CoNet – Construindo redes em e-Learning

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Abstract. *In spite of all the recent changes in the e-learning area we continue feel that these developments are far from the complying with our needs and expectations, as there are still structural limitations related to the systematic offer of training in HEI institutions. Also, there is a deficit in the use of pedagogical practices which suit the new technological learning contexts. Another problem, created by the many available and different e-learning CMS systems, is their lack of interoperability and the lack of solutions to integrate different technologies, namely those developed to support mobile learning. Finally, quality is another factor which is not given much attention in the vast majority of the solutions adopted by the different institutions and that can play an important role in assuring efficiency. This article, thus, aims at identifying and describing the main weaknesses in the Portuguese HEI system, as far as the implementation of e-learning is concerned, and at presenting a research project that brings together seven schools of Porto's Polytechnic Institute (Portugal), joined in a common effort to implement a series of research and development activities to face some of the identified weaknesses.*

Resumo. *Apesar dos constantes desenvolvimento na área do b-learning é possível denotar que os mesmos ainda se encontram aquém do esperado, uma vez que ainda existem limitações estruturais da oferta de uma formação sistematizada e institucionalizada. Pode ainda constatar-se que existem défices no que concerne a utilização de práticas pedagógicas adaptadas aos novos contextos tecnológicos de aprendizagem. Outro dos problemas que surge, inerente às diversas plataformas web para suporte ao processo de ensino-prendizagem, é a sua falta de interoperabilidade entre sistemas e integração das diversas tecnologias da informação e comunicação, nomeadamente o mobile learning. A qualidade é outro dos factores que não é garantido na maior parte das soluções implementadas pelas diversas instituições e que deveria ser tida em linha de consideração. Este artigo descreve as principais lacunas sentidas no campo do e-learning no ensino superior Português e propõe um projeto de investigação que envolve as sete escolas do Instituto Politécnico do Porto (Portugal) para a implementação de actividades de modo a fazer face às lacunas identificadas.*

1. Introduction

The information and communication technologies have contributed significantly to educational and methodological changes in higher education. It happened, because there was a need exists, felt by educational institutions, to rethink existing models of education in order to meet the needs arising from the knowledge society and lifelong learning. Thus, several learning web environments have appeared, facilitating information proliferation, promoting self-learning and contributing to knowledge construction in an increasingly collaborative way. However, despite these new developments and realities have already obtained good results, it is still possible to see that they are still below expectations, since there are still structural constraints in the supply of a systematic and institutionalized training. We can also see that there are deficits regarding the use of pedagogical practices adapted to new technological learning contexts.

Another problem that arises, inherent to the different web platforms, is its lack of interoperability between systems and the integration of several information and communication technologies such as mobile learning is also lacking. Quality is another factor that is not guaranteed in most of the solutions implemented by the various institutions and should be taken into consideration. Therefore, being aware of these issues in higher education institutions, particularly at Porto Polytechnic (IPP), we intend to contribute to the processes and skills improvement within the e / b / m-learning within the seven schools that constitute IPP.

Being mindful of the diversity and the needs of each one of the schools, we want to find an intersection and an interchanging process that improves and empowers the creation of knowledge and skills based in a technology enhanced web learning systems. After examining the different realities in IPP (realities which can also be extended to other institutions), this project aims to build an environment of multidisciplinary integration, supported by digital technology that enables a dynamic, innovative, sustainable and transferable configuration.

This paper is organized as follows. The first section presents a brief state of the art concerning the major concepts involved in CoNet project. Section 3 defines and presents CoNet Activities. Section 4 presents some final remarks.

2. Literature Review

The rapid growth of the Internet and educational technologies has allowed deep transformations in teaching and learning (T&L) processes and paradigms. The Internet, as a mediator-facilitator platform, allows new contexts for learning opportunities. The importance of technology-mediated education lies in its potential for personalized, generative, adjustable environments that add value to the traditional classroom (Littlejohn, A.H, 2003). The success of online learning resides on the balance of the old but still relevant T&L concepts and innovations taking full advantage of technology's potential (Salmon, G., 2002). Therefore, we need a new T&L culture (Cox et al., 2003), where technology: is a facilitator of fundamental changes in diversifying new processes/contexts (Coghlan, M., 2003), promotes collaborative and personalized learning opportunities; generates higher levels of student performance and motivation (Means, B. & Golan, S., 1998). These modifications should impact on the organizational culture of schools, its pedagogical practices and the redefinition of roles

