ASSISTING ENGINEERING EDUCATORS FROM DEVELOPING COUNTRIES WITH THE DESIGN AND IMPLEMENTATION OF ONLINE LEARNING.

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ABSTRACT

In this paper the authors report on a course that was given in Cuba in 2010. The funding for the course came from the European Union, within the ALFA III program. The project was called US0+I; Universidad, Sociedad e Innovación and its aim was to facilitate the exchange of educational methodology and pedagogy between the partner countries that made up the US0+I consortium. Within this project the University of Borås was assigned the task of giving the above mentioned course about the use of Learning Management Systems (LMS) in Higher Education. This paper describes the design and implementation of the course, with emphasis on how it was adapted to meet the needs of lecturers in a developing country. It also analyzes the results of research data that was collected during the duration of the course. The main aim of the research was to more clearly define key questions and issues in the area of cross cultural use of Information Communication Technology (ICT) as part of a larger action research project concerning ICT and cross cultural equity. The basic question that drives this research project is: What technical, social, economic and cultural differences affect the implementation of LMS in developed as compared to developing countries?

Key words: information and communication technology, e-learning, Learning Management systems, engineering education, developing countries

INTRODUCTION

In this paper the authors present the results of preliminary action research undertaken while carrying out part of the project *Universidad, Sociedad e Innovación. Mejora de la pertinencia de la educación en las ingenierías de Latinoamérica*

(University and Society: Improving the relevance of engineering education in Latin America) or US0+I. The project is financed by the European Union, within the ALFA III program. During the second year (2010) the project partners run courses for each other to ensure that there is a transfer of educational ideas, practices and technologies between countries.

The University of Borås was asked to give a course about the use of learning management systems (LMS) in higher education. The LMS was also used for virtual communication among the associates of the network to support the actions of curriculum development. While conducting the course about LMS the authors also took the opportunity to investigate the participants´ attitudes to the use of LMS and open educational resources and refine issues and questions connected with action research into cross cultural factors in the educational use of ICTs. The focus on teacher attitudes is important because the literature indicates that they can be a critical factor when institutions make use of ICTs to change their teaching and learning practice [1, 2]. Positive teacher attitudes are crucial to the success of educational reforms that include the more efficient use of ICT in university teaching.

Information and Communication Technologies (ICTs) have been used as an essential tool in the course. For the most part they are presented and used within the context of a learning management system (LMS). They are used by the facilitator himself (the first author) in demonstrations but they are also used by particiapants. The course is designed in such a way that the participants not only experience the use of an LMS but also get the chance to adapt their own coursework by making use of an LMS and the various ICT tools that it contains.

The idea is not only that they learn how to use the tools from a technical point of view but also update and enhance their pedagogical skills. ICTs are, after all, tools that can be used skillfully or unskillfully. In the course the teaching staff got to update their current knowledge about LMS and learn new ways of using the ICTs contained in them so that they helped rather than hindered learning. Another important aspect of the course design was that it focused of student centred learning. This planning of the course was founded on a constructivst philosophy. Since that philosophy argues that individuals construct thier own individual knowledge, skills and attitudes we used methods that were in tune with that theory and encouraged participants to make use of the same philosophy when adapting their own courses.

ICT IN EDUCATION IN DEVELOPING COUNTRIES

The report 'Technology in Schools: Education, ICT and the Knowledge Society' [3] sums up the major reasons for increasing use of ICT in education. Firstly, since ICT increasingly pervades every aspect of life, new generations need to become competent in their use. Secondly, schools can use ICT for productivity enhancement. Thirdly, ICT can help create more effective learning environments and improve life-long learning skills and habits in students. In regard to the third point the report admits that 'so far ICT have not provided any large-scale breakthrough in learning improvements' but there is still a lot of promise and tremendous potential to do so [3]. Educational institutions in most developing countries have to simultaneously meet the

challenge of a growing population and the necessity of raising the general level of education.

