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Customized *X*-Learning Environment: Social Networks & knowledge-sharing tools

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Abstract

The educational model based on fixed time, place, curriculum, and pace is not enough in today's society and knowledge-based economy. The education system needs to address the diversity of students' backgrounds and needs. Furthermore, educational equity is not about equal access and inputs, but ensuring that a student's educational path, curriculum, instruction, and schedule is developed in order to meet students' needs. Finally, personalized learning requires a leveraging of modern technologies enabled by smart e-learning systems, developed to track and manage the learning needs of all students, and to provide access to learning content, resources, and learning opportunities which are not all available within the traditional classroom. This is the time where the "new" world citizens' people feel "naked" without the use of technology. In this context, this paper presents a solution that integrates the concepts of social media and knowledge management allowing students, teachers and external experts (most of the times these can be future employers) to create an environment for educational work in a collaborative interdisciplinary space within and outside the institutional sphere. The solution presented is framed as an inclusive smart information system since it is developed in an adaptative learning environment (e-learning; m-learning; u-learning) for students, in higher education institutions that, due to several reasons (e.g. lack of supervision), feel a little bit lost when they have to manage their learning environment and deal with a certain topic for an essay adapted to his / her profile.

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1. Introduction

In the last years, education had undergone several changes both from a technological and a social point of view[1]. As a matter of fact, it is assumed that the educational model based on fixed time, place, curriculum, and pace is not enough in today's society and knowledge-based economy[2]. The education system needs to address the diversity of students' backgrounds and needs. Furthermore, educational equity is not about equal access and inputs, but ensuring that a student's educational path, curriculum, instruction, and schedule is developed in order to meet students' needs. Finally, personalized learning requires a leveraging of modern technologies enabled by smart e-learning systems, developed to track and manage the learning needs of all students, and to provide access to learning content, resources, and learning opportunities which are not all available within the traditional classroom. This is the time where the "new" world citizens' people feel "naked" without the use of technology.

Besides, the lack of interaction in traditional classes is a well-known problem with a long history of research[3]. The interaction between teachers and students is essential for learning in accordance with teaching theories[4], resulting in increased adoption of e-learning platforms and less frequently, of web 2.0 services. But what about the interaction between students / teachers and external experts or potential employers? Can they also be players in this game?

Independently of the training model adopted by each educational institution, it needs to have a component of assessment / examination of knowledge and essays prepared by students whether during the classes or at the final exams. This means that education needs to take into consideration "*how [teachers] develop ... programs and activities so that all students learn and participate together*"†. Ideally, this should include the participation of external experts that can bring added-value and experience as well as some professional supervision. On one hand we need to take into consideration that the interests, preferences and abilities of each student will condition his / her choices. On the other hand, students can and should count on the support of teachers and / or external experts (for instance for final dissertations) that can supervise them during the development of the referred work. Additionally, teachers or external experts can have ideas and needs of topics / themes to be developed as final dissertation which might not be known by the students because these might not have been disseminated or its dissemination was not adequate, or because of the lack of students work experience.

As for the selection of the topic / theme of each work / essay that suits the interests of each student and workplaces and which is in accordance with his / her competences, the objective is to create, within the Customized x-Learning Environment (Cx-LE) (for more information about this CxLE model please see Mesquita et al[5], a net of personalized knowledge for students, teachers and professionals / experts which recommend connections between users and potential ideas for works.

In this context and based on a previous proposal[5], this paper presents a solution that integrates the concepts of social media and knowledge management allowing students, teachers and external experts (most of the times these can be future employers) to create an environment for educational work in a collaborative interdisciplinary space within and outside the institutional sphere. The solution presented is framed as an inclusive smart information system since it is developed in an adaptative learning environment (e-learning; m-learning; u-learning) for students, in higher education institutions that, due to several reasons (e.g. lack of supervision), feel a little bit lost when they have to manage their learning environment and deal with a certain topic for an essay adapted to his / her profile.

The paper is organized as follows. In section 2, we identify the need to add vertical social networks to the CxLE which integrates the contributes of external experts and potential users, in particular with the suggestion of topics and themes for research and exploration during a degree. In section 3 we present the model based on a previous work,

† http://www.inclusionbc.org/our-priority-areas/inclusive-education/what-inclusive-education

taking into consideration the gap identified in section 2. Finally, in section 4, we draw some conclusions and point out future work related with the testing and extending the proposed model.

2. The gap

In this section we present some important theories or concepts that constitute the basis of the proposed model. These are: social networks and knowledge sharing. We explain also what the limitations of the existing concepts are so the reader understands what is proposed in the next section.