of its intervenients. An Adaptive Hypermedia Systems (AHS) (Brusilovsky, P. and Millán, 2007) (D. Benyon, 1993) builds a model of each user and uses it, dynamically, through the Domain and Interaction Models, to adapt its contents, navigation and interface to user needs (Brusilovsky, P. and Millán, 2007).
The global architecture proposed by Benyon (1993) and De Bra (2004), indicates that AHS must have three essential parts:

1. The User Model that describes the information, knowledge, and preferences of the user; this component allows extracting and expressing conclusions on the user characteristics;
2. The Domain Model represents a set of domains concepts; in different AHS these concepts can have distinct functions, weights and meanings; most commonly, each concept is connected/related with other concepts, representing a semantic net;
3. The Interaction Model, which represents and defines the interaction between the user and the application.

In Educational Adaptive Hypermedia Systems (EAHS), the emphasis is placed on students' knowledge in the domain application and Learning Style (LS), in order to allow them to reach the learning objectives proposed in their training (Martins et al., 2008). Also, Collaborative Educational AHS focus on adaptive collaboration support, storing knowledge about different users to form a matching group, e.g. one that combine efforts to solve the problem at hand (P. Brusilovsky, 1999).
In EAHS, the Student Model (SM) has increased relevance: when the student reaches the objectives of the course, the system must be able to re-adapt, for example, to his knowledge (Martins et al., 2008). A Student Model includes information referring to the specific knowledge that the system judges that the user possesses on the domain, known as the Domain Dependent Data (DDD). This Domain Independent Data (DID) is composed of two elements: the Psychological Model and the Generic Model of the Student Profile, with an explicit representation (Martins et al., 2008).
Two different types of techniques are used to implement the Student Model: Knowledge and Behavioral based (Martins et al., 2008). The Knowledge-Based adaptation typically results for data collected through questionnaires and studies of the user, with the purpose to produce a set of initial heuristics. The Behavioral adaptation results from the monitorization of the user during his activity. This adaptation can be implemented in two forms: the Overlay and the Perturbation methods JISC. (2008). These methods relate the level of the student knowledge with the learning objectives / competences that he intends to reach (Martins et al., 2008)
The key of constructivism theory is that the student must be actively involved in the learning process. It is important for teachers to understand that the construction of knowledge acquisition occurs from knowledge that the student already possesses and differs from student to student. The role of the teachers is now to be a guide for the student (Martins et al., 2008), (Martins et al., 2008b). Students learn in different ways and depend upon many different and personal factors (Martins et al., 2008b). The emphasis in students individual differences is also important in a context to recognize, design and support students activities (tasks). In constructivism learning theory, students have different Learning Styles. Also, the capacity of adaptation in different social contexts and the constructive social aspect of knowledge must be taken in consideration (Martins et al., 2008). Generally, Learning Styles is understood as something that intent to define models of how a person learns.

Some case studies reveal teachers should assess the learning styles (LS) of their students and adapt their instruction to best fit each student's LS (Stash N., Cristea A., De Bra P., 2005). Different LS models (based on different psychological theories) can be considered, such as models based on (Martins et al., 2008b): personality; information processing approach; social interaction; multidimensional factor (Martins et al., 2008b). More development and experimentation is still necessary to adequate features and effectiveness of these systems (Martins et al., 2008b). The use of technology in T&L process was not accompanied by a shift in pedagogical methodologies that would truly transport the T&L process into Learning Management Systems (LMS), turning technology into a recreational agent instead of contributing to its educative use. This is the biggest challenge of today's education, once LMSs have been used as libraries for content storage and distribution (Dalziel, J., 2005), where there is neither accommodating for learning activities (Britain, S., 2004) nor for students' opportunity to perceive the different phases of their learning process (Vogel, M., & Oliver, M., 2006). There is a need to adopt student/activity-centered models, in which the tutor is an organizer, a facilitator and a mediator for the construction of knowledge and interactions, allowing the student to succeed as learner and as individual Santos, E. (2003). The findings in (Oliveira, L. & Vaz de Carvalho, C., 2009) shows it is possible to reduce time and effort inherent to the process of planning active learning strategies, varying between 40% and 80%. Learning Objects (LO) are one of the most important tools to be used in the T&L process, as teaching aids. It can be delivered in many ways e.g. Interactive web pages, readable packages. LO can be compared to LEGO™ building blocks: small units that can be fitted together any number of ways to produce customized learning experiences (Hodgins, Wayne with Marcia Conner., 2000). If they are included in course materials the professor can provide them to the students and cover some particular situation or/and add richness to certain issues (Smith, Rachel S., 2004). These materials can also be shared among courses and formers producing intersecting experiences and methodologies. Bearing this in mind we need to choose or develop a user friendly tool in order to concept and create LO.

