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From Blended to Inclusive Learning: Accessibility, Profiles, Openness, and Higher Education

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Abstract: The use of technology can be seen as an innovative challenge to restructure the teaching-learning process and integrate Information and Communication Technologies (ICTs) in independent, collaborative and interactive work. The main purposes of this study are to understand users' needs and to identify their profiles, in order to empower the quality of online teaching-learning process. Identifying teachers' and students' profiles and their needs as Course Management System users, in particular, is necessary to guarantee the quality of a b-learning process, with a more comprehensive face, towards inclusive learning. Sixty-eight (68) face-to-face interviews were conducted and validated, and a systematic content analysis was merged with a multivariate analysis. The results reveal four profiles of teachers, i.e., activities-oriented, interaction-oriented, assessment-oriented, and collaboration-oriented, and three profiles of students, i.e., interactive learning environment-oriented, training-oriented, teachers' beliefs-oriented. In terms of recognizing, understanding and responding to the academic community specific needs, this study can support an inclusive, multi-dimensional and holistic ICT knowledge for choosing adjustable teaching-learning strategies that could be applied into the enhancement of accessibility and info-inclusion into the learning environment.

Keywords: online teaching-learning process, Course Management System (CMS), users' profiles, accessibility, blended/inclusive learning, holistic Information and Communication Technologies (ICTs) knowledge, higher education
Categories: L.2.2, L.3.0, L.3.4, L.3.5, L.3.6

1 Introduction

In Higher Education (HE), technology may be either used to re-enforce the prevailing practices, such as lectures, or it may be used to transform and disrupt those practices. Although, Information and Communication Technologies (ICTs) have provided a potential for change, allowing the development of comprehensive approaches regarding teaching and learning, there is still insufficient knowledge as regarding best practices in Higher Education Institutions (HEI), mainly concerning the use of online learning environments (e.g., Module Object Oriented Dynamic Learning Environment - Moodle - platform) and communication tools [Redecker et al., 2009]. Additionally, research evidence suggests that the open source platform Moodle as an effective Learning Management System (LMS) is able to be adapted to different needs and pedagogical contexts [Graf and List, 2005]. From this panorama, the process of

learning can occur in a variety of ways, from presence lectures to online activities, supporting concepts, such as *produsage*, in order to emphasize certain skills and attitudes, including digital creativity, collaboration, communication and critical capacity [Bruns and Humphreys, 2007]. On the other hand, Fisseller and Bühler [2007] emphasize that the use of online learning activities raises problems for students with disabilities in the context of HE; nevertheless, they also argue that social computing applications might serve to support and facilitate accessibility in three inclusive ways, namely: (i) with the creation of a central interface personalised to each individual's needs, so the provision of information accessed by different networks/services becomes possible; (ii) with the integration of standards for accessibility in the design of social computing services, facilitating the creation of accessible content to supporting accessible authoring practices; and (iii) with the presence of students with disabilities on LMS and by fostering of their interaction, collaboration and communication with other students, as a means to raise awareness of their needs.

Thus, e-teachers, in order to recognize strategies to potentiate inclusive learning, perhaps should identify the needs of each e-learner, but also understand that effective learning requires active co-construction of knowledge by the learner and open negotiation about learning experiences.

1.1 Learning Management Systems

Technologies seem to allow students to learn more in less time - anytime and anywhere - and to permit the universities to centre on global learning environments when used appropriately. As Shackel [2009] argues, it is important to evaluate some parameters that reflect the multidimensional usability nature of an LMS, i.e., efficiency, learning, flexibility and the user's attitude. Regrettably, some usage profiles indicate that the LMS is mostly a tool set for information delivery and administrative helpfulness, rather than a system with potential to develop teaching and learning activities [Morgan, 2003]. According to Graf and List [2005], as Internet communications tools progress quickly, Course Management System (CMS) developers should start to consider the enrichment of system personalization, adaptability, and adaptation, i.e., giving students larger control over content and learning process. On the other hand, students have also become accustomed to be producers of content in some environments that seem much richer and permit much more freedom and individual expression than any LMS can provide. At the same time, some evidences show that LMS use for educational issues is not necessarily correlated with student's satisfaction [Jones et al., 2008]. Despite this, a study by Wandzilak, Bonnstetter and Mortensen [1994] underlines that the learning environment is favourable when teachers are organized and motivated. Further evidence suggests that course content was the most important organizational issue in relation to student's satisfaction, as well as the importance of course websites to support conventional teaching [Malikowski, 2008; Sun et al., 2008]. Furthermore, according to Rudd et al. [2006], the reorganization of the teaching-learning process (by teachers and students), through phenomena, such as social networking, collaboration and connectivity, requires the establishment of complex roles in the process of learning and knowledge construction. In addition, from a global perspective, it is important to remember that the process of technology integration

takes time and also requires a substantial systemic engagement [Guzey and Roehrig, 2009].

1.2 Blended Learning Accessibility in Moodle

Blended (b-) learning, holistically speaking, can be understood as a combination of traditional face-to-face and online learning, which openly expresses that teaching-learning process occurs both in the classroom and online environment. In turn, mixed learning modes, commonly labelled hybrid, flexible, blended or sandwich learning can represent simple or complex scenarios, depending on the users' understanding. In other words, *"Blended learning describes learning activities that involve a systemic combination of co-present (face-to-face) interactions and technologically-mediated interactions between students, teachers and learning resources"* [Bliuc et al., 2007: 234]. Additionally, some relevant explanations behind the common use of b-learning scenarios have been emphasised, namely: pedagogical richness, access to knowledge, social interaction, personal agency, cost-effectiveness, and ease of revision [Osguthorpe and Graham, 2003].

