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# Sustainable Cooperative Distance Learning System for Education in Developing Countries

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**Abstract:** The use of Information and Communication Technologies (ICTs) in a cooperative way can give a good improvement in the educational field; in developing countries, especially in Sub-Saharan area. Sustainable technologies and collaborative LMS are investigated in a case study as possible ways to improve, towards distance learning systems, education and towards it, social empowerment and development. A web-based system, customized for an academic year proposal in medicine and surgery field, helps the development of cooperation among universities and research empowerment and exchange, useful for both entities and their stakeholders. Different uses and approaches to the technological solution allow different participants to model and interact with the project despite difficulties and environmental gabs that could occur in some territories of the Sub-Saharan countries.

**Keywords:** Sustainable technologies, LMS, cooperative learning.

## 1. Introduction

Information and Communication Technologies (ICTs) developments have influenced all sectors of human life, and the educational sector is not excluded from this process. In fact, distance learning technologies have been changing a lot in the last years and with them application and educational offer that schools and universities can give to their students and users. The adoption of distance learning has been encouraged and suggested to the institution thanks to pedagogical and socio-economic factors changes.

Through cooperation and collaboration among institutions and spread of possibilities of learning and study, progress especially in developing countries could have a good development and support. On the other end, cost-effectiveness and pedagogical improvement through the possibility of downloading all the materials and to use them also in off-line context, gives a new appeal and new possibilities to reach a larger and geographically different number of students. Both trainers and learners can follow different applications, which are flexible in time, in place, personalized, renewable, and can also participate to a cooperative maintenance of the ICT tools according to the different needs of the users [1].

The objective of the cooperation in the educational sectors is to train local staff and support the services of the countries and institution involved, to promote development and improve access, quality and accessibility of education and professionalism provided.

 

Through scientific research, it will also be possible to share remotely in a collaborative and participatory way, the different specific skills, effectively constituting a single cultural platform capable of feeding a virtuous cycle of mutual enrichment.

This paper discusses the application of ICTs in teaching and learning starting from a concrete experience had towards African countries, starting from a distance-learning project held by University of Genova.[2]

The basic idea has been a cooperative web based system tailored on a free Learning Management System frame, LMS, with different levels of interaction and different access by students and teachers. It is completely free and adaptable to different types of infrastructures and internet connections and allows to transfer knowledge and specifically medical information between two universities and to empower cooperation and research in high educational and healthcare field through an open source platform.

Among the developing countries, Sub-Saharan Africa,[1] in particular, has the greatest concentration of criticality in terms of poverty, disease and low levels of education and professional education, given mostly by lack of social security as well as a presence of low level politics actions and policies [3].

One of the challenges that could be addressed, in order to prevent such a kind of lack in many fields of social life, is the improvement of ICT based solution.

In such particular contexts like developing countries are, the consideration of infrastructures and technologies to be chosen is fundamental. [4]

For this reason, sustainability meant as "the feature of a process that can be maintained at a certain level indefinitely "[5]

Characteristics for a sustainable technological system:

- Local training;
- Ease of use;
- Ease of maintenance;
- Local availability of technology and updates;

In the following paragraphs of this work, a deeper analysis of the contexts, requirements and approaches to the issue will be investigated

## 2. Objectives

In order to improve the quality of education and increase the pool of people who can benefit of this, priority solution should be given to "brain drain" phaenomenon [1]; according to this due to lack of adequate training, people decide to study in other countries mostly in Europe. After they graduation, they often refuse to return to the land of origin due to an absence of solid social guarantees and the prospect of a salary inadequate to their preparation.

For this reason, cooperation among universities and the creation of a community of high educated people that helps with a less expensive system to give a good quality of education, is vital to provide these countries with responsible and complete leadership on their future.

The importance of collaboration within distance learning approaches has been highlighted already by Preece (2000)[6]; Salmon (2002)[7]; Hamburg, Lindecke, and ten Thij (2003)[8]; and Thurmond and Wambach (2004) [9] and as a result online forums and discussion boards Have grown their importance and their contribution in societal and policy development.

LMS allow students to communicate with their peers and tutors thus empowering them to socialise and learn together also through remote technological systems that allow them to participate on their own education.

For the case under study, the important objectives were, to address the principal needs of University of Ebolowa in Cameroun and to help University of Genova Students in taking care of an open source platform, able to help free flow of knowledge.

First aim of the project was addressing a complex technological and technical situation; the main goal was to give the possibility to students belonging to a smaller study centre in Cameroun continuing their studies without transferring in different cities or in different countries.

