

How to Promote Learning in African Countries?

Open d-Learning System Based on an Open Content

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Abstract— The learning process has always been a privileged appeal for individuals to improve their knowledge and skills to enable them to become more productive and contribute to the sustainable development of society. However, poverty in most African countries generally, hampers the implementation of the learning process-face. These prove to be expensive when considering the cost of construction of facilities, teaching materials and also paying the teachers for tracking learners and contents production. To overcome the various constraints (personal, social and pedagogic) that impede the classical process of learning, we propose to use an open d-learning system.

It is a learning system that relies largely on contents 2.0 produced by researchers and experts and open content (open archives and open journal). Digital libraries can provide our system with a favorable environment in order to engage learners, motivate them and orientate them along their researches. Pedagogy and technology go together in this system to provide a quality learning environment. Indeed, management systems for the content of the company ECM provide an environment capable of managing the content despite their diversity and dispersal in several servers. The recommended pedagogy is the one which is active and constructive centered on the learner. An open d-learning plays an important role for the promotion of human development and thereby ensures the progress and changes in developing countries. The proposed system deals with an open generic and modular design to meet scalability of content and learning services always evolving. It allows access through several data -processing objects in the first level. The second one provides different learning services such as exercises, assessments, conducting practical work or projects. An intermediate level has been proposed to capitalize and gather the free content on the web identified as being useful for learning to enable their re-use and their sustainability. Finally, the fourth level which is in the form of an educational heritage consists of a free content but rich and varied. Such a system would be able to offer new opportunities for the countries in the process of development to guarantee human development and to become thus more competing at the era of globalization and the emergent technological development.

Index Terms— open d-learning system, open content, d-learning, pedagogy, human development.

I. INTRODUCTION

Education, training and scientific research are the nervous system of any country. Moreover, only a well-educated population, highly educated and advanced in scientific research is able to lead a change to ensure the reduction of the digital divide between information -rich countries and information-poor countries.

There are many factors that hinder development in Africa, particularly the education sector. This is a key factor in sustainable development. Indeed, the qualitative and quantitative analysis of data on indicators of the global monitoring report on Education For All (EFA), covering all African countries revealed major inequalities in education [1]. In addition, the implementation of the learning process requires heavy investment, notably, construction of facilities, teaching materials and also paying the teachers for tracking learners and content production.

Thanks to technological developments, new learning environments have been created to promote learning for all and everywhere. In this context, the d-learning plays a paramount role not only to overcome the spatio-temporal, pedagogical constraints but also the accessibility ones.

Questions arise consequently: Which role will play the d-learning in the world of education and training in Africa during the digital era? How to promote the training via d-learning? This article proposes an open d-learning system. It constitutes an alternative to classical learning in Africa and provides an open education services as learning environments must be available in open Access. Such a system rests on the ICT on the one hand and on the open content on the other hand.

Initially, we will recall some personal, social and pedagogic constraints which hinder the generalization or the implementation of classical learning process. Then, we will introduce the concept of open-learning. Then we will precise some needs in terms of ICT to develop such a system. At the fourth section, we will highlight the importance of open content and open access movement. We reserve the fifth section for the platform for learning and the appropriate pedagogy for open-learning. Finally, we present the architecture of such a system.

II. DISTANCE LEARNING: OVERCOMING SEVERAL CONSTRAINTS

In the era of the extraordinary technological change and globalization, the economic environment has become increasingly competitive. The companies need versatile executives who are skilled and equipped with the emerging technologies. In this regard, a continuing need for training sees the light of day. The learning process, in the context of the classical training or the initial one, constituted the sole remedy to meet these changing needs. However, several constraints hamper the generalization of such quality learning. We distinguish three types of constraints: personal, social and pedagogic constraints.

A. personal constraints

We mean by personal constraints the ones related to the learner. It is mainly spatio-temporal constraints. Indeed, the commitments of individuals in work processes prevent them from following normal training. In addition, sometimes the training requires traveling. Yet, this is not always feasible either for work or other constraints (illness, financial, family). In addition, personal constraints may include those relating to accessibility in terms of the handicapped that can be prevented from following their learning with specific needs.