To facilitate the realisation of b-learning in practice, flexible CMS are required. As an example of a free, open source course management system, is the Moodle platform, which can be seen as a universal well-known LMS that supports b-learning [Aberdour, 2007]. The latter belongs to the kind of LMS that is intentionally built on a particular pedagogical strategy (e.g., behaviourism, cognitivism, constructivism, connectivism). Apparently, LMS Moodle is designed and developed by a social constructionist pedagogy, which is based on four main concepts, namely: constructivism constructionism, social constructivism, connected and separated behaviour [Dougiamas, 2007]. Stemming from this pedagogical approach, the LMS Moodle provides many communication tools, facilitates the creation and administration of learning objects, allows management of user data, fosters usability, and exhibits adaptation capabilities [Graf, 2007].

On the one hand, to implement and develop an inclusive CMS, two major key issues should be addressed, i.e., personalization and accessibility. On the other hand, to make the approach interoperable and reusable, it must be based on open software applications/options. Accordingly, at a step further, in the HE context, inclusive/adaptive learning has been addressed in a wide variety of European projects that blend a wide variety of concepts such as LMS, educational standards, web accessibility, and adaptable e-learning [Boticario and Santos, 2008; Boticario, 2012]. Some of these initiatives started to link the gap between inclusive/adaptive learning systems and LMS developments; however, all these are still in the exploration/research stage (pilot results), not covering yet, in this way, all personalization and accessibility issues in actual practice.

In any case, considering a holistic approach to reach accessible b-learning there is a need to offer accessible learning experiences, and not necessarily an accessible b-learning experience [Kelly et al., 2005].

1.3 Research Purpose

The research purposes of this study are to assess users' needs and to identify their profiles, in order to enhance the online learning-teaching quality process towards

inclusive b-learning. Overall, this study aims to answer the following questions: Are users satisfied with b-learning course? How do they perceive a b-learning environment? What instructional tools/strategies were used in LMS Moodle and could be incorporated towards the inclusive b-learning concept? In other words, this study intends to identify and describe the main features of the CMS, implemented in LMS Moodle, from the point of view of the teachers and students of the undergraduate courses offered by a public HEI. In addition, with this knowledge gained, from blended to inclusive learning viewpoint, the online component of the latter can be considered as an extension of the face-to-face component, aiming at overcoming time-space boundaries and at meeting some of the users' (teachers and students) needs, fostering further the accessibility within the learning environment for the users with disabilities.

2 Methods

2.1 Participants

In order to deeply understand the LMS Moodle (htt://moodle.org/) usage, the subjective position of the users (teachers and students) of five undergraduate courses offered by a public HEI was analysed. The current empirical study involved 32 teachers (50% female), aged between 24 and 54 yrs (M = 43.19, SD = 8.01). Also involved 36 students (61% female) with ages ranging from 18 to 48 yrs (M = 22.05, SD = 5.44). All participants have being using b-learning via LMS Moodle for at least 6 months.

2.2 Instruments: Semi-structured interview, data coding, multivariate analysis

Semi-structured interviews are considered a powerful tool of qualitative research methodology in studying people's positions and subject interpretations of the complexities of their life-worlds and institutions [Flick, 2002]. However, Denzin emphasizes that *"Meaning is always shaped by the effects of particular systems of power and discourse"* [2002:361]. Therefore, a semi-structured face-to-face interview was conducted, with questions previously validated from experts in the field. Seven interviews were randomly chosen for the purpose of testing the coding reliability. The interviews were organized in four distinct parts. The first part aimed to characterize the communication tools used in the LMS (*LMS Moodle tools*); the second part enabled the analysis of the opportunities and benefits of LMS usage (*Potential advantages*); the third part intended to understand the users' concerns about LMS usage (*Weaknesses*); and the fourth part aimed to identify users' future expectations to improve quality of LMS-supported b-learning (*Suggestions*).

Data were collected in the first semester of 2010/2011 academic year and every interview was audio-recorded and verbatim transcribed. The collected data (from 68 face-to-face interviews) were analysed using the content analysis software MAXQDA (MAX Qualitative Data Analysis, http://www.maxqda.com) to develop a classification/coding system and were statistically explored using the statistics analysis software SPSS 18 (http://www-01.ibm.com/software/analytics/spss/). As for

the statistical analysis, a Multiple Correspondence Analysis (MCA) was conducted, since it is considered a useful technique for the structural analysis of multivariate categorical data and also suitable to reduce the dimensionality of the original variables set [Blasius et al., 2009].

3 Experimental findings: Identification of the MCA Dimensions

From the interviews' content analysis, some categories emerged as the most important ones. In turn, the results of the MCA allowed data clustering into four different teachers' profiles and three different students' profiles regarding the CMS use. In order to determine the reliabilities of the dimensions and to assess their internal consistency, *Cronbach's alpha* (α) was calculated. All Cronbach's alpha coefficients were higher than 0.75, i.e., ranging from 0.78 to 0.96 (Table1). This indicates a good internal consistency and reliability. In addition, in Table 1 the variance accounted for the total (eigenvalue) and inertia for each dimension are also provided in a descending order. In particular, MCA is based on a singular value decomposition which provides *eigenvalues*. The latter give an indication of the quality of representation associated with each dimension [Fichet et al., 2011]. In other words, the eigenvalue can be seen as the total sum of squared component loadings in each dimension, i.e., the relationship between *Cronbach's alpha* and the total variance accounted for, as expressed in the eigenvalue [Kaplan, 2004]. Moreover, the *inertia* quantifies the explained variance by each dimension, ranging from 0 to 1. Note that as more closely the inertia appears to the upper limit, more variance is explained by the dimension.

Dimension	**Cronbach's Alpha**	**Variance Accounted For**	
		Total (Eigenvalue)	**Inertia**
Teachers' dimensions			
1	0.872	4.771	0.367
2	0.846	4.411	0.339
3	0.840	4.192	0.322
4	0.779	3.554	0.273
Total		16.928	1.302
Mean	0.839[i]	4.232	0.325
Students' dimensions			
1	0.961	7.902	0.493
2	0.930	6.270	0.392
3	0.942	4.173	0.261
Total		18.345	1.146
Mean	0.946[i]	6.115	0.382

[i]Mean Cronbach's Alpha is based on the mean Eigenvalue.