## 3. Methodology

The partnership with an University in Cameroon is born thanks also to the fact that University of Genova is third- ranked University chosen in Italy by number foreign students ( 6.2% ) ; Cameroon is among the first African countries to have introduced the teaching of the Italian language, in 1995. In addition, it is almost the only African country from where for over 10 years, each year, average of 400 students come to Italy. According to data of the Italian Ministry of Education, Cameroon is the second country, after Albania, with the largest number of foreign students in Italy. In addition, many Italian universities have signed with universities Cameroonian cooperation agreements in various fields, among them the University of Genova.

According to the preliminary and basic studies that in a cooperation system it is necessary to exploit, a former introductive analysis on telecom infrastructures was made; through a dialogue with technical staff in Edward Cozen University (Ebolowa) such a study has been conducted in order to find the best solution of contact and management of technological resources and to cover all the characteristics for a sustainable approach to the technological issue.

### *3.1 Distance learning technologies' Description: Moodle*

According to the cooperative and sustainable approach to education, the software that encountered the specific tasks of the users involved in the project has been identified in Moodle (Modular Object - Oriented Dynamic Learning Environment) accessible via the internet . This solution allows to have all the essential tools suited to the transfer of educational materials and to the interaction between teachers and students [6]. This approach brings to a collaborative maintenance of the software and of the platform itself and it has the advantage of being open source, modular, and configurable according to specific needs and enriched with new features. A large community that gives information for maintenance and possible evolutions to the educational process of students and users and the participation itself, is a way to stimulate people to care about their own education.

Moodle is an environment for the management of courses, based on the ideology according to which each constructionist learning would be facilitated by the production of tangible objects [6] [17] [18].

Its software is written in PHP and JavaScript; It is open source and modular, thus allowing any user group to develop additional features customized.

The constructionist ideology behind Moodle, from which was born the US "No Child Left Behind Act of 2011" [19] is highlighted by various aspects of development, such as the ability to insert and comment data tables or wiki students, or to deliver tasks over the Internet. It offers a range of modules that enable tutors to create online courses and it tries to empower and address the need for pedagogical support, promoting the definition of constructionist learning, where a student learns from his or her own experiences, giving shape to student-centred learning environment.

Although E learning synchronous systems are preferred, in case of lack of connection or electricity distribution like in this case study, the asynchronous use and distance learning methods are more reliable and convenient. [20] [4]

Moodle still leaves the teacher the possibility to manage its own course, directing it to the achievement of results and to manage it in a remote way.

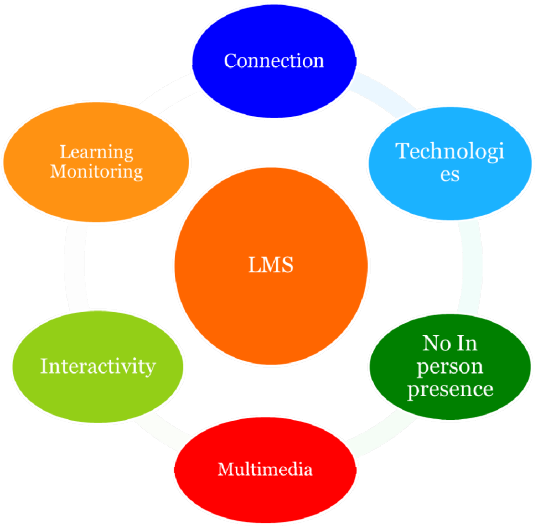


*Figure 1: LMS Elements*

What Moodle empowers from the pedagogic point of view is especially mentioned as follows:

- Provision of lectures in the classroom adaptable to different circumstances of access to the Internet.
- Teaching materials (PPT and PDF) and video accessible at any time and downloadable
- Availability of additional teaching materials and / or suggestions of deepening: References to articles, distribution articles supporting the lectures, references.
- Forum / chat for interaction with teachers and ask for clarification.
- Archive structured and indexed upgradeable, to search for topics.
- Access management and administrators privileges students' teachers.
- Exams' management: the tutor/teacher local learns how to examine, have carried out the examination to students and corrects.
- Video conference when necessary.

### *3.2 An Applicative Case Study: Kite Project*

The case study refers to a platform conceived especially in a high educational medical contest.

In order to ensure a continuous high level educational support a dedicated platform has been created and updated, on an ongoing basis h24, structured so as to provide a scientific archive (selection of the major scientific journals) and the ability to have access to educational material (video, slides, audio, etc.). It also provides the sharing of content and case studies, with the possibility of questions / answers between teachers and students in the two locations.

The service delivery to students is coordinated by resident tutors who curate audio-visual reproduction of teaching materials, according to the course syllabus.