B. Social Constraints

These constraints are related to the environment of the learner. Among these constraints, there is poverty. Indeed, in poor areas, it is impossible to build schools or have the means to organize on spot initial or continuous training. In addition to this, there is the lack of competence in some areas and the lack or absence of budget to call upon outside experts to create contents fit for the needs of the population.

C. Pedagogic constraints

In this category, the difficulties of implementing traditional teaching approaches are listed. Indeed, despite the emergence of learner-centered pedagogy, in which the interaction and collaborative work play a basic role in the construction of knowledge, it is still difficult to implement. Moreover, in the classroom-face, it is difficult, if not impossible, to provide specialized training, to create homogeneous groups, and to manage learner autonomy. In addition, it is impossible for a teacher to follow different rhythms and be adaptable to all of them.

Faced with these constraints, the d-learning attempts to combine technology with education to create a learning environment suitable for human development.

III. OPEN D-LEARNING

The learning field has undergone several changes following the technologies and web services that have emerged. Three generations have emerged successively: E-learning, M-learning and P-learning. The first generation (E-learning) is defined as a learning environment based on the use of information and communication technologies to provide learning activities and services related to online training. It also manages the interactions between the learners, the tutors, the author and the administrator during learning sessions. The second generation is M-learning which is distinguished from E-learning by the use of mobile technologies. The third generation is P-learning defined as a learning environment in which actors use pervasives technologies to interact with their context, between them and to access to learning services and content.

The learning needs for human development on the one hand and the difficulties and constraints to implement the classic learning process on the other hand were behind the birth of the open d-learning.

A. D-learning: E-learning to P-learning

The first generation of d-learning is based on classical technologies. The second is based on mobile technologies and Web 2.0 services and its successors. And third generation uses pervasive technologies. Each new learning

environment includes the benefits of the previous one and provides new opportunities.



Figure 1. E, M and P learning continuum

However, we believe That It is time to return to the original concept distance learning (d-learning), combine to all those concepts are intertwined usually which is several aspects.

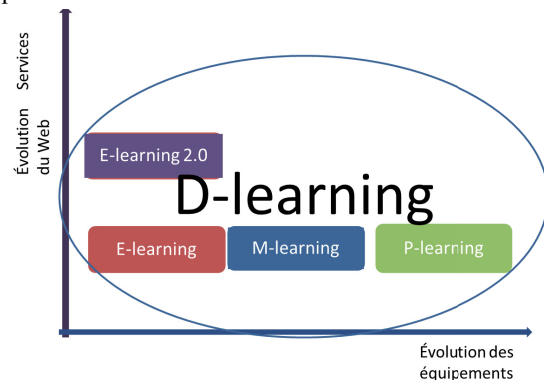


Figure 2. Our d-learning vision

We define d-learning as a learning environment enabling all actors to perform tasks in their technological environment. Learning environment that ensures the quality improvement of the learning process, regardless of any constraints, offers services using the web and pedagogical approaches appropriate to the context of each stock actor.

B. D-learning: the essential pillars

In order to provide distance learning, it is very important to establish five inescapable pillars illustrated in figure N°3.

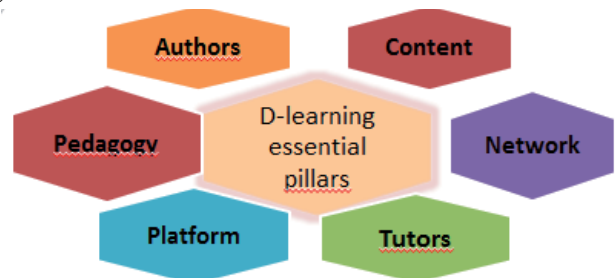


Figure 3. Essential pillars of d-learning

- **Content:** this concerns educational resources, links, bibliographies, works practice and directed works. It is necessary to create a rich and varied content under multiples formats in order to allow the learners with different devices to access.
- **Pedagogy:** it is necessary to combine teaching with technology in order to achieve the learning objectives: among the most successful approaches are: collaborative learning, situated learning and active learning.
- **Authors and tutors:** they are responsible for the content and the monitoring of the learner. They create, manage and update teaching resources and learning paths. They are also required to accompany and guide learners during the realization of their learning activities.
- **Platforms:** an environments for the access and the management of learning activities is obligatory in the d-learning. It should provide an interface for each of the actors to manage the content and the services. The tutors: for monitoring and supporting the learners .
- **An infrastructure networks** for the exchange and communication of content and learning services.