Table 1: The model summary of the number of dimensions identified. The dimensions are displayed in a descending order, according to the amount of variance accounted.

After examining the model summary, it is important to spatially understand the interrelationships between the variables (categories). As it seen from Table 2, for each variable, a discrimination measure, which can be regarded as a squared component loading, was computed for each dimension. This measure is also the *variance of the quantified variable* in that dimension.

Teachers' dimensions				
Variable (category)	**Dimension**			
	1	**2**	**3**	**4**
Files/resources (FI)	**0.999**	0.060	0.169	0.449
Glossary (GL)	**1.000**	0.040	0.047	0.340
Content repository (CR)	**1.000**	0.497	0.356	0.166
Teacher-student interaction (TS)	**0.842**	0.044	0.213	0.235
Wiki (WK)	0.055	**0.610**	0.343	0.181
Chat (CH)	0.122	**0.579**	0.191	0.216
Label (LA)	0.167	**0.548**	0.035	0.137
Courses at postgraduate level (CP)	0.001	**1.000**	0.092	0.022
Work assignment (WA)	0.237	0.150	**1.000**	0.162
Quiz (QZ)	0.090	0.246	**0.972**	0.128
Sharing information (SI)	0.029	0.263	0.018	**0.575**
Online tasks (OT)	0.100	0.053	0.359	**0.606**
Usability (US)	0.129	0.321	0.397	0.337
Students' dimensions				
Variable (category)	**Dimension**			
	1	**2**	**3**	
Webmail (WM)	**1.000**	0.056	0.112	
Chat (CH)	**0.876**	0.387	0.164	
Teacher-student interaction (TS)	**1.000**	0.177	0.323	
Sharing information (SI)	**0.861**	0.028	0.433	
Self-regulated learning (SL)	**0.650**	0.342	0.014	
Accessibility (AC)	**1.000**	0.341	0.239	
Efficiency in learning (EL)	**1.000**	0.001	0.056	
Teachers' beliefs, subject matter (TB)	0.060	0.106	**1.000**	
Lack of time (LT)	0.036	**0.619**	0.356	
Linkability to other systems (LN)	0.228	**1.000**	0.436	
Glossary (GL)	0.192	**0.647**	0.030	
Students' ICT training (ST)	0.291	**0.894**	0.097	
Usability (US)	0.334	**1.000**	0.496	
Collaboration (CL)	0.030	0.376	0.091	
High number of students (HN)	0.021	0.122	0.138	
Label (LB)	0.323	0.174	0.188	

Table 2: The discrimination measures per variable and dimension of MCA of Teachers (top panel) and Students (bottom panel). In both cases, the numbers in boldface denote values over 0.50.

The dimensions in Table 2 are ordered in a descending order of *eigenvalue* (see Table 1). According to the results of Table 2, a reduction of the variables number per dimension could be achieved when considering only those that exhibited a discrimination measure over a common threshold, i.e., >0.5 (denoted in bold). Generally speaking, here we are trying to reduce the dimensionality of a set of variables in much the same way as factor analysis; that is, looking for common factors which identify the relationships between the variables (categories) by explaining a maximum amount of variability. The aim is similar to principal component analysis, apart from the fact that the variables are categorical, so the missing link is the quantifications given to the categories.

For better understanding the role of each dimension in the explanation of each variable, the corresponding 2/3-dimension Line Plots (2D/3D-LPs) have been produced. In particular, Fig. 1 depicts the 2D-LPs for the case of teachers for all unique combinations of the dimension pairs; similarly, Fig. 2 depicts the corresponding 3D-LPs.

From the 2D/3D-LPs depicted in Figs. 1 and 2, along with the distribution of the bold values in Table 2 (no variable overlap across the dimensions), it is clear that the variance of the important variables (those in bold in Table 2) is expressed by a sole dimension. For example, Dimension 1 explains Files/resources (FI), Glossary (GL), Content repository (CR), and Teacher-student interaction (TS) and none of the rest variables included in Table 2 (top panel). When focussing at these variables in the corresponding 2D/3D-LPs (see Figs. 1 and 2), their lines have high value (most of them equal to one) across the axis of Dimension 1 and significantly smaller values (definitely less than 0.5) across the Dimension j, where $j = 2,3,4$. The same holds when focussing to the rest of the dimensions and their corresponding variables, accordingly.

In a similar fashion, Fig. 3 illustrates the 2D/3D-LPs for the case of students for all unique combinations of the dimension pairs and the one triplet.

From Fig. 3 and the non-overlapping of the important variables across the three dimensions (see bold values in Table 1-bottom panel) it is clear that, similarly to the teachers' case, each dimension explains a unique set of variables. For example, Dimension 1 explains Webmail (WM), Chat (CH), Teacher-student interaction (TS), Sharing information (SI), Self-regulated learning (SL), Accessibility (AC), and Efficiency in learning (EL). As the discriminate measures of the latter variables are higher than 0.5 and, in general, converge to 1.0, the corresponding lines in the 2D/3D-LPs will have high values across Dimension 1 and small ones across the rest of the dimensions (in all combinations of pairs and triplet). The same behaviour is noticed for Dimension 2, whereas Dimension 3 explains only one variable (Teachers' beliefs, subject matter (TB)). Finally, it is noteworthy that the variables Collaboration (CL), High number of students (HN), and Label (LB) are not explained by any dimension; to this end, they are ignored in the rest of the analysis.

From the grouping of the variables belonging to each dimension (see Table 2), a characterization of the latter is feasible, according to the corresponding underlying profile. Consequently, the identified dimensions are corresponded to the following *a posteriori* interpretation: i) Teachers' dimensions: Dimension 1-Activities; Dimension-2: Interaction; Dimension-3: Assessment; Dimension-4: Collaboration, ii) Students' dimensions: Dimension 1-Interactive Learning Environments; Dimension 2-

Training; Dimension 3-Teachers' beliefs and subject matter. The role of these dimensions in the structure of the profiles of teachers and students is described and discussed in detail in the succeeding sections.