2.1. Social networks

According to Boyd and Ellison[6], a social network is "… *a web-based service that allows individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system. The nature and nomenclature of these connections may vary from site to site." The Merriam Webster*[‡] *dictionary defines social network as "a network of individuals (such as friends, acquaintances, and co-workers) connected by interpersonal relationships (This seems to make sense: partners of the same age, race, religion or educational level … will reinforce each other's self-esteem, find mutually enjoyable pursuits and receive support from their extended families and social networks*".

Social networks can be classified as horizontal or vertical, with the first being used for more general purposes, i.e., without a clear defined purpose, and the vertical dedicated to an activity or specific interest. Vertical networks can be characterized by a highly segmented user base, addressing specific topics in depth and has a high degree of specialization and are generally more private and closed.

Horizontal social networks have very diverse users, address a wide range of topics, have a reduced specialization, less privacy and are public. For example, Facebook has more than 1 billion[§] monthly active users that discuss and share everything. And this is precisely what a lot of users see as a problem – the fact that there is a lot of information available, with few or no filters, used by a diverse population of users. The most important or general horizontal social networks targeting the general user are: (1) Facebook (http://www.facebook.com) and (2) Twitter (https://twitter.com/). They do not target a specific public, namely students, teachers and experts or future employers. Networks such as (3) Flickr (https://www.flickr.com/), (4) Pinterest (https://pinterest.com/), Foursquare (https://foursquare.com/), Tumblr (https://www.tumblr.com/) and Instagram (https://www.instagram.com/), promote the interaction based on the published contents.

Users willing more targeted experiences are looking for increasingly specialized social networks (vertical social networks). Taking into consideration the target of the proposed model in this paper (see section 4) which are students, teachers and experts / future employers, the use of vertical social networks (e.g. professional, academic social networks) seems to be more adequate. Examples of these are: (5) Patatabrava.com (http://www.patatabrava.com/), (6) Mendeley (https://www.mendeley.com/), (7) ResearchGate (https://www.researchgate.net/), (8) LinkedIn (https://linkedin.com/), Academia.edu (https://www.academia.edu/), Unono.net (http://unono.net/), and SocialStudent (https://socialstudent.com/). According to data presented in table 1, vertical networks are more focused on the personalisation of services. Additionally, the general vertical social networks can interact with even more vertical social networks, i.e., those specifically related with the selection of training activities (hard skills). Examples are: Stackoverflow (https://api.stackexchange.com/); Github (https://developer.github.com); Doximity (https://www.doximity.com/developers/home); etc.

It is possible to see that there are several networks that can be used on the higher education ecosystem. In fact, social networks acquired a lot of importance and central place in people's life and in particular in students' life[7], but none with the specific concern to share topics of proposed essays / works and even less to allow the relation with

[‡] http://www.merriam-webster.com/dictionary/social%20network

[§] http://expandedramblings.com/index.php/by-the-numbers-17-amazing-facebook-stats/

external experts. As a consequence, they do not allow the generation of new ideas although they are still virtual places of knowledge share.

2.2. Knowledge sharing

According Van Den Hooff and De Ridder[8] knowledge sharing may be defined as a "*process where individuals mutually exchange their implicit (tacit) and explicit knowledge to create new knowledge*". Additionally, De Vrie et al.[9], stated that this definition implies that every knowledge sharing behavior consists of "*the supply of new knowledge and the demand for new knowledge*". This knowledge sharing could be divided into formal knowledge sharing and informal knowledge sharing[10].

In Taminiau et al.[10] formal knowledge sharing includes all the forms of knowledge sharing that are institutionalized by management (resources, services and activities). While Werr and Sjernberg[11] shown the importance of informal knowledge sharing when there is a connection between informal knowledge sharing to informal networks and informal communication.

Gurtenn[12] state that Sharing Knowledge is important because "*the creation and application of new knowledge is essential to the survival of almost all businesses. There are many reasons*" that could include: (i) Intangible products - ideas, processes, information are taking a growing share of global trade from the traditional, tangible goods of the manufacturing economy; (ii) Increasingly the only sustainable competitive advantage is continuous innovation; (iii) Increasing turnover of staff. People don't take a job for life any more. When someone leaves an organisation their knowledge walks out of the door with them, (iv) Accelerating change – technology, business and social. As things change so does our knowledge base erode – in some businesses, as much of 50% of what you knew 5 years ago is probably obsolete today.