C. Towards the open d-learning

UNESCO defines open learning in 2002 as "The open provision of educational resources, enabled by information and communication technologies, for consultation, use and adaptation by a community of users for noncommercial purposes". The learning contents used in this environment are commonly called "open education resources" OER defines « teaching, learning and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use or re-purposing by others. Open educational resources include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials or techniques used to support access to knowledge” [2].

The open d-learning is a learning environment that offers new opportunities of alternative training to the classic one and makes it possible to overcome the personal, social and educational constraints. It is obvious that the content is not sufficient for the acquisition of skills. In this context, a new definition has been proposed to extend the concept open learning (open d-learning) “Open education is not limited to just open educational resources. It also draws upon open technologies that facilitate collaborative, flexible learning and the open sharing of teaching practices that empower educators to benefit from the best ideas of their colleagues. It may also grow to include new approaches to assessment, accreditation and collaborative learning.” [3].

It is clear that this definition puts the finger on measures of great value to take into account the open learning, especially: collaborative work, flexibility and open sharing of learning practices. The open d-learning is a solution for the African countries to contribute to human development.

IV. ICT SERVICES FOR OPEN-LEARNING SYSTEM, IN AFRICA

The implementation of the open-learning requires a significant telecommunications infrastructure.

A. A favourable technological environment

It is noteworthy that despite the poverty of many countries, statistics show that many of these technologies are increasingly available and are experiencing a growing use. The creation of a digital infrastructure covering the whole territory is among the major concerns of African countries. Several efforts have been made by telecom operators to ensure widespread connectivity. Moreover, their multiplication, nowadays, favors a climate of competition and offer better services [4].

B. Creating assistance centers

To ensure access to information for citizens not having the means of being equipped or having other constraints of accessibilities, measures must be taken for the creation of access centers equipped with computer tools which are secure and connected to the Internet with a broadband. Regard to remote areas, one might consider the realization of wireless network.

African countries should invest in media centers that can be multi-functional (access to the learning services, e-government ...) in addition to their use by many users. This investment is crucial not only in the open d-learning but also for the implementation of e-government strategies.

V. WHAT IS THE ROLE OF OPEN CONTENT AND OPEN ACCESS TO THE OPEN-LEARNING?

The open d-learning system can take advantage of new Web 2.0 services and its successors and the wealth of content available on the Wiki, Blogs, social networks and open archives, whether institutional or personal they are produced by academicians. A very rich and varied content develops thus systematically supporting the open d-learning

A. Content 2.0 from academicians, scientists and researchers

The internet has become a real producer through social networks, wikis and blogs. As a result, Content 2.0 was born.



Figure 4. content 2.0

It is especially of great value since it is produced by experts in different fields (researcher, expert, teacher and learner). In fact, this category can transmit knowledge and skills through Web 2.0 services. It presents usually a group of working, helpful and very knowledgeable people. Learners can effectively exploit content 2.0 produced by researchers, academicians and experts to acquire

knowledge and skills. Tutors can also use this content for better support and guide learners. Moreover, they can enrich the teaching resources and update them.

B. Content Open Access

The open access movement has emerged during the last decade. In Berlin Declaration (2003) [5], it was defined as a comprehensive source of human knowledge and cultural heritage that has been approved by the scientific community." Available content on open access include "original scientific research results, raw data and metadata, source materials, digital representations of pictorial and graphical materials and scholarly multimedia material. » [5]

Open access content is digital, online, free of charge, and free of most copyright and licensing restrictions. It can be delivered through open Journals, which perform peer review, or through open archives or repositories, which do no "Open access to research results is mainly based on three fundamental principles: access to scientific papers, the durability of access and free access." [6]

It is a scientific content: digital, rich, updated, validated, accessible, available, and free reusable with less restriction.