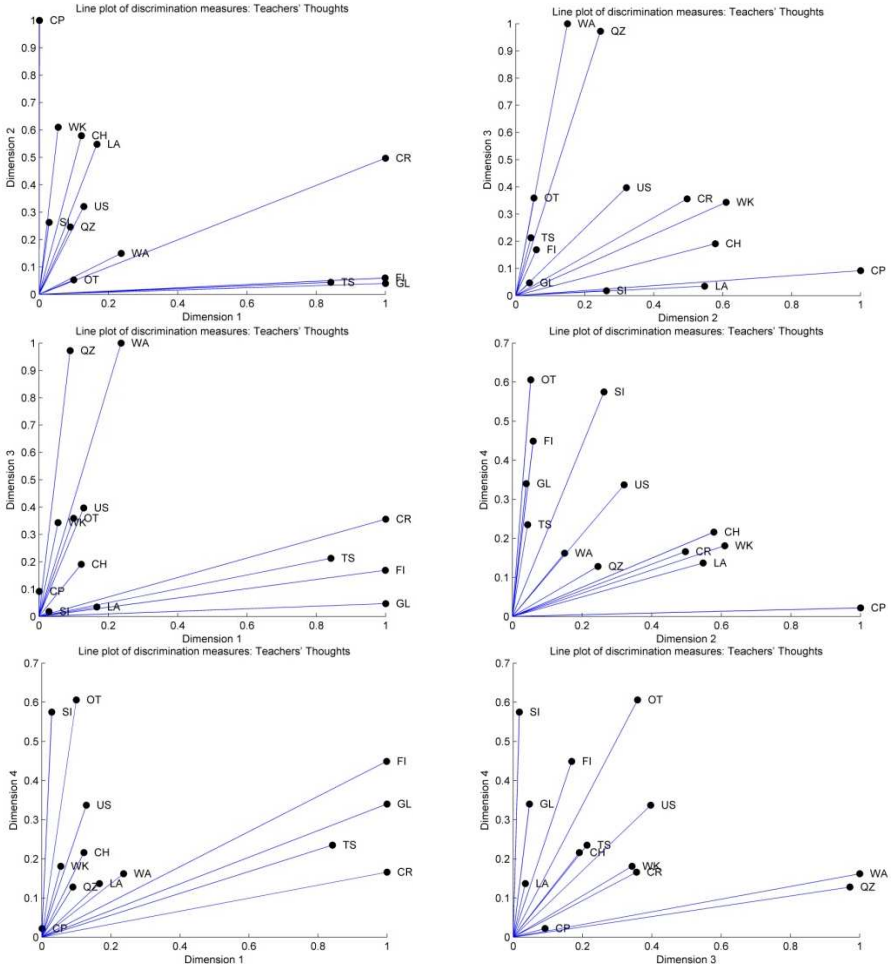

Figure 1: 2D Line Plots for the case of teachers for all unique combinations of the dimension pairs. The abbreviations correspond to the variables as coded in Table 2.

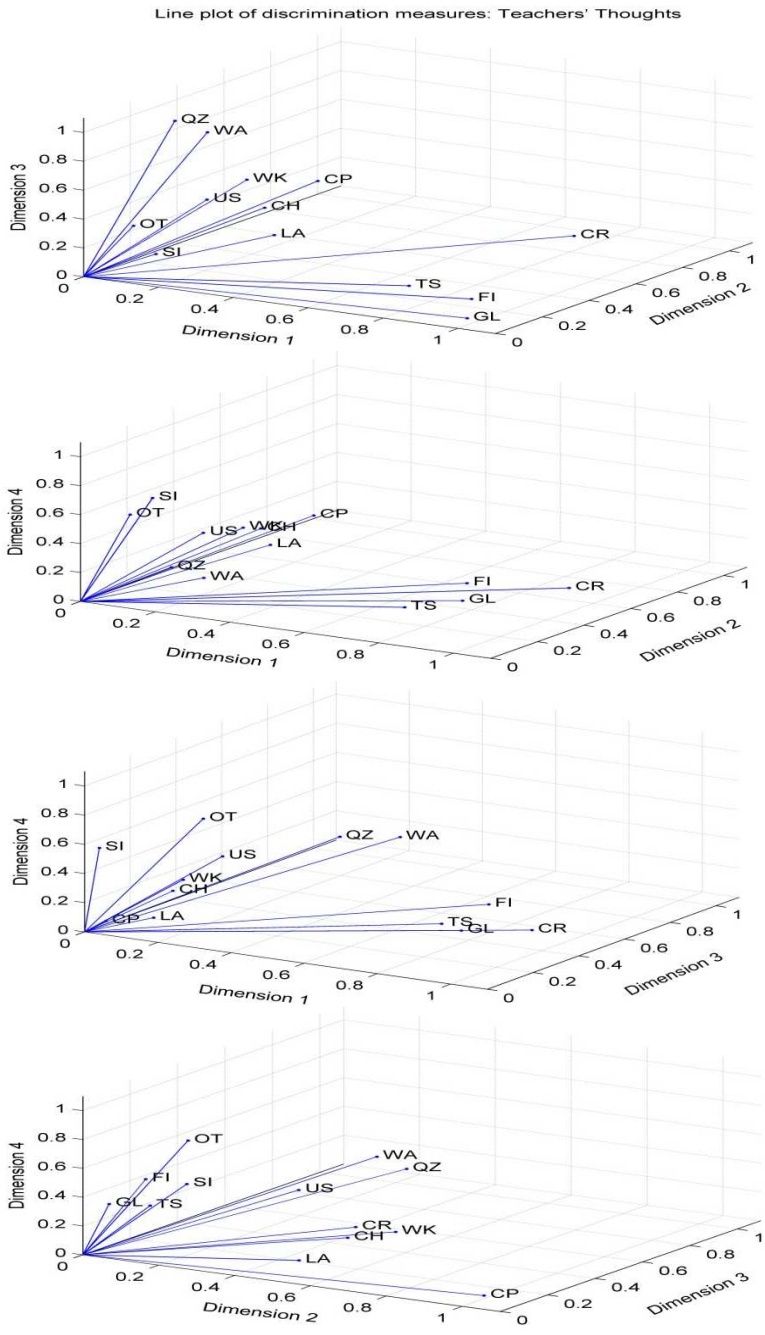

Figure 2: 3D Line Plots for the case of teachers for all unique combinations of the dimension triplets. The abbreviations correspond to the variables as coded in Table 2.