It is a common hope that increasing demands for higher education in developing countries can be met by extensive use of ICT, in particular by the use of distance learning [4-7]. Such a hope is underpinned by a number of assumptions, not all of which are valid. This paper for example focuses on a particular Latin American country, namely Cuba, where educational standards for the entire population are remarkably high but the use of ICT that is connected to the internet is low by western standards. This is true for both schools and society. For a number of complicated reasons, Cuba has lagged behind other Latin American countries in terms of fast and easy internet access for all. There is not space in this article to delve too deeply into this topic but it is important to keep it in mind when speaking generally about developing countries, particularly those in Latin America.

E-LEARNING

E-learning refers to teaching and learning processes that make use of ICTs. The use of ICTs in education extends from the supplemental use of technology in the classroom, through blended or hybrid uses comprising a mix of face-to-face and fully online instruction, to fully online synchronous and asynchronous distance learning environments delivered to remote learners.[8] There are a number of teachers and researchers, the authors included, who prefer the term e-learning to distance learning, since e-learning can provide an immediacy that is sometimes lacking in face to face lecturing. Many young people today do not experience any distance when chatting with friends in different parts of the world.

LMS

Learning management systems (LMS) are computer programs that integrate functions for teaching, evaluation and administration of courses. Other terms that are sometimes used include Virtual learning environment or VLE [8, 9] and the broader term Information and communication technologies or ICT [8, 10]. Both the terms VLE and ICT are broad enough to include LMS as a component. These days most LMS, whether they are commercially available or free, have major features in common, for example, the capacity to share documents, create tests, manage statistics and enable both syunchronous and asynchronous discussion [11].

OPEN EDUCATIONAL RESOURCES (OER)

The definition of the term Open Educational Resources (OERs) is not unambiguous [12]but there seems to be a consensus that 'open' in this context includes free online access and unrestricted distribution and re-use [13]. Educational Resources refers to course material, usually media files containing text, sound or audiovisual content or computer software used in learning or learning management[14]. Today, an abundance of OERs for higher education can be found on the world wide web. A number of institutions as well as individual teachers have made course material and software for education freely available on the internet[15]. Developing countries have

a particular interest in utilizing free material from the internet to improve the quality of higher education and give more people the opportunity to receive a higher education while keeping the total cost for education down[4, 16].

COURSE AIMS

The course which we trialled and used as a source of data for this research report included the following learning outcomes. By the end of the course that participants should be able to:

- Explain what the abbreviations ICT, VLE, OER and LMS stand for and provide a definition and example of each of the terms.
- Give examples of how ICTs can be used in higher education and explain how access to ICTs will affect both the pedagogy and the didactics of the subject they teach
- Use and adapt the common tools in an LMS to design and implement virtual education/courses.
- Complete exercises and carry out a project intended to give practical experience in the handling of an LMS.

SPECIAL CONSIDERATIONS

To give a course about the educational uses of information and communication technology (ICT) in the third world one has to consider a number of special circumstances and cope with the following issues:

1) The speed and reliability of the Internet in the third world is not what teachers in developed countries are used to and many teachers do not have internet at home.

2) Many teachers in developing countries have little or no experience in using the Internet and information technologies in their practice.

3) The price on course material and software must be kept down.

It follows that during the course one cannot rely on undisturbed internet access. The participants may have to take turns on the available computers and the computer literacy might be low. The cost of materials are important during the course, but even more important is the long-term cost for any material or software that is necessary for teachers to apply their new skills and implement the use of ICT in their teaching.

COURSE DESIGN

Most of the special considerations mentioned above are problems that the participants could be expected to encounter in their own work as teachers. It was therefore desirable that the design of this course be used as an example for the participants as well as a means to reach the specific aim of the USO+I project. It was also desirable to design a course that was sustainable, easy to distribute and

structured so that other teachers, in the future, would be able to follow the course without the help of an instructor. The solution was to create a course in which all the material was made available via USB memory sticks. The course material consisted of instructive videos and texts from the internet and some texts written for this occasion.