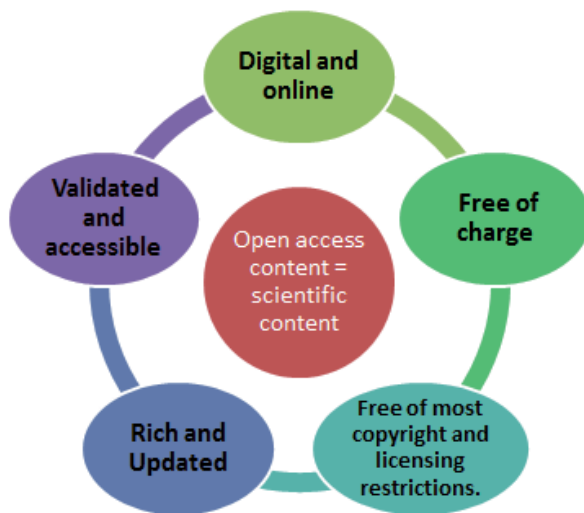


Figure 5. Some of open access content characteristics

The value of such content is invaluable for promoting education, training and research in African countries. Indeed, it can be considered as educational resources for training sessions and continuing throughout life according to the needs of learners. The author may enrich and update his course directly by the means of some links to freely available content. Free access to content and services is essential for learning of an open-learning system.

C. Use of open source simulators to enhance practical learning

Learning activities can be limited to setting access free educational resources. Other activities are important, such as practical work and tutorials. When it comes to jobs that require a practical context the cost is high (Laboratories or the use of materials and equipment). To overcome this problem, one may use (when possible), simulators and especially open source to enrich the open d-learning system.

D. The Role of Open Access digital libraries in promoting the open d-learning

Research libraries are particularly expensive. Even in the developed countries, few people afford good access to scientific, legal and scholarly information. In less affluent countries, the situation is worse, even the best universities cannot afford good libraries. With the growth of digital libraries, this situation is changing. An ever-increasing amount of information is available on the web with open access. Nowadays, Open Access digital libraries have emerged, they support and promote Open Access to scholarly literature and allow their collection be used and distributed without barriers. The use of the Information and Communication Technologies provides the library with another means of reinforcing the image of its contemporary relevance, librarians are discovering new challenges and opportunities for reaching distance learners. They have been integrated and contributing members of the distance education instructional development team. [15]

The delivery of library services to distance learners is undisputedly the most pressing challenge that "distance librarians" encounter. Libraries must be more flexible and introduce innovative strategies into their delivery process. Indeed, in traditional library services students go to the library to access the range of information services that they need to satisfy their learning needs. In distance education many modalities have to be used to take library services to distance learners [14]. Therefore, librarians, distance educators and administrators must adopt new strategies to ensure that quality library services are available to those who learn at a distance. In order to take library services to distance learners, many libraries have placed more of their services on-line. In addition to on-line catalogues (OPACs), library services now include not only a traditional postal loan service, but also off-campus access to Internet databases, student are able to examine Abstracts and in some instances read full text e-journals or specially digitized books. Besides is the delivery of information literacy, bibliographic instruction and research skills as on-line courses [15].

Furthermore, "distance librarians" contribute to the process of producing information for distance education [15]. They develop materials for distance learners such as electronic research guide, video instruction manuals, FAQ (Frequency Asked Questions), tutorial material, lecture notes, quizzes, projects, etc. Another new feature of distance library services is the creation of research assistants who act as intermediaries between the information seeker and the information source. In this context, the use of a variety of delivery strategies to take the information to distance learners is necessary. It is particularly important to collaborate with external partners (other digital libraries, e-publisher, agencies, etc.), because without their assistance, it would be impossible to provide quality library services to distance learners [15]. Thus, the library portal links to resources which should be carefully selected by subject specialists in the institution. Distance learners can search and browse through the resources, and be confident that their results will connect them to websites relevant to learning, teaching and researching in their subject area. E-reference services can also be developed, but need to be available by careful planning and staff development [11]. Besides is the use of Web 2.0 tools (tags, ratings, comments and social

networks) to create an on-line experience that engages educators and librarians in sharing their best teaching, searching and learning practices [12].