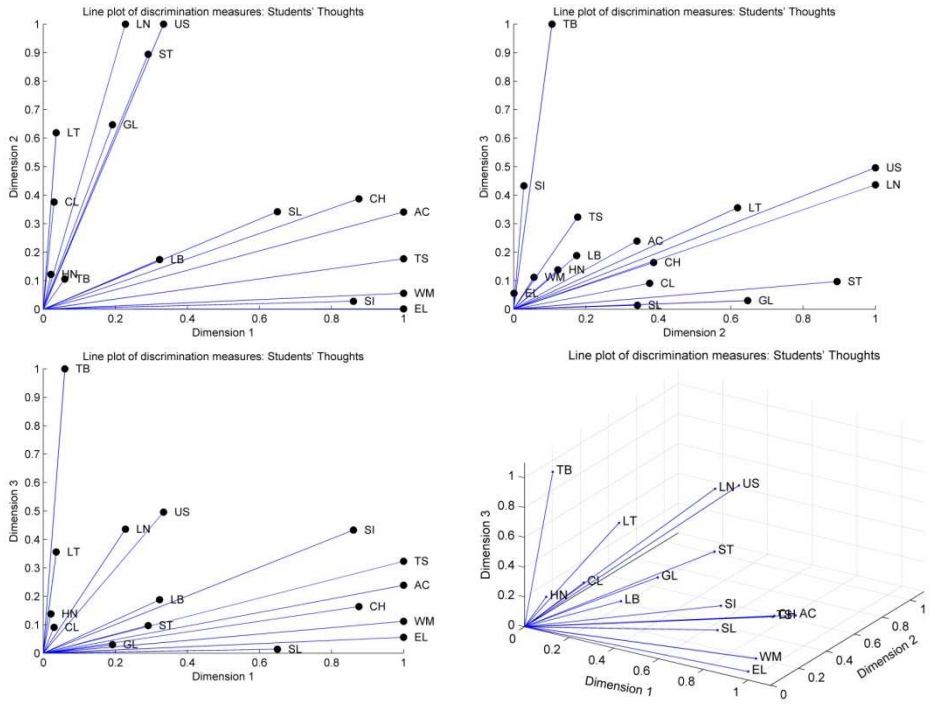

Figure 3: 2D/3D Line Plots for the case of students for all unique combinations of the dimension pairs/triplets. The abbreviations correspond to the variables as coded in Table 2.

4 Focus on Teachers' Profile

4.1 Dimension 1: Activities

The first dimension explains the types of activities valued by teachers when using the LMS Moodle. Statistical results seem to confirm that there is a strong relationship between the use of different asynchronous tools (e.g., files/resources, glossary), the content repository, and the teacher-student interaction (see Tables 1 and 2). Indeed, the significant increase of Free/Open Source Software (F/OSS) philosophy, associated with the concept of asynchronous structures and collaborative activities, has been under discussion by some authors [Yengin et al., 2010]. The pedagogical use of asynchronous tools in a structured way seems to prove the advantage to incorporate collaborative online activities, since they are flexible tools, i.e., teachers can explore, adopt and adapt them for personal use [Ronen et al., 2006]. In this sense, some studies have shown that F/OSS applications, supported by a model-based interoperability, have facilitated the process of creating, editing, formatting (Web content), reuse and export learning content with Sharable Content Object Reference Model (SCORM) standards (e.g., XHTML editor (eXe), http://exelearning.org) [Doherty et al., 2007]. Most teachers, however, tend not to exhibit Technological Content Knowledge and

Technological Pedagogical Knowledge to enable them to build both their Web pages and their collaborative e-activities [Mishra and Koehler, 2006]. Nevertheless, quality, ownership value, validity and reliability of open source software systems, sometimes, seem to turn out to be less transparent and even confusing for teachers [Yengin et al., 2010]. In fact, most LMSs appear to be poorly utilised in educational institutions, being primarily used to facilitate access to documents used in lectures and PowerPoint presentations, i.e., as a common content repository [Sclater, 2008]. One of the interviewees still reveals the following: *"Simply responding to emails, sometimes it becomes a rather tiresome. Right now, I am also using some resources, forum postings and assignments. However, I think that student's assessment and teaching process are not so easy to do in an online environment"* (Teacher#26). The results also seem to suggest that this cluster of teachers believes that the LMS Moodle ecosystem is a privileged environment that can empower the triangular relations of student-teacher-content interaction. In turn, the literature emphasizes that the increase of interaction between teachers and students tends to allocate a more flexible and adaptable learning, allowing for more individualization of learning, accessible at anytime, anywhere [Bates and Sangrà, 2011; Ifenthaler and Pirnay-Dummer, 2011].