There are also activities of hospital clinic based on the analysis of real clinical cases selected by the tutors and aimed at combining theoretical knowledge to the practical aspect

of the problem. Each activity is followed a moment of plenary discussion, useful to compare different experiences and standardize the management of the cases.

Specifically, the establishment of a platform with different types of access (area public and private) and with a range of services aimed to students and educators involved in the project is provided.

More specifically, the platform includes administrative services and the secretariat for the educational activities of the project, services, virtual library services, multimedia content distribution (recorded lectures, slide, etc.), news services and tools for the access and processing of different kind of data.

## 4. Technology Description

The two sites of the project have two equal platforms HW / SW, which deliver information and content through the Internet network. The University of Genoa [2] provides the collection, preparation and packaging of the teaching material. As possible, all the material is transferred just ready, and replicated on the remote platform installed in the destination site.

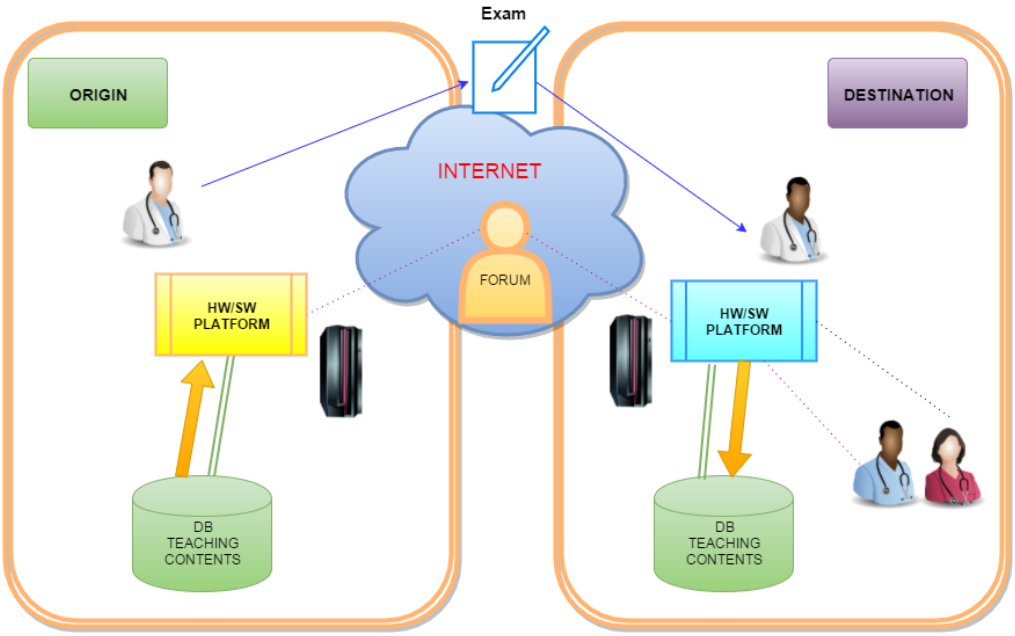


*Figure 2: General Scheme System Perfectly Replicated in Both Sites*

### *4.1 Service and System Requirements*

The distance learning system includes:

- Network connection;
- Computer;
- Monitoring the level of learning;
- Multimedia;
- Interactivity.

In the specific case, the absence of physical presence constraints is not only for students but also for teachers, which can administer their teachings from laptops or tablet.

The lessons do not take place in real time but delayed, but interactivity is provided by forums, chat, video conferencing and mentoring. This choice is due to the discontinuity of the electricity service delivery, therefore the realization of a true virtual classroom with teachers via video conference may not be available according to the schedule.