That is also a medium to maintain contact with distance learners and as a mean of sending and receiving communication related to their need for information. However, "such technologies can only be applied effectively if there is a clearly developed rationale and well-defined strategy which addresses the issues those libraries must engage with in order to best serve the needs of distance learners." [11]. New skills are obviously required of those who will work in distance library services.

VI. PLATFORMS OPEN SOURCE AND APPROPRIATE PEDAGOGY

The availability of content, despite their wealth, cannot provide learning services. Indeed, it is imperative to use the appropriate pedagogical approaches and platform access to services.

A. ECM for access and management of learning content

The learner needs a learning environment allowing him to choose the service they want to access. However, the contents in the open d-learning are scattered across multiple servers. To account for different types of contents used in the learning process we can use the ECM to manage learning content and enjoy the multitude of open source tools.

"Enterprise Content Management (ECM) is the strategies, methods and tools used to capture, manage, store, preserve, and deliver content and documents related to organizational processes. ECM covers the management of information within the entire scope of an enterprise whether that information is in the form of a paper document, an electronic file, a database print stream, or even an email." [7]

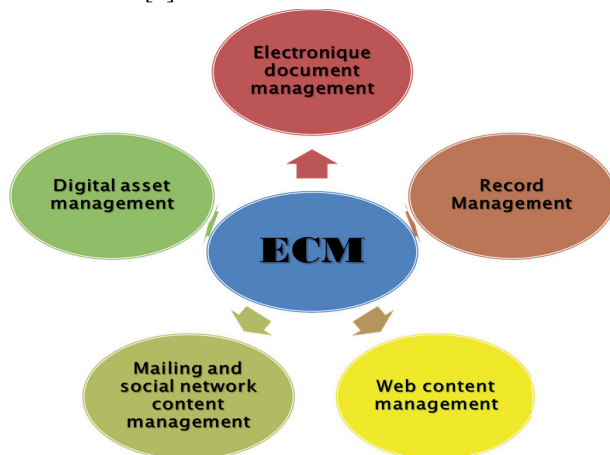


Figure 6. Components of the ECM

In the context of distance learning, a platform will serve to manage any type of useful content in the learning process. So, the ECM seems useful for this purpose [8].

Indeed, the educational heritage that we want to provide learners with is very rich and varied. It takes into account the basic pedagogic resources created by the author, content 2.0 academicians and researchers, the contents of the open archives and open access journals. That content

may come from several sources stored on remote servers. Also, it can have different formats (pdf, doc, ppt,..) or be composed of different media. They may also combine multiple versions. Learning content can therefore be stored on different media and it may use multiple diffusion channels, hence, the interest in the use of ECM. In addition, there are several open source tools that can be used for open-learning system.

B. An adequate pedagogy

The availability of content is not enough to provide quality learning. Pedagogy is a key pillar. Cognitivist approaches and constructivist learner-centered are very useful to engage the learner in a learning process, motivate him/her and accompany him/her as well.

An open d-learning system that we propose is not limited to the creation of an open access educational heritage. Far from it, it should create an interactive environment for communication and exchange. Thanks to Web 2.0 technologies, the exchange and the interactions we may overcome the constraints of classical classes. Implementation of learner-centered pedagogy is the agenda and thus benefits from an active and contextualized training.

VII. ARCHITECTURE OF OPEN-LEARNING SYSTEM

The objective of this architecture is to create a core of services, activities and educational content that will serve to create an educational heritage of open content and open access which can be exploited via various existing and future technologies. This architecture must meet three criteria: generic, open and modular.

- Generic in sense that it must provide a core of basic services common to the developing technological environments.
- Open in the sense that it must allow the communication, exchange and use of learning content apart from their development environments.
- Modular: this architecture must meet an evolutionary need. To facilitate its extensibility towards integration of new technologies and new contents, the modular decomposition seems to be the suitable solution.

A. Architecture of communication in virtual communities

Communication is a fundamental requirement to transmit knowledge. To achieve the educational goals of learning, the actors use interaction and communication. In this sense Lebus et al. confirm that "social interactions play a key role in any learning or acquiring knowledge because they promote confrontation of viewpoints and knowledge development. The elaboration of knowledge has therefore much to gain from a process of collective development" [9]. The communication thus makes it possible to the actors to interact and exchange knowledge which will enable them to enrich and to build their knowledge.