Concerning the standards and specifications in the developing of LO, SCORM appears to be the most popular technical specification among e-learning developers. The reason is that SCORM adopts most of the mentioned e-learning industrial to support comprehensive e-learning capabilities, enabling interoperability, accessibility, and reuse of Web-based learning content. SCORM integrates technology developments from groups, such as IMS (IMS, 2001), AICC (AICC), ARIADNE (ARIADNE), and the IEEE LTSC (IEEE, 2002) – within a single reference model to specify consistent implementations, which can be used across the e-learning community.

The e-portfolios are collections of digital artefacts created online by the learner during his training, combining multiple formats (audio, video, text, images), articulating experiences, achievements and learning (JISC., 2008). They are important to (a) assessment, noting creation, organization, preservation of content and reflection produced in academic life, (b) planning for professional development or career and (c) active learning, incorporating results of research during his training route (Attwell, G., 2007). They are useful in evaluation of competencies, especially when integrated with LMS in a personal learning environment (PLE) (Attwell, G., 2007). The student can add content not necessarily related to his academic work, preparing the process of entering in labour market (Oliveira, L., & Moreira, F., 2010). The student’s profile has changed

along the last years, due to social, behavioral and technological issues (Zhang, L., Kunz, R., 2007). Several factors contributed to this changing, such as (Rhys Lewis, 2003): i) the increasing mobility of our society; ii) general access to the Internet; iii) mobile devices with Internet connectivity. Mobile devices become increasingly popular in various areas due to its simplicity, functionality, portability and ease of use (Jo Rabin, Charles McCathieNevile, 2008). In this context, has emerged the mobile learning (m-learning) concept, which aims to incorporate mobile devices in T&L process (Marçal, E., Andrade, R., Rios, R, 2005). In fact, m-learning has been listed by the New Media Consortium 2010 as a key technology for T&L for next years (Myers, A., Nichols, J., Wobbrock, J. & Miller, R., 2004). After 1998 the Bologna Process united 49 European countries around European Higher Education Area. In 2005 the Standards and Guidelines for Quality Assurance (ESG) were adopted (ENQA, 2009). The ESG addresses both internal and external quality reviews. Several approaches to implement internal quality assurance have been proposed (Amaral, A., 2006) (Reichert, S., 2007). Courses with learning opportunities supported by e/b/m-learning differ from the practices employed in face-to-face education. Quality evaluations need not only to recognize these differences, but also to take them into account when the processes for quality assurance are designed. Projects like Q-Cert-VET (Q-Cert-Vet, 2010), a project co-funded by the European Commission, addresses these diverse modes of delivering courses. The main deliverable of Q-Cert-VET is the Quality Certification for Learning and a derived profile for e-learning – QCEL - used to validate the quality assurance process model.

Although several learning web environments and solutions have appeared, facilitating information proliferation, promoting self-learning and contributing to knowledge construction in an increasingly collaborative way, it is possible to observe that the results obtained by their use are still below expectations, since some structural constraints in the supply of a systematic and institutionalized training remain. We can also identify deficits regarding the use of pedagogical practices adapted to new technological learning contexts. Another problem that arises, inherent to the use of different web platforms, is their lack of interoperability between systems and the integration of several information and communication technologies such as mobile learning. Finally, quality is another factor that is not guaranteed in the vast majority of the solutions implemented by the various institutions. Being aware of the need to fill these gaps in higher education institutions CoNect intends to contribute to the processes and skills improvement within the e/b/m-learning by finding an intersection and an interchanging process that improves and empowers the creation of knowledge and skills based in a distance learning system by building an environment of multidisciplinary integration, supported by digital technology to enable a dynamic, innovative, sustainable and transferable configuration.