To keep the material costs down as much as possible and avoid problems with copyright only material that was free to use in education and free to redistribute could be used. There are a number of free open source LMS one can use and most the same tools as the systems that are for sale[17]. The course was given using the open source LMS Moodle (XXX) as an example and Moodle was also used to manage the course, distribute material and so on.

If, as in this case, high-speed internet access is not available at all times and the material has to be downloaded and redistributed, it should be noted that most of the free-to-use resources on the internet are still under the originators copyright and their use may be restricted. For example, when a film is uploaded on YouTube ™ the originator gives permission for it to be viewed on the internet, but not necessarily to be redistributed, used to produce derivative works or used commercially. For most videos used in this course it was deemed appropriate to approach the copyright holders for permission. No one had any objections to their material being copied for use in the context of this course.

Since the course was intended to give the participants skills and experience in handling an LMS it was natural to use Problem Based Learning as the principal teaching and learning method[18]. The main assignment was for each participant to select a course from their practice and adapt the existing course material to be used with an LMS. It was also possible for them to add some new material and to make plans for the appropriate use of tools such as discussion boards or grade books during the course in question. During the workshops emphasis was placed on cooperation and the sharing of ideas in solving the given tasks. The intention was to establish informal groups that could continue working together online or face to face during the distance learning part of the course.

COURSE MATERIAL

Some text material about Moodle, which is freely available on the internet, was used as well as a number of video-clips that are also available on the internet. These were downloaded on to the USBs. In addition and some documents were especially written for this course. These included learning outcomes, exercises and assignments, a time plan and contact information.

SOFTWARE

The following programs were also included on the USB-sticks: Moodle, Sumatra PDF, VLC media player, LyX, HotPotatoes 6, AbiWord, MoWeS, Portable II, OpenOffice. All of these programs are freeware or free to use under the GNU Public

License protocol. No operating system was needed, otherwise it would have been easy to include a free operating system. For example Linux Mint should meet all needs and would only have occupied approximately 700 MB of memory capacity. It may also be stored on a CD to avoid problems with the use of a USB-stick in some older operating systems.

IMPLEMENTATION OF THE COURSE

The course was given in two parts, the first part with the participants gathered on campus for a two weeks period and the second part to be delivered via distance learning over a three month time span. For the group in Cuba the course started in March 2010 and was facilitated by the first author of this paper. The participants were lecturers at the Instituto Superior Politécnico José Antonio Echeverría, Facultad de Ingeniería Eléctrica, Havana, Cuba. The course took place at the Institute. Each participant was given a 4GB USB-stick with the course material and the software mentioned above. As mentioned above the LMS Moodle itself was installed and executed from the USB memory sticks and not distributed over a network. The most obvious advantage is that lecturers who do not have their own computer with internet access will still be able to work with the LMS as common computers become available. Once a teacher has made changes to a course, he or she can save it to the memory stick and upload the modifications the next time they have access to the web. It is also an advantage that the lecturers get to practice the alternating use of online and offline mode, an important skill when handling courses of their own, since their students cannot be expected to have the free internet access we take for granted in developed countries.

IMPLEMENTATION OF THE ACTION RESEARCH PROJECT

During the course the participants' opinions and suggestions about the course were collected to provide the basis for future development of the course and generate data for our action research project. The students were also asked about their attitudes to LMS and their use in teaching and learning. We felt that such information could be important in any future implementation of an LMS in their educational institutions. At the end of the two weeks introduction course the students anonymously gave their opinions about the course and the lecturer's performance. The results were compiled to form part of the course evaluation report. Additional information was gathered in a series of informal interviews and focus group discussions. Some of the questions concerned the participants' teaching situation and their access and use of ICTs and the internet.

There were fifteen participants and all were willing to fill out the anonymous questionnaire. The questionnaire consisted of ten statements and three open ended questions. The statements were assessed on a five grade scale: 1= I fully agree, 2= Agree, 3= Neutral, 4= Disagree, 5= I do not agree at all. Question 4 asked if the students felt confident to make use of an LMS in the delivery of their courses. Given that the course was only two weeks under way their response is understandable. Only about half the students felt that they could confidently utilize an LMS at the time.