3. Social networks & Knowledge sharing

The combination of social networks and knowledge sharing allows to create strong networks. It allows the sharing of generalized interests and knowledge, while the use of knowledge sharing systems forces a more systematized and organized interaction among all participants.

In the next section we compare some social networks adequate to be used in higher education institutions allowing to "*share ... research with friends, classmates, colleagues or associates*". Also based on these assumptions we selected some knowledge sharing systems such as the Faculty Student Knowledge-Sharing Platform (FSKSP)[13], the Expert Cloud[14] and Diigo (https://www.diigo.com/). We also selected some social networks such as: (1) Facebook (http://www.facebook.com), (2) Twitter (https://twitter.com/), (3) Flickr (https://www.flickr.com/) and (4) Pinterest (https://pinterest.com); (5) Patatabrava.com (http://www.patatabrava.com/), (6) Mendeley (https://www.mendeley.com/), (7) ResearchGate (https://www.researchgate.net/), (8) LinkedIn (https://linkedin.com/).

The analysis of the social networks and knowledge sharing platforms took into consideration the following criteria: (i) personalized services; (ii) suggested links; (iii) suggested publications; (iv) allows connections with relevance; (v) allows trustful connections, (vi) content oriented to Works / essays and portfolios; (vii) universitária; (viii) allows to connect experts and freshmen; (ix) space to look for and communicate knowledge; (x) space to nurture ideas. The analysis reveal that the networks and knowledge sharing systems studied do not offer personalized educational services and recommend work connections to the users. Additionally, we also verify that none of the systems is oriented towards the dissemination of ideas / topics for workplaces and students' portfolio sharing. Taking into consideration the results, we can conclude that nowadays there are not yet tools focusing on the link and dissemination of knowledge for academic and labour work. We believe on the need to integrate these systems as well as social networks in the CxLE, in order to allow the dissemination of ideas/knowledge among students, teachers and experts so students can choose their topics according to their capacities, interests as well as to allow them being supervised not only by teachers but also by experts / future employers.

Table 1. Comparative study of social networks (horizontal and vertical) and knowledge sharing tools

Criteria	Social Networks								Knowledge sharing		
	Horizontals				Verticals						
	General		Content-based								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Personalized services	√	√	√	√	-	√	√	√	-	-	-
Suggest links	√	√	-	√	-	-	√	√	-	√	-
Suggest publications	-	-	-	√	-	√	-	-	-	-	-
Allows connections with relevance	√	√	√	√	-	-	-	-	-	-	√
Allows trustful connections	√	-	-	-	-	-	-	-	-	√	-
Works / essays and portfolios oriented content	-	-	-	-	-	-	-	-	-	-	-
Universitaria					√	√	√	-	√	-	-
Allows to connect experts and freshmen	-	-	-	-	-	-	-	√	-	-	-
Space to look for and communicate knowledge	-	-	-	-	√	√	√	√	-	-	-
Space to nurture ideas	-	-	-	-	-	-	-	-	-	-	-

The comparative analysis of social networks and knowledge sharing systems presented in table 1 shows that none of the networks and platforms take into consideration the criteria “Works / essays and portfolios oriented content”. According to Robles-Flores et al.[15] knowledge networks facilitate the tacit knowledge transfer. Thus the identification of the knowledge network inside the organization allows to use the organizational resources in a more adequate way. Considering the combination of preferences and competences of students as well as the proposals made by teachers and external experts as resource in the knowledge network, it is possible to create a mechanism inducing the improvement of the student profile concerning the development process of his / her work during the last year of his / her degree.

4. Proposed Model

In an attempt to give the student the total control of his / her learning space, while allowing the registration of learning activities[16,] we suggest a possible solution to integrate the static nature of Learning Management Systems (LMS) in the dynamic notion of a Personal Learning Environment (PLE). Conde et al[16] designate it a service-based framework. One of the main goals of this service is to facilitate the communication between the learning environment and the institutional LMS. For that, the service should comprise as components: 1) the institutional context (include one or more LMS in which the students carry out their academic activities, e.g. Moodle), 2) the personalized context (facilitates de integration of the different tools that students use in their learning and 3) the communication channels (provide methods for bi-directional information exchange). In addition some other elements may be included, such as mediator elements (to facilitate communication between specific instances of the LMS and the online tools included into the PLE) and / or the representation of these elements in other contexts (such as mobile devices).

The integrated use of LMS, PLE, social networks and knowledge sharing systems are still in a very embryonic stage since there are no concrete studies integrating all these elements, used on e-learning, m-learning or u-learning, as discussed in the next section.