3. CoNet Activities

The general plan to develop CoNet starts by the creation and development of a collaborative and adaptive platform of e/b/m-Learning with the objective of supporting the classroom and virtual classes, by consolidating a learning process tailored to student's learning style. For that CoNect aims at defining of a new architecture for the implementation of a Collaborative Educational Adaptive web platform to support and improve e-Learning courses. This architecture will also supply the platform with a

collaborative learning environment where students will be able to actively interact by sharing learning experiences. The main goal of Adaptive Systems is to adequate its relation with the user according to a User Model (UM). The adaptation ability of these systems will be used to increase the efficiency of the instructional process. The architecture of the system will incorporate strategies already used in Adaptive web Systems (AWS). As a result we aim at defining and implementing an architecture to implement an adaptative platform to support and improve e-Learning courses. The devised architecture will provide the access to the platform from different kinds of devices, including mobile devices.

The AWS will have three essential parts: the UM, describing the information, knowledge, and preferences of the user; the Domain Model (DM) representing concept hierarchies or maps and the related structure for the representation of the user knowledge level; and the Interaction Model to define the interaction between the user and the application. The principal result of the first part, will be the definition of a Student Model (SM). Two different approaches will be considered to implement the SM: Knowledge and Behavioural based. The DM represents concept hierarchies and the related structure for the representation of the user knowledge level. The most important function of this model will be to provide a structure for the representation of the user domain knowledge. Thus, CoNect will define and implement a module able to define the DM according the student characteristics represented in the UM. This process will also include the selection and adaptation of the more relevant Learning Objects and the more suitable Pedagogical Strategy. The curriculum planning is the first step of the adaptation process and precedes the beginning of each learning session. The following adaptation step occurs during the learning session and includes the adaptation of contents or links. This behavior falls under the scope of the third subtask: “Interaction Model”. The Interaction Model will be responsible by changing the content presentation, the structure or annotation of the links. To guide the user to the relevant information and keep him away from the irrelevant information we will use the technique known as link adaptation. Also, the platform will add to the contents additional or alternative information to certify that the most relevant information is shown, using content adaptation techniques. Another step in this project will be the development of a Learning Objects Repository. For that, CoNect will search, catalog and classify Authoring Tools. For the selection process, a team will perform tests to determine the scope and feasibility of the tools for the purposes of the project. After the selection procedure is complete, CoNect will establish a set of goals and capabilities that the prospective user should acquire, in order to properly work with the Authoring Tool and allow the teaching community to develop and create Learning Objects and share them, in a collaborative platform and mobile devices. We will separate learning resources and learning activities in order to facilitate reusability of learning resources.

Inherent to the operation of E-IPP is the existence of a collection of digital LO and the need for these to be retrieved manually, to be managed by teachers and content developers, and automatically, to be presented to the students in accordance with the respective learning style and knowledge. To make this possible, a metadata record will be associated to each learning object. This metadata document will contain the information pertaining to the learning object creators, the learning object identification, such as title, short description and keywords to help the search and retrieval actions, and also information pertaining to the learning object pedagogical characteristics, to allow

for the learning object to be retrieved by the system if found suitable to a particular students knowledge and learning style. As far as LO are concerned, there are two established metadata schemas currently in use: the IEEE Learning Object Metadata (LOM) and the Dublin Core Metadata Element Set (DCMES) (Barker 2010, Currier 2008). The IEEE LOM is a multi-part standard, currently consisting of a conceptual data schema (IEEE 2002) and its XML schema binding (IEEE 2005). This standard defines a structured set of 76 data elements, covering a wide variety of characteristics found to be relevant to define a learning object. In view of the characteristics and development of IEEE LOM and DCMES, and since E-IPP is at an early stage, it was decided to adopt IEEE LOM as the basis for the development of E-IPP domain model, mainly because it defines a large set of metadata from which one can choose the elements found relevant to characterize a specific set of LO and also because it allows the insertion of non-LOM elements or attributes if deemed necessary.