4.2 Dimension 2: Interaction

The second dimension refers to the level of understanding teachers have about the usage of several interactive tools in LMS Moodle. Considering the statistical analysis results (see Tables 1 and 2), it seems fair to state that there is a strong correlation between the use of distinct communication tools (e.g., wiki, chat) and education level (courses at postgraduate level). Muirhead and Juwah [2004] characterize the interaction dimension as a set of: i) abstract characteristics (e.g., facilitation of interpersonal communication) and ii) interaction types (e.g., learner-instructor interaction), in which communication can be established synchronously or asynchronously. In this dimension, teachers seem to reveal some implicit knowledge from several synchronous and asynchronous tools. In this context, Lakhan and Jhunjhunwala [2008:37] note: *"Among the import Web 2.0 features are social networking sites, video-and photo sharing sites, blogs, RSS feeds, tags, podcasts, wikis, and discussion forums. Knowledge transfer has become a two-way process, with users both receiving and contributing information. As a result, information has become a common and accessible commodity, circulated via interactive communities"*. Some studies, for example, reinforced the prospect that teachers within an LMS mostly use repository/delivery content and an administrative tool, with the latter being used moderately as communication learning and interaction tools [Morgan, 2003]. One of interviewees stated that: *"I need more time to feel comfortable with interactive tools, such as wikis, assignments, forums or a chat (...) because the use of technology is very time-consuming"* (Teacher#3). Effectively, different levels of education (graduate or undergraduate) reveal different educational needs, which differ from using online CMS. In this scenario, a fairly recent study [Dell'Aquila et al., 2008], showed a repository of teaching modules to embed an organized and differentiated database, attending to the genuine different needs of students, different curricula, as well as different levels of education.

4.3 Dimension 3: Assessment

The third dimension refers to the teachers' understanding of how to assess students using a LMS. Statistical results suggest that there is a positive association between the use of work assignments and learning activities (e.g., quiz) (see Tables 1 and 2). The possibility of monitoring the students' progress within a LMS was also looked upon as a key element in the process of co-construction of knowledge, once it helps teachers to provide students with formative feedback on their learning progress. In this context, an interviewee stated that: *"I think that online resources, weekly assignments and different ways of using formative assessment tools promote the students' motivation and engagement in the learning process"* (Teacher#20). In order to strengthen the institutional commitment and interpersonal accountability of students in the teaching-learning process, some studies show that the development of a harmonious and effective online course seems to depend on feedback interventions and motivational strategies used, i.e., promoting a rich environment for active learning [Yengin et al., 2010]. Indeed, issues related to the pedagogical design, assessment activities, and feedback (interactive and formative) seem to be fundamental features that allow to validate (or to ensure) the online formative assessment in HE [Gikandi et al., 2011]. Some authors also reinforce the importance of collaborative activities and strategies in the construction of knowledge, in other words: *"Engaged learning is a collaborative process in which the teacher and student are partners in construction knowledge and answering essential questions. This strategic approach includes setting goals, establishing timelines, and creating and assessing authentic products"* [Conrad and Donaldson, 2010:8]. Perhaps, both feedback-based evaluation and proactive community of practice seem to be critical components for the effectiveness of teaching-learning process.

4.4 Dimension 4: Collaboration

The fourth dimension refers to the way teachers understand the creation of a collaborative community in a LMS. A positive relationship was also observed between the sharing information and online tasks (see Table 1 and 2). In this dimension, teachers are more concerned with the creation of social networks, as well as a privileged space to provide research and information sharing, collaborative learning and networking (e.g., discussion forums, debates). In turn, the concept of collaboration is based upon a set of interactions with various complexity levels – such as lesson structure, types of learning task [Tutty and Klein, 2008], students' and teachers' beliefs, type of communication tools and, perhaps, the stakeholder circle in an educational institution. In this sense, blended collaborative learning can assist students to feel more interactive and also exerts a positive influence in terms of motivation, behaviour and self-determination, as well as engagement in learning activities [Wijnia et al., 2011]. In this context, an interviewee reported that: *"I believe that the main advantages in using Moodle platform are the possibility of re-designing pedagogical strategies, interdisciplinary collaboration and interactive network; but, sometimes, it was difficult for me to find the appropriate tools"* (Teacher#30). The development of a community of practice (CoP) based on collaborative learning can arise from meeting of minds, i.e., when students within the clusters begin to discuss their solutions online [Wheeler, 2005]. More recently, some institutions have

integrated in LMS Moodle other user-friendly systems (e.g., Learning Activity Management System - LAMS, http://www.lamsinternatioal.com/) with particular potentialities in design (e.g., LAMS sequences) and management of collaborative learning activities [Cram et al., 2010]. Accordingly, this dimension seems to be more focused on real opportunities and creative approaches applying social media in collaborative work, i.e., how to use the features available in LMS Moodle in order to enhance social work research, networking or knowledge-sharing network [Bosman and Zagenczyk, 2011].

5 Focus on Students' Profile

5.1 Dimension 1: Interactive learning environments

The first dimension explains the type of learning community valued by students. Findings appear to suggest that there is a highly positive correlation between the use of several communication tools (e.g., webmail, chat), the benefits of interaction (e.g., teacher-student interaction), the self-regulation processes (e.g., self-regulated learning), and the accessibility/efficiency of LMS Moodle (see Tables 1 and 2). The interaction is considered as a determinant factor in online learning, once it may condition the success of the learning outcomes (or construction of knowledge) and the quality of online learning *per se* [Maor and Volet, 2007]. Some researchers demonstrated that the creation of a learner-centred LMS implies some interaction relationships associated with online learning, i.e., learning-interface, learner-self, learner-content, and learner-learner [Hirumi, 2009]. In this perspective, the features of LMSs will allow a flexible and rich context, i.e., an adaptive ecosystem, that can integrate different interactive learning activities. Based on the students' responses, the improvement of LMS interactivity may result in the students' higher satisfaction; in other worlds: *"I believe that some teachers are more comfortable using interactive tools, such as wikis, assignments, forums or a chat than others (...) depends on the subjects, but we have more motivation and high-interest for interactive activities; I think that the learning process is, this way, easier and more attractive"* (Student#17). For instance, social computing can be used to communicate and collaborate in several ways, e.g., using various types of media in order to promote the students' network, and considering both knowledge construction and sociocultural perspective.