Taking into consideration the previous work and existing learning theories, as well as the necessity to integrate the learning environment with specific social networks (one or more, according to the needs of the student), we present here our contribution to the discussion of the development of learning and work environments. This solution represents an evolution of the model presented at Mesquita et al.[5].

Knowledge is a social product meaning that is the result of interactions among people. Thus an e-Learning environment should provide learners with opportunities and tools to integrate learning communities and networks and to benefit from knowledge and practical advice from peers and experts.

4.1. Model proposed – the Customized x-Learning Environment with integration of social networks and knowledge sharing tools

The construction of the CxLE requires the definition of a set of very important activities concerning the integration of the various components. First, it is necessary to define which model to use, i.e., to establish if the learning environment will be customized for e-learning, m-learning, or u-learning, being the "x" the e, m or u. This initial decision is related with the technologies that will be used as well as with the adequate learning theories. Then it is necessary to define a learning environment in wider context, the interaction with social networks (horizontal and vertical) the knowledge sharing tools, and ways to communicate with the institutional environment (LMS). For this purpose a communication structure is required between the institutional, personal environment, social networks and knowledge sharing tools. The model should work as follows: (i) what happens in the wider context that can be used in the institutional environment: (ii) learning contents/activities can / should be enhanced with the functionality of the LMS; and (iii) enhanced with social networking and knowledge sharing tools contents.

With this model it would be possible to implement the Learning Environment as a set of services, tools and communication channels that allow students to complete the learning activities in different context. Furthermore, this Learning Environment provides ways of displaying to the institution, the results of the learning activities carried out outside the LMS.

The model presented in this paper is service-oriented and enables the communication described above using web services and interoperability specifications. This structure facilitates the representation of institutional features in devices (fixed and mobile devices) using web services. Although the export functionality allows the representation of PLE in several contexts, this model needs a way to combine tools, social networks and knowledge-sharing tools, a common environment and communication channels to return the results of learning activities to the LMS.

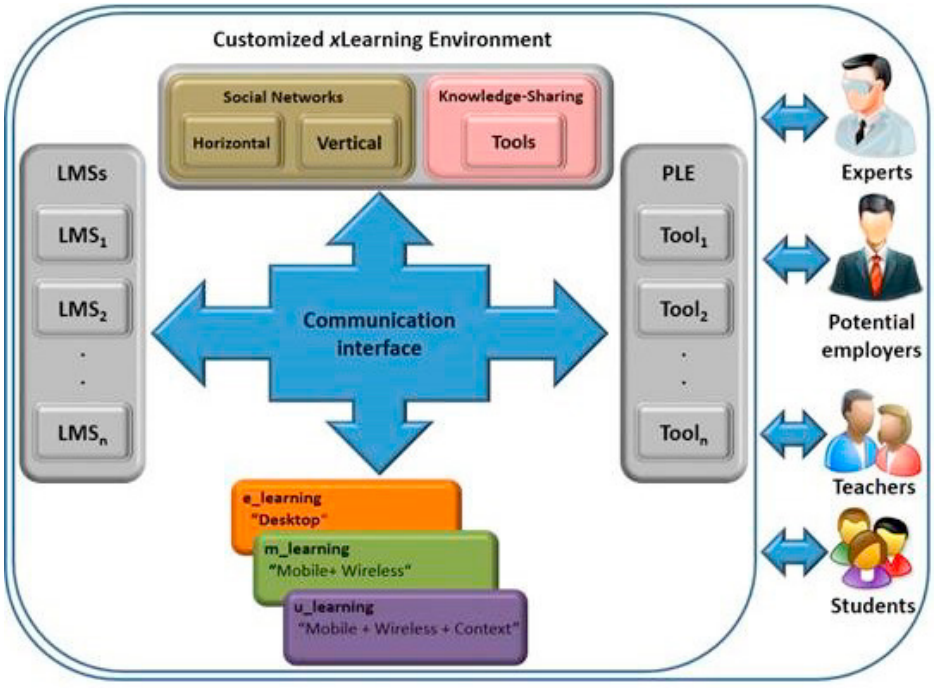

Fig. 1. Proposed model adapted from Mesquita, et al.[5].

From an architectural point of view (Fig 1) the five core structural elements are: the institutional environment (one or more LMS), PLE (one or more tools), social networks (horizontal and vertical) and knowledge-sharing tools, the channels and interfaces of communication and the model to use, i.e., which learning environment will be customized.