To guide the design and implementation of the repository, we shall define a set of design principles related to reusability, compliance with existing standards, reliability and efficiency. Architecture will be discussed from the point of view of users and developers, mainly their interests regarding the system, also taking into account more detailed features and connections between different layers. Simultaneously, CoNect will define user's profiles and roles as well as screen layouts. The main approach for this task shall be made through focus groups. We shall also conduct workshops where the implementation of the repository and metadata set will be openly discussed among participants. After the development of the architecture and metadata a prototype will be built. The building of the prototype, applied to context of Porto Polytechnic, will include the installation and configuration of software, selection of colors and choice of logo, the type of persistent identifiers, metadata schema adopted, and a prototype server to prove technical feasibility, illustrate interface and workflow. A controlled testing procedure will be established and feedback analyzed. To establish usability, a group of voluntary individuals will test the platform and make a report about the procedure.

Another objective of this project is the construction and integration in the platform of a repository of models, pedagogical strategies and educational content, in order to maximize a more diversified use and reuse of educational content. Currently there are, to our knowledge, no collections of teaching strategies/solutions to meet teachers' specific needs, targeted to achieve the objectives and competencies defined in curricular units. Furthermore, there are no guides that help determine the features that should be taken into account when designing a strategy mediated by web technologies. Finally, there is no model that answers the question on how to integrate web technologies in the teaching-learning process. CoNect project will search and adopt tools to overcome the above mentioned problems. The first step will be, thus, to investigate and develop tools to optimize educational planning, while promoting the exchange and reuse of teaching strategies to maximize the sharing and saving time and effort in developing them in order to encourage creativity and innovation in learning strategies. The next step will be to create a model adjusted to different levels of education, areas of knowledge and cultures to support the integration of web technologies in students' learning process.

The platform will also integrate a tool for the creation of digital portfolios, which will be targeted at students and alumni and open to the business sector, in order to promote and increase students work visibility. As mentioned, the integration of e-

portfolios, PLEs and LMS are useful in the learning process but to be valid for students' assessment, the Higher Education Institution (HEI) has to ensure the preservation of content created by the students, maintaining the system housed in its infrastructure and under its control. There are no known cases of HEIs in Portugal that have implemented a system with these characteristics. To confirm the validity of this concept, we will develop a prototype based on open source software in compliance with standards for interoperability of e-portfolios, integrated with AWS platform and accessible through mobile devices. In what respects the use of mobile devices is concerned, it is the teams' perception that the use of these devices in HEI is still very much at an exploratory level. Therefore, we intent to use this project as an opportunity to advance in the use of this type of mobile devices, using IPP schools and reality to soundly test and evaluate their application and acceptance. For that we will, first, conduct a study to characterize mobile devices usage and analyze future expectations concerning the usage of m-Learning platforms. This exploratory study will include a survey, using a questionnaire, encompassing four main issues: i) Inquired profile: student or teacher; ii) main mobile services used by respondents; iii) technological characteristics concerned with mobile devices used; iv) educational and learning mobile contents. Simultaneously, we will make a more deeply literature review concerning m-learning state-of-the art. The next step will be to identify the system requirements needed to allow the m-learning objectives, and the design of an m-learning framework for the delivery of suitable e-learning content to the mobile devices of our students and teachers. The framework should allow the different levels of education, areas of knowledge and cultures to support the integration of web technologies in students' learning process. The platform development, implementation and configuration will, thus, be the next task.

4. Final Remarks

The project is being conducted by all partners, thus bringing together the expertise necessary for all subjects and needs related to the project. The project is currently concluding its first phase of implementation and development which mainly involved:

- The analysis of needs and expectations of the target community and teaching units;
- The development and establishment of the technological infrastructure;
- The deployment of the project in the community and the identification and promotion of courses;
- The implementation of a quality management methodology and development of first researches,

As this is a collaborative project, built upon knowledge collected from the different research units in the IPP community, this process is itself being tested and assessed and receiving further contributions, in fields like mobile-learning which are expected to enhance both the technological and the pedagogical approach.
Since we are trying to implement the internationalization of this project we need to reflect on the different elements that should be taken into account. That consequently leads to different levels of involvement and different approaches towards this idea of

internationalization. At the moment, we have already done some steps forward namely the agreement with the Mackenzie University in order to offer a common e-learning post-graduation course.

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