5.2 Dimension 2: Training

The second dimension identifies the relevance of training towards an efficient LMS use. In other words, results obtained from the present study also appear to indicate that there is a positive relationship between the lack of time (to explore the potential of LMS Moodle), the need to integrate other resources (e.g., linkability to other systems, glossary), the students' ICT training, and the LMS usability (see Tables 1 and 2). In fact, the new arena and the new challenges (in an era of globalization) perhaps deserve new models in the development of the teaching-learning process. Some studies have shown that the faculty members need more time to expand experience in technology-based instruction (e.g., e-moderation [Salmon, 2000], integration of ICT [Mishra and Koehler, 2006]), with the purpose of improving their technological and methodological knowledge for their own and for their students.

From the students' responses, it is obvious that lack of time to explore the potential of the LMS Moodle is still a relevant limitation. One of the students interviewed said that: *"I need more time to explore several activities and useful tools of the Moodle platform, such as chats, wikis, and forums or how to send assignments to the teacher! In some situations I do not know how to effectively use the platform tools and, for example, how to communicate with my colleagues"* (Student#11). Indeed, many interactive learning environments are a combination of multimedia with the hypertext, which incorporate analogous or associative characteristics, accessibility, linkability, intuitiveness, and nonlinear organization [McGuire, 1996]. Thus, the integration of non-linear, multi-sensorial, and multimodal interactive systems, tends to offer strong potential to expand learning opportunities and strengthen underlying assumptions to individual construction of knowledge. Certainly, technology knowledge in online learning environments tends to be an emerging need, requiring *"a new set of skills for most educators and learners"* [Simonson, 2005a:284]. However, surprisingly, the results of a study conducted in 2005 by EDUCAUSE showed that more than 36% of students surveyed consider that they do not need additional training to ICT use in their courses [Kvavik and Caruso, 2005]. In turn, Oh and Park [2009] argued that lack of faculty motivation to integrate technology into its online courses is considered the most important challenge for the implementation of blended teaching.

5.3 Dimension 3: Teachers' beliefs and subject matter

The third dimension identifies the importance of teachers' attitude in the use of the LMS Moodle. Based on statistical analysis results, it seems reasonable to assume that there is a strong association between the teachers' beliefs and subject matter, e.g., cultural issues, computer self-efficacy beliefs, and subject differences in the content areas (see Tables 1 and 2). Even though there is an increasing awareness of teachers about the value of training as to ICT use, relatively few teachers are prepared to incorporate ICT into their teaching activities [Wang et al., 2004]. In fact, external obstacles (e.g., access, training, local support) and internal obstacles (e.g., teacher's beliefs, teacher's self–efficacy, teacher's attitudes) were defined as two categories of obstacles that influence the teachers' ICT implementation efforts [Ertmer, 1999]. Moreover, (multi) cultural identities and thinking processes have also frequently been stressed as barriers to the integration of ICT in the education processes [Correa et al., 2008]. According to Simonson and Crawford *"cultural differences play a large role in how distance learners from different parts of the world interact with teaching and learning"* [2005b:95]. In students' point of view, the differences in the teachers' behaviour (in LMS Moodle) were essential due to the teachers' personal beliefs/knowledge: *"I think that some teachers are more familiar with the technology and others just do not use the tools and resources that are available in the LMS, (...) they need to be more self-confident about using the LMS for teaching-learning activities"* (Student#32). There is also evidence that, teachers with a strong sense of self-efficacy that are open to new ideas and new strategies have also been associated with an attitude towards efficacy on computer use in education [Compeau and Higgins, 1995]. Some studies have also shown that the disciplinary differences are important factors in design and development of an online course [Arbaugh et al., 2010]. Accordingly, distance learning in applied disciplines (e.g., Engineering,

Nursing, Education) tends to be more diversified and more geared to a CoP, compared to the pure online disciplines (e.g., Nature Sciences, Humanities, Social Sciences).

6 Towards an Inclusive LMS Moodle

Educational systems and HEI working together could be strategically guided to influence society. In this sense, a main concern for institutions should be to understand the real meaning of individual's multiple identities/multiple sociocultural identities, embedding the sound of equality and diversity issues (particularly at a time when HEI are facing with increased diversity in the students' population). In addition, the impact of globalization from the combined perspectives of the different dimensions of e-community and e-identity may justify innovative methodologies in the design, implementation and development of the teaching-learning process [Wenger, 1998]. Unfortunately, in HEI is not so easy to identify practices that respond to students' special needs; however, in order to get relevant improvements in the educational process it seems clear that the most innovative changes should embrace inclusive and universal principles to develop new or improved methods of e-teaching and e-assessment, which appear to simultaneously require a generous mental effort [Clark, 2003].

In this study, a first step was to identify in the LMS Moodle the users' profiles and their needs, revealing a clear diversity and heterogeneity of users' profile (directly) and courses (indirectly). In a second step, the Moodle LMS can be easily extended to improve/integrate current components features (e.g., integration of the EU4ALL framework, http://www.euall-project.eu/) and simultaneously deal with accessibility issues, such as alternative media for text, audio or image contents, in order to intelligently/dynamically adapt the user interface to all heterogeneity of users (including students with disabilities or students with special needs).

More specifically, the focus on teachers' technological training seems to play a key role in supporting learners to access online learning opportunities in a proactive and personalized way. Also, it seems important to remember that technology and teaching-learning applications do not of themselves immediately solve inclusive learning. On the other hand, from a holistic perspective, b-learning can really have positive impacts for both teachers and students, particularly in making accessible, flexible and encouraging more independent learning [Bonk and Reynolds, 1997; Coombs, 2010].

Apparently, towards an inclusive b-learning environment, a set of mediators is also necessary to assist the management of the interactions of the users with the LMS. To this end, among others, interactive tools, interoperability/linkability issues, educational standards (e.g., SCORM), multi-modal resources, instructional differentiation, assessment/feedback resources (previously discussed in Sections 4 and 5) must be incorporated in the LMS Moodle to support different types of users with diverse needs. If we consider the users' profiles described in the previous sections as an additional source of information, then optimization processes could take place that could be fed into the LMS Moodle and, by affecting some structural elements, could increase the accessibility of the outputted b-learning to the receivers (teachers and students). This is schematically presented in Fig. 4, where the depicted diagram shows an ordinary LMS with its inputs and output, blended with additional branches

(represented by the dashed squares) that control the LMS Moodle output (inclusive b-learning).