In this architecture the institutional environment includes one or several LMS. The PLE includes tools and devices, institutional and own tools. Social networks include some other horizontal and vertical, depending on the area CxLE apply. In addition, the model must include proxy tools to interact with, for example, Google tools, social networking, i.e., use the APIs provided by the various suppliers. An important issue for the use of these APIs is the need for evaluation of the activity performed in the external tools (not controlled by institutions) so it is necessary to integrate information (performed activity) for the assessment to be carried out "internally" so that evidences of assessment remain preserved, since it is a formal teaching-learning process. In this context, the components must be connected by interfaces based on web services and interoperability specifications.

The way to test this model is by implementing it as proof of concept. This implementation involves some restrictions of design that affect the technologies used in the components of the model. The first issue is the institutional point of view, that is, in this context there are many LMS available (commercial and open source) but the option is to use one or multiple instances of Moodle LMS. This platform was selected because it is open source and has a very wide community of users, includes a web services layers that allows the inclusion of new technologies and facilitates the integration with other tools as well as the existing experience in national educational institutions[**].

The second issue is directly related to the choice of the most appropriate social networks for training activities (hard skills or soft skills), with a natural tendency, in horizontal social networks to Facebook[††], etc., and in the vertical social networks, Patatabrava.com[‡‡], etc., and knowledge sharing tools, Diigo[§§], etc. Finally, the communication channels can be implemented through the mechanisms of communication among the components of the model, for example Moodle web services[***] and BLTI[†††] (an interoperability specification), and to interact with the LMS to integrate the results of students in relation to activities carried out in other environments / tools.

According to what we have said so far, the inclusion of, for instance, smart information systems, allows the use of a personalized knowledge network for the different actors, namely students, teachers and external experts (potential employers) with the capacity to create and disseminate ideas/knowledge in a collaborative way; build connections and facilitate the access to the job market.

As any information system, these smart information systems need to be assessed in order to know their quality, i.e., which are the critical factors for such a system as well as the utility of the proposal. In the first case, one of the first approaches should be the Quality of Experience (QoE), i.e., the satisfaction level of a user when a smart information system works as expected. With this purpose it is necessary to use objective parameters (measurable) and subjective (personal experiences) as well as data gathered from observation in order to allow continuous improvement. It is possible to use these metrics to define the experience of the user. If the experience is not enough, probably the system will be abandoned by the users. In order to be adaptable, the smart information systems need to use observations as well and take into consideration privacy, security and usability demands, For the second situation, we will suggest the use of the Technology Acceptance Model 2 (TAM2)[17] to validate the utility of the proposal adding the elements mentioned by Peres and Mesquita[18] that includes technical, pedagogical and institutional dimension.

5. Conclusions

With all the challenges in the educational environment, educational institutions need to be more and more dynamic and entrepreneurs. The availability of different information technologies is entailing changes concerning teaching methods and pedagogy. Discussions are also covering aspects such as the need of learning to become "personalized" meaning that every student is different and so materials and strategies of teaching and learning should be adapted to the different types of learners and targets. Moreover, it is necessary now to start involving and integrating the external environment into the educational environment in order to minimise the existing gap between these worlds while

[**] http://moodle.org/stats
[††] https://developers.facebook.com/
[‡‡] http://www.patatabrava.com/
[§§] https://www.diigo.com/
[***] https://docs.moodle.org/dev/Core_APIs
[†††] http://www.imsglobal.org/developers

promoting the employability of students by, for instance, using topics and themes prepared by potential employers in their academic essays and dissertations.

Education should become more and more students' focused and oriented. Thanks to e-learning platforms, social networks and web 2.0 as well as the recognition of the need to move student to the center of all the process, new models of learning environment are emerging. We presented a model – Customized x-Learning Environment – that takes into consideration all the elements present in the learning process as well as the available technologies, allowing learning to take place anytime / anywhere, depending on the student's needs and characteristics. Of course this represents a huge step towards ubiquous learning and to the increased responsibility of the learner since he / she will need to become more active and participative. Besides, the introduction of the smart information system is one step more forward the development of a smart education system, to create an efficient learning model that forecasts in an adequate way the performance of the student providing clues and supervision concerning the training route defined for each student. It also allows to see the academic weaknesses of the student permitting preventing and avoiding failure. There is still a long way before this kind of model becomes a reality. Our aim is to contribute to the reflection and discussion about this topic. Nevertheless, it constitutes a step towards the desired real customized learning environment where the student is the real actor of the whole process.

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