspect.

The evaluation framework that was used was a combination of elements from an evaluation method proposed by Colace et al. (2003, 2006). This model has been used to make comparative evaluations of a sample of existing learning platforms.

A series of indices describing functional elements of the platform were examined in order to test the platform's potential to satisfy students' training needs. All indices' value is calculated by dividing the obtained value for the supported tools, by the maximum value. So, the maximum value for each indicator is 1. Weights are assigner to the supported tools that indicate the relative importance of each of the platform's examined features.

The indices were:

1.Management Index

This index determines the number of services for the management of students and their progress that are available in the learning platform (ex. Progress tracking, contents management, reports, assessment, on-line registration etc.).

2. Collaborative index

This index aims to determine how many collaborative services are available in the platform (ex. E-mail, forum, chat, video, etc.).

3. Management and enjoyment of interactive learning objects

The title fully describes the aim of the index. It determines the platform's availability of functions such as: videos, contents download, application sharing, virtual classroom, etc.

4. The adaptation of users' formative learning path.

This index aims to evaluate how many services offered by the platform allow the creation of personalized learning paths and the continuous assessment of students (ex. progress tracking, reports, assessment, multiple question test, etc.).

The scores obtained by the Remote Sensing platform for each index are presented in Table 1.

	Remote Sensing Platform	Other commercial platforms
Management Index	0.875	1, 0.917,0.750,0.875
Collaborative index	0.68	1, 0.5, 1,0.47
Management and enjoyment of interactive learning objects	0.44	1, 0.22, 1, 0.22
The adaptation of users' formative learning path	1	0.818, 0.818, 1, 0.818

Table 1. Scores for the self-evaluation process

The scores obtained show that the learning tool proposed may be considered quite satisfactory since it provides possibilities for an effective and successful on-line training in the field of remote sensing.

B. Students' evaluation

The next stage of the formative evaluation involved a group of students from the Physics Department that attended an approximately twenty-hour course in order to get acquainted with the learning material.

Students were first asked to complete a detailed questionnaire concerning heir experience in the use of new technologies in their studies. During the course, students were asked to complete several questionnaires concerning:

The technical characteristics of the platform.

The content and quality of the learning material.

The correlation of functions offered by the platform (forum, e-mail, easy navigation, extra resources, links, etc) with elements that have to do with interaction processes and attitudes developed by the students (participation, trust, cohesion, conflict, etc.) based on the model proposed by Chang et al. (2006).

The students' attitudes towards the practices of collaborative learning.

The performance of the instructor in the specific learning environment.

The maximum value for each index is 1, as in the previous evaluation and the scores obtained by the learning platform are presented in Table 2.

Technical characteristics	0.68
Learning material	0.82
Interface functions that promote interaction processes and attitudes	0.70
Collaborative learning	0.80
Performance of instructor	0.92

Table 2. Scores for the students' evaluation

The evaluation process gave interesting material for processing which will be processed in order to reveal aspects of the platform's performance which may not be obvious or absolutely clear in this first phase of the indices estimation.

Discussion-Findings

The Remote Sensing platform's scores demonstrate that its overall design, structure and use indicate its potential as a good learning tool for the distribution of knowledge in a computer-assisted manner.

It is worth stating that the highest scores were obtained for :

Adaptation of users' formative learning path (1) and

Instructor's performance (0.92),

while the lowest one was for the 'Management and enjoyment of interactive learning objects' (0.44).

The results reflect to a great extent the priorities that were set when designing and developing the electronic learning tool. The work was not technology driven and did not focus on creating an impressive –from its technical aspect- electronic platform. A main concern was to create a learner-centered environment that would provide students with the possibility to create personalized learning paths suitable for their various learning styles and needs. Moreover, since the blended learning approach was chosen, it was important to ensure that the instructor would successfully act as a facilitator who uses the media effectively and helps students frame their experiences, guiding them with mastery and removing obstacles of any kind.

Technical improvements of the platform are already being considered, while inclusion of learning material covering more thematic areas is already being worked on. The learning

tool's actual integration in the curriculum for one period of the specific course will allow the collection of more feedback from students and experts in order to verify its 'real-time' performance and allow for all changes necessary to support the technological and pedagogical approaches chosen for the promotion of learning in the area of Remote Sensing.

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