

# C&D-Learning: Adapting eLearning to Developing Countries

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## **Introduction**

Modern research in cooperation for development is led toward innovative solutions for (institutions and people's) problems at developing countries. Traditional technical problems at educational institutions in these countries have been identified. There are many proposals for using e-learning tools at developing countries, but in general they are only affordable for the most advanced universities in the Third World. A crucial goal of cooperation is to improve education at developing countries. Research on learning, and specifically on e-learning, is one of the most productive research fields at occidental universities. Nevertheless, advances in these areas are made regarding educational needs of developed countries, where the situation is quite different from developing countries. Those differences are not only technical, but also at the human and communication level.

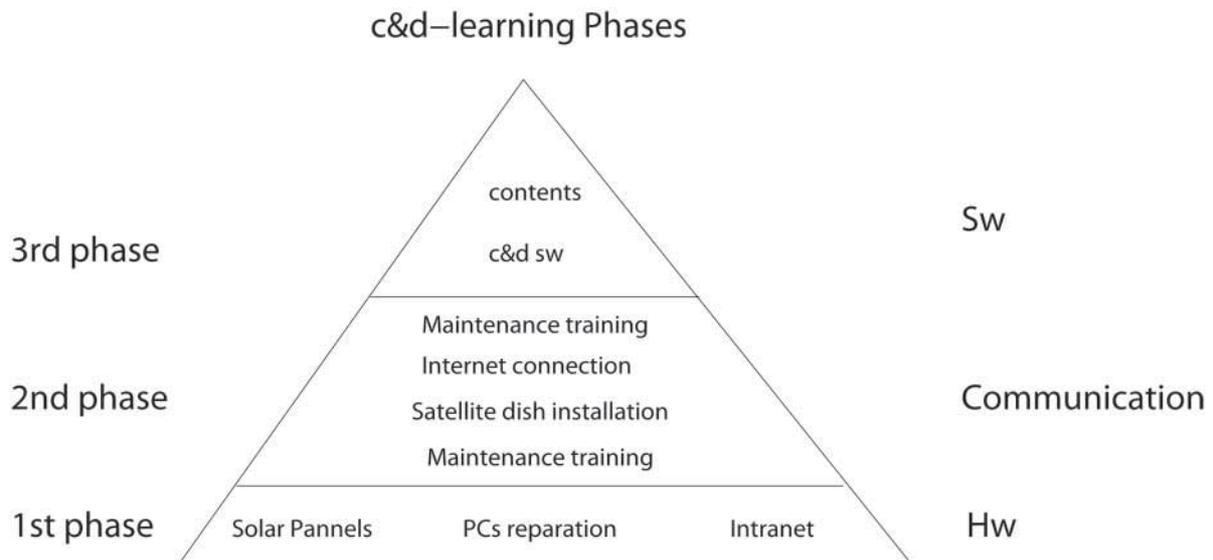
The cooperation group TEDECO (Technology for the Development and the Cooperation, <http://tedeco.fi.upm.es>) has been studying the necessities of a group of universities of Central Africa (Ngozi, Mwaro and Bujumbura universities at Burundi; and Bukavu University, Peace University, High Pedagogy Institute at Congo Democratic Republic). Some common problems have been identified: damaged wires, irregular electric supply, outdated hardware, lack of internet connection, lack of specific software, lack of technical faculty staff and, of course, economic problems. In addition, the situation is completely different to occidental universities. In conventional e-learning the professor is working full time at the university and the students have Internet connection at their houses. They study in an asynchronous timetable using e-learning platforms. At our target universities the situation is completely the opposite. The students have not computers at home, they are at the university together with Internet. The students can study following a fix timetable at the university but the professor is not there. In most cases, professors cannot be connected at the same time that students, since it is partial-time job for them.

Attending to these differences it is quite obvious that conventional e-learning cannot be applied to our target universities. An adaptation of hardware and communication conditions is needed for using e-learning applications in a different way. Contents should be adapted thinking about the specific context of the classes. Our work aims to cover the majority of these tasks. We propose the concept of c&d-learning (e-learning adapted to the cooperation for the development) and we describe the c&d-learning implementation architecture based on three main phases: hardware, communication and software; e.g. computer and technical equipping, internet accessing and e-learning platform adaptation. Proper adaptation of educational contents to c&d-learning is discussed and a real case of application in which the authors are involved is described: the Ngozi University at Burundi were TEDECO has been working during the last three years thanks to Technical University of Madrid funding for TESSON (Technology for Sustainability of the university of Ngozi, 2006) and TICAMEN (Communication and information technologies applied to education, 2008) projects.

## **c&d-learning Implementation Architecture**

We propose a three-phase architecture that should be implemented starting by the bottom one. We explain details about each phase in the rest of this section. The figure provides a detailed representation of the implementation architecture. TEDECO group has already finished the

implementation of the first and second phase at the University of Ngozi during the execution of the TESON project. Nowadays the third phase is progressing thanks to funding through the TICAMEN project.