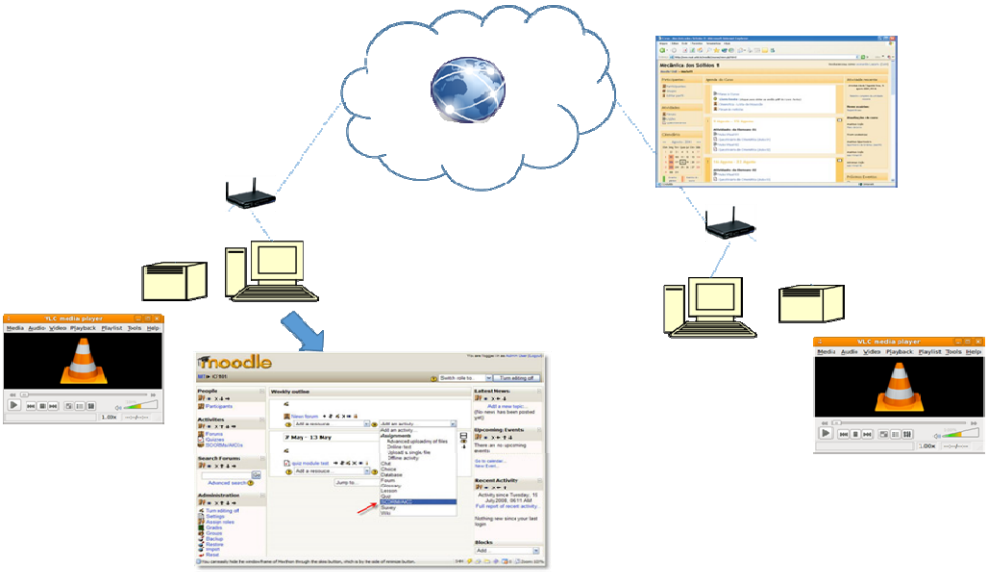

*Figure 3: Applicative Layout of the Platform in the Case Study*

As visible in figure 3 here the description of the system and the hardware in Genova:

- Moodle: The platform is based on Moodle is a learning management system open source and modular: different functionality can be added and customized through plug-ins to install (forums, blogs, chat, video viewer, wiki, glossary, quizzes ).
- The Moodle interface is the same as Aulaweb University of Genoa, but the entire platform is independent.
- On the homepage you see a list of lessons with their topics, and the link to power point presentations and video. The entire program of lectures could be consulted by students and tutors.
- The logon credentials have different privileges depending on whether they are teachers, students or administrators.
- Computers: At the University of Genoa it is set up a desktop PC with Windows operating system installed on a virtual machine with Ubuntu operating system and Moodle.
- NAS: Reading materials will not be uploaded directly to Moodle, it is stored in a NAS on the network, so as to ensure greater flexibility and efficiency to the system.
- UPS: a static group of continuity will be used to keep constantly fed electrically hardware, so that the service is always available.

Hosting University:

- Computers: Students of the hosting University display the Moodle platform through any computer with access to the Internet and thus have access to the entire interface, the learning material (which will reside in Genoa NAS and tools such as forum, chat etc…)
- Nas: If the internet is not available, will be able to regain access to the course materials available on the hosting University NAS, "twin" of Genoa. In that case you can not see the Moodle interface, but videos and presentations of the lessons are available an archive.
- UPS: a static group of continuity could be used to keep constantly fed electrically hardware, so that the service is always available.
- Projector and screen: you can connect a PC to the projector and projected on a screen or any video conferencing lessons to serve the entire group of students

## 5. Results

The University of Genoa, through the agreement with the University of Ebolowa established to transfer a complete course for the 4th and 5th years of Medicine and Surgery degree.

After this case study and project application, it has been developed a complete system that offers a dedicated part to the medical education made of 38 complete cycles of lesson of medicine and surgery with more than 100 hours of edited lessons.

All lessons aggregated and correlated of the material that is downloadable on a personal laptop or tablet in order to follow courses in a remote way, thought in English with the full course that is available as it is for Medicine's Genoese students.

It is possible so, according to the agreements signed, to give the opportunity to complete at least the main courses of the last two years of a medicine and surgery degree program

The Platform has four levels of access as administrator, student, teacher and technical manager all of them with different passwords and different way of interaction on the platform itself.

The platform is totally replicable and could be spread in many other countries with similar technological contexts.

*Table 1: List of Topics Produced for the Release*

| MEDICINE | SURGERY |
|---|---|
| Endocrinology/Metabolism | General Surgery |
| Cardiology | Plastic Surgery |
| Heart disease pathology | Vascular Surgery |
| Nephrology | Infectious diseases |
| Kidney disease pathology | Urology |
| Lung disease pathology | Otolaryngology |
| Pathology | Orthopaedic Surgery |
| Respiratory disease | Ophthalmology |
| Rheumatology | Gynaecology |

## 6. Conclusions

Towards use of technologies and LMS it has been provided a complete academic year of educational for future medical experts and professionals.

This will allow people completing their career in their local universities, to give their contribution to the society that took care of them since the beginning of their education and to establish a connection with their countries and their people.

Empowering this platform and customising it according to new advices and needs, the scope of this project could be spread in many fields, and towards it, many other countries and educational systems could benefit of a high quality service at a cheap price. Moreover, digital divide problems that could occur in some areas of the world could be overlapped thanks to the use of open sources but consolidated technologies, able to adapt to different territories and circumstances.

Following such an approach entities and educational system, especially in developing countries that would like to empower their offer, will give the chance to their students and teachers to really take care of their own education and research, raising awareness and towards it social empowerment and subsequent policy development.

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