Inclusive b-learning can truly represent an opportunity to enhance an institution's position, expand access to institution's educational offerings, facilitate social dynamics, and also reduce operating costs. According to Wenger *"...focusing on identity brings to the fore the issues of non-participation as well as participation, and of exclusion as well as inclusion. Our identity includes our ability and our inability to shape the meanings that define our communities and our forms of belonging"* [1998:145]. Additionally, with the development and implementation of interoperability standards, it will be easier to find and select content for individual students; nevertheless, it is vital that CMS administrators follow the WWW accessibility guidelines and interoperability principles, in order to represent a remarkable advantage to students with disabilities and a real motion to equal learning opportunities for all students, and, as a result, to try to guarantee universal inclusion practices [Coombs, 2010; Peacock et al., 2002]. In others words, the administrators also need to be aware of the whole landscape about what, why and how decisions are made about the inclusive and accessible technologies.

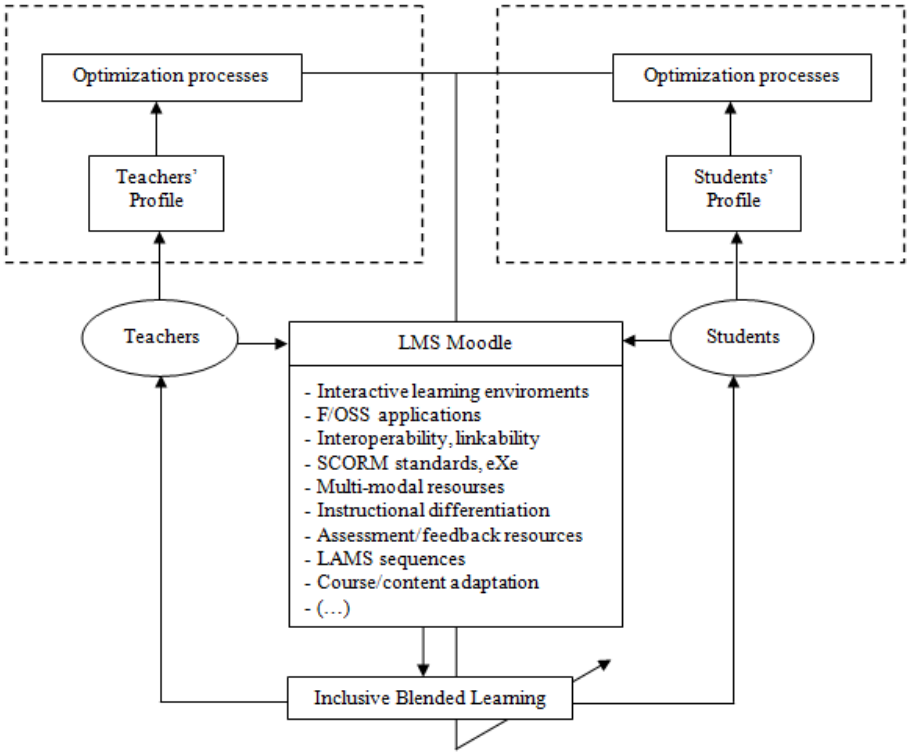

Figure 4: Graphical representation of the research design towards inclusive b-learning. The dashed squares represent additional information deduced from this study incorporated with the standard version of LMS Moodle.

Considering these perspectives, HEI will need to continue the hard work to make the information society feel the purposes of accessibility and info-inclusion truly real, once the legislation by itself cannot educate both hearts and minds.

7 Conclusion and Future Work

There are indicators that showed that users (teachers and students) were motivated to use the LMS Moodle and the online learning environment seems to be flexible and user-friendly. Our findings suggested important signs that reflect the emerging need of a new and more inclusive model in techno-pedagogical strategies, in order to develop technological, pedagogical and methodological teachers' e-skills. In summary, distinct teachers' profiles, i.e., activities-oriented, interaction-oriented, assessment-oriented, and collaboration-oriented, and students' profiles, i.e., interactive learning environment-oriented, training-oriented, teachers' beliefs-oriented, were identified/discussed as key issues, representing the sociocultural framing of educational thought and, perhaps, practices on online distance education.

The present study has a limitation that must be considered when interpreting the results. In particular, the interview sample is not representative of the overall group of users (teachers and students) at the university and it is a small-scale study that documents an individual institution's effort, holistically concerned with ICT integration and quality of their use.

In terms of recognizing, understanding and responding to the academic community's specific needs, this study can support an inclusive, multi-dimensional and holistic ICT knowledge for choosing adjustable teaching strategies. At the same time, a more concrete awareness of the profiles enables teachers to choose more accurate teaching strategies to meet the students' specific requirements, something that could be of particular interest for students with disabilities, enhancing, therefore, the level of co-responsibility and educational value about accessibility issues for inclusive b-learning scenarios in HEI.

As part of future work, we intend to scrutinize the emerging concept of Massive Open Online Courses (MOOC) recently introduced by Downes and Siemens [McAuley et al., 2010]. Globally speaking, the MOOC methodology, i.e., free online courses designed to be an all-inclusive learning experience, is based on a wide blend of traditional tools, such as video lessons, evaluation tests and final exams combined with Web 2.0 tools (e.g., community of learning, wiki, blog, social media), and already offered by the top USA institutions, like Harvard, MIT or Stanford. Based upon *connectivism* and considering particular characteristics, such as diversity, autonomy, openness, self-organization, interactivity/connectivity for sharing knowledge, this approach can represent a unique opportunity to discover more about how, where, when, what and with whom people can learn in large open networks.

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