*Detailed c&d-learning Implementation Phases.*

### **Hardware Phase**

Due to technical problems that target universities use to suffer, the implementation of the c&d-learning it is extremely important to ensure that the hardware infrastructure would work properly. This process has been divided into three sub-phases listed below: electric current stabilization, installation of several computer classrooms for e-learning teaching (we have used thin client technology [2],[3]), and installation of a local network (intranet) to connect computers within the university.

The hardware phase was finished with adaptation of technical equipment and training of human resources. These resources were needed for a local network that should be built and maintained by qualified local staff.

### **Communication Phase**

Developing countries generally do not have a large deployment of conventional infrastructures for telecommunications, traditionally implemented by telephone networks. Non-standard connection technologies must be used to overcome connection problem in these countries. For this project with the University of Ngozi we have installed and tested a satellite connection.

*Satellite Connection.* The use of satellite communication implies some limitations that are important not only from a technical point of view, but also from an academic perspective regarding educational content preparation. The most important characteristic of a satellite connection is the asynchronous communication, i.e. the information is sent and received through independent channels (downstream and upstream).

*Connection Sustainability.* We included training for the local team to maintain PCs and intranet infrastructures. At this point a similar training process is necessary for the communication infrastructure.

In the University of Ngozi case we propose the installation of a cyber within the campus to collect the satellite connection fee. A viability plan was prepared at the beginning of the implementation of the project to guarantee its sustainability.

## **Software Phase**

Although some software applications have been already developed in two previous phases, a third and final phase is being carried out which works exclusively adapting and developing a learning platform.

*Learning Platform.* With several open and available learning platform, each day it is more difficult to justify the development of this software from scratch. Free solutions such as Moodle, <http://moodle.org/>, are suitable for multiple operating systems and are backed by a large community---i.e. Forums, documentation, updates, etc. Consequently, these solutions can be adapted to every user requirements.

In our case we are currently working to adapt Moodle to developing countries requirements, optimizing an asynchronous education model with three new features: an automatic content synchronization avoiding the use of the Internet connection in periods with high demand of bandwidth (working hours); an enhanced *off-line courses* management system, and a new role, the local professor as a content facilitator to local students.

After studying the different possibilities for education (conference, teleconference, videoconference and off-line courses) taking into account thin client limitations we find the Off-line courses are a good alternative. When there is no guarantee in sending audio or video, it is strongly recommended the use of an alternative, such as the off-line exposure of a subject. This option is specially interesting in those partnerships where there is a significant time difference.

## **Content Presentation**

Educational content adaptation should meet actual technological limitations. A solution based on thin client technology has some remarkable limitations inherent to its structure, mainly focused on network usage. This should be also taken into account when different options for e-learning are considered.

The difference is quite significant suggesting that video, and multimedia content in general, should not be included within the information transmitted to every student. Since we have assembled computer classrooms with low-performance equipment, and the internal network does not allow the transport of a high bandwidth, there are some limitations that suggest some rules to create educational content, such as: remove multimedia contents (video, animations, etc.) to avoid permanent updates consuming the bandwidth, and slide resolution reduction, i.e. less content by slide and more slides.

In summary, any bandwidth reduction is an improvement in these situations. Specially those related with unnecessary visual effects.

## **Conclusions**

During many years the survival of universities with our means at the south depends on the charity of foreign professors that travel to these countries to teach. Depending on help received it may be an unsustainable solution, so it is not acceptable.

A number of universities at developing countries are in a difficult situation for economic problems. E-learning could be widely used at these universities to overcome some economic issues. Nevertheless, the minority of centers that use e-learning in south countries are the most advanced ones. It is a paradox, but classical e-learning is not adapted to these countries due to specific needs and technical characteristics. E-learning is oriented to facilitate things to occidental students with technological possibilities but it is not oriented to help students without means.

We have proposed [1] a variant of e-learning adapted to developing countries limitations, and we provide an architecture to implement the so-called c&d-learning. It is a complete proposal that

cover from hardware details to software adaptation issues or communication infrastructures. The most important characteristic of these implementation should be always the sustainability.

### **References**

1. Escudero, F., Muñoz, S., Pérez-Rey, D., and Suárez, F. (2008). c&d-learning: b-learning eficiente adaptado a países en desarrollo con bajos recursos. In IV Congreso Universidad y Cooperación al Desarrollo. Fundación Cisneros (2008).
2. Martínez, J. and Pérez, I. (2008). Lan core: Thin client server, operating system and management application. <http://lancore.sourceforge.net/>.
3. Martínez, J., Pérez, I., Muñoz, S., and Lancho, D. (2008). Thin clients in the academic environment. In IV Congreso Universidad y Cooperación al Desarrollo. MIT (2008).