The question was important since it indicated that the participants really thought about their answers rather than simply filling in the form thoughtlessly. The questions and their responses are given in the table below.

Table 1: Responses to the ten statements in the questionnaire.

Nr	Statement	1	2	3	4	5
1	The course objectives, contents and procedures were made clear	15				
2	I understand what a LMS is	15				
3	I understand the common features of a LMS	14	1			
4	I feel prepared to use a LMS in my work	8	7			
5	The course fulfilled my expectations	15				
6	Videos and other materials were well suited to the course objectives	15				
7	The practical task were well suited to the course objectives	14	2			
8	There was a high level of cooperation and interaction amongst the participants	14	2			
9	The course objectives agree with the material covered in class	15				
10	In general, the lecturer is an effective teacher	15				

The first open ended question asked the participants how they thought the teaching methods used in this course could be improved. All the participants said that they were satisfied with the methods used although some pointed out that it would have been good to have access to an online discussion forum for the group. The second question was: How do you think the contents of the course should be changed? The participants said that they found the material to be very useful and sufficient for their needs. It was suggested that some more videos showing how lecturers have used LMS before might have been interesting. The third open ended question invited the participants to state anything that they would like to bring to the lecturers attention? All the participants agreed that they had learned a lot and appeared prepared to make use of the knowledge and skills they had gained in their work. It was pointed out that the use of a portable application was essential to cope with the limited internet access. The above results from the course evaluation are also presented in the article 'Training teachers in E-learning without internet access' (Garrote *et al.*) pending publication at the conference EDULEARN 2010.

The participants also answered another questionnaire about their intentions to use different parts of an LMS in the future and their opinion of freeware and the use of an LMS system. Their answers are consistent with the responses to statement 2 and 3 above.

Table 2: Attitudes about the use of LMS and OER.

Statement	1	2	3	4	5
I think the use of free course material on the internet offers great opportunities to increase the quality of higher education.	13	2			

I am willing to make a lot of my course material available as freeware on the internet.	13	2			
A LMS can facilitate the work of the lecturers to a large extent.	12	3			
A LMS can increase the performance of the students at my institution.	9	6			

Even if we take into account a 'politeness effect' given that the lecturer had travelled especially to Cuba to run the course it is fair enough to conclude that the course was a success.

RESULTS

The main result in terms of our action research project was that the above course allowed the researchers to gather data and to refine some key questions for the next research cycle. As this paper is being written the first author is running the same course, mentioned above, in Guatemala. This will enable us to collect additional data in the second cycle. The first cycle focused on the following questions:

- To what extent do teachers use the ICT tools that are available in most LMS?
- What things help or hinder the pedagogical use of LMS in engineering education?

In the first cycle the researchers surveyed a group of engineering educators in a Swedish university. The results were presented in 2009 in the *European Journal of Engineering Education* [19]. Funding from the USo+I project has enabled us to combine the delivery of the course described above with data collection. This has enabled us to propose and refine a new set of research questions which we are in the process of investigating. The questions include the following:

- What assumptions underpin the use of LMS in engineering education?
- What technical, social, economic and cultural differences affect the implementation of LMS in developed as compared to developing countries?

In this paper we have described the strategies that were used to overcome the lack of computers and fast internet access in Cuba. It became obvious to us that fast internet access cannot be taken for granted when seeking to implement the use of LMS in developing countries. Unfortunately it is too often assumed that the world wide web, as its name suggests, is a world wide phenomenon. In fact many developing countries, or large populations in such countries, cannot access the world wide web for a complicated set of reasons. Our next research cycle will investigate those reasons. It is also true that large populations in developed countries do not access the world wide web but this is not usually because of insufficient infrastructure. Data collected from both the first and second cycles will be used to answer the research questions mentioned above and to develop strategies and practical solutions to the problems that can arise in the pedagogical use of LMS in Engineering Education.

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