Thanks to Web 2.0 services and its successors (web 3.0, web 4.0 ...) learners can belong to virtual communities which are generally very active and can help, motivate and sometimes accompany these learners realize their projects. These collaborative spaces 2.0 can allow not only communication and interaction between learners, but also with specialists and experts on the one hand and their

tutors on the other hand to favor an open learning as illustrated in figure N° 7.

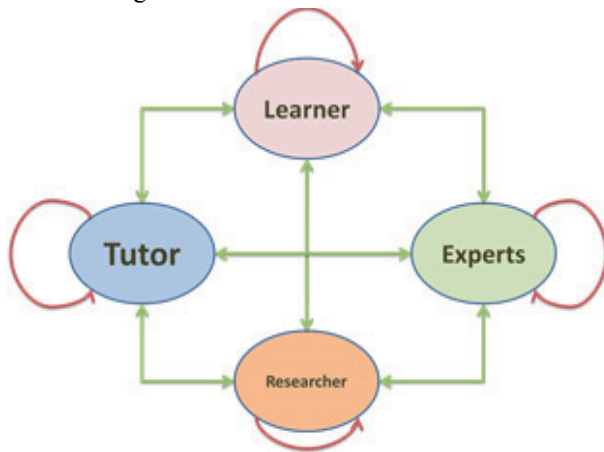


Figure 7. communication architecture between open d-learning actors.

B. Open d-learning architecture

An open d-learning system can operate in four layers as shown in figure N°8.

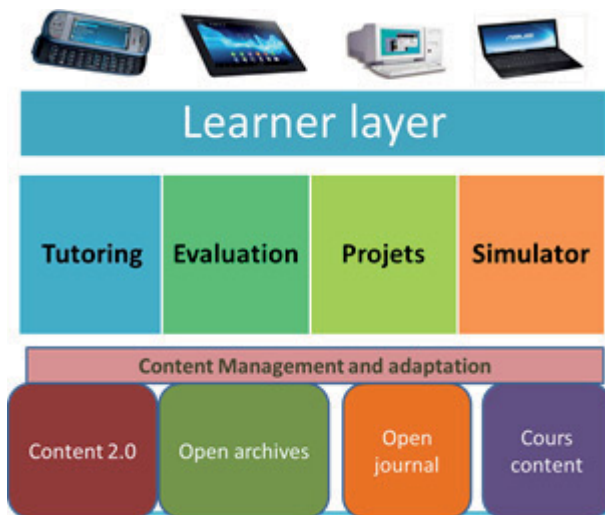


Figure 8. An open d-learning system architecture

- **Learner Interface:** The learner, through its learning device (mobile or desktop computer) can access various services through the first layer.
- **Learning services:** Services related to the learning process will be grouped at layer two: practices, exercises, projects, evaluation, learners profile management, etc.
- **Layer for content management and adaptation:** this layer provide to author and tutors possibilities to validate and control, if possible, content before integrating them in platforms. It's their responsibilities to evaluating and actualizing content.
- **Educational heritage:** All types of content can be taken into account and managed independently. Content managed at latest layer which can be an aggregation of multiple servers according to their content types.

VIII. CONCLUSION

Human development is a sine qua non indispensable for the development of nations. For African countries to become more competitive in the era of globalization and the extraordinary evolution of technologies, they are called to invest in initial and continuous training. Moreover, only a well-educated population, highly educated and advanced in scientific research is able to lead the change and undertake the development.

To overcome the various constraints that can block this process, we propose to use an open d-learning system. It is a learning system that relies largely on open content and Content 2.0. The digital library will offer a variety of services to support and guide learners. They also provide an enabling environment for e-research and development of new skills. Pedagogy is combined with technology to provide a quality learning environment. Thus, the open d-learning is learner centered and promotes collaborative work where the learner becomes more active and effective and contributes to the construction of knowledge. This is possible thanks to virtual communities that allow active communication among experts, researchers and tutors. The open d-learning is based on an open modular architecture and has four levels .

The open-learning system to provide learning services freely available but certainly its implementation will highlight other research questions, such as: the problem of interoperability of content and services, security and validation of the open content.

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