Towards an Enhanced Learning Management System for Blended Learning in Higher Education Incorporating Distinct Learners’ Profiles

Sofia Balula Dias* and José Alves Diniz
University of Lisbon, Faculty of Human Kinetics, Estrada da Costa, 1495-688 Cruz Quebrada, Lisbon, Portugal // sbalula@fmh.utl.pt // jadiniz@fmh.utl.pt

*Corresponding author

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ABSTRACT
In a blended education context, Learning Management Systems (LMS) can be thought to integrate collaborative and interactive learning activities; this, however, requires a strong institutional and sociocultural commitment from all stakeholders. Consequently, an empirical study that aims at identifying learners’ profiles and uses them as an optimization feedback-like process to the LMS towards effective blended (b-)learning was adopted here. The latter involved 36 undergraduate students with variant b-learning activity at a public Higher Education Institution. In a synergetic combination of qualitative and quantitative evidences, semi-structured face-to-face interviews were conducted and validated, and a systematic multivariate content analysis was articulated. Results revealed three distinct students' profiles oriented to interactive learning environment, Information and Communication Technologies (ICTs) teachers’ beliefs, and students’ training. Under this multifaceted scenario, a rethinking of the LMS within the b-learning environment could be approached through the enhancement of interactivity, fostering users’ ICT acquaintance, and incorporating further training.

Keywords
Learning Management System, Blended learning, ICT knowledge, Higher Education, Learners’ profiles

Introduction
World Wide Web phenomena, in general, and the Web-based Instruction, in particular, can open up (re)new opportunities for the development of micro-educational environments. The current paradigm shift from traditional educational environments to online educational environments in higher education can also be seen as a challenge to create an active and interactive learning environment, one which gives the learner opportunity to engage and think in multiple ways (Bonk & Reynolds, 1997). In fact, there is a variety of electronic learning (e-learning) environments that consider and combine different Information and Communication Technologies (ICTs) tools and instructional strategies; nevertheless, blended learning (b-learning), which combines face-to-face and online learning, has been considered as “the most common mode of e-learning” (Bates & Sangrà, 2011a, p. 42). Actually, b-learning meets multiple and differentiated instructional online activities, therefore it has the potential, human and technological, of accommodating students with distinct learning needs. In this sense, ICT can potentially be used: i) to support creative and collaborative learning activities in distance education, which can easily emerge from a “meeting of minds”, where clusters of students can both work and discuss ideas online (Wheeler, 2005, p. 151); and ii) to create a learning culture that supports the students’ individual processes. Multi-stakeholders (e.g., alumni, faculty and administrators), nevertheless, should be actively engaged in this process to encourage a more holistic, comprehensive, co-constructive and globally convergent attitude.

Accordingly, some studies suggest that the development of a harmonious and effective online course depends on feedback interventions and motivational strategies (Fisher & Baird, 2005; Simonson, 2005). In addition, pedagogical design, assessment activities, as well as feedback, seem to represent key features to validate the online formative assessment in higher education (Beatty & Gerace, 2009; Gikandi et al., 2011). In turn, Simonson et al. (2011) have argued that rethinking and reorganizing online teaching and learning dynamic through emergent phenomena, such as group interaction, collaboration and teamwork, requires the establishment of complex/golden roles in the process of higher-order collaborative learning and construction of knowledge. In fact, an effective b-learning environment enables users to participate in the co-creation, produsage, of knowledge through social and technological affordances, and to promote skills and competencies, such as creativity, adaptability, communication and higher-order thinking (Redecker et al., 2009).
To improve the quality/optimization of a b-learning process it seems reasonable to take into account both educational resilience and interpersonal engagement, in order to understand constructivist and sociocultural core principles. Furthermore, technological systems, and their analogous tools, can be valuable educational instruments in b-learning, depending on the way they are used. From the latter perspective, Learning Management Systems (LMSs) have been structured, as a means to manage teaching and learning activities in an online learning environment, such as that of b-learning (Black et al., 2007). A typical LMS embeds agents that belong to an interactive learning environment assisted by mediating tools that support, for example, inter/intra-action, collaboration, training, communication and sharing information amongst the LMS users. Regrettably, some LMSs are primarily used as a tool set for information distribution and administrative effectiveness rather than a system with potential to improve teaching and learning activities (Black et al., 2007; Kvavik et al., 2004). To achieve the latter, the role of the LMS users should be taken into consideration. In particular, in a process that focuses on learning, it is particularly important to provide an enriched educational experience to all students in an environment that is supportive and inclusive. Thus, in order to prevent these specific technological and emotional weaknesses, it seems essential to evaluate the multidimensional and dynamic usability nature of a LMS, i.e., effectiveness, learnability, flexibility and the users’ attitude (Shackel, 2009). From this perspective, some questions arise, regarding the effect of the LMS structure on the students’ learning and vice versa, i.e., the perception of the role and functionality of a LMS in their effective learning and social engagement. In this line, for example, Jones et al. (2008) from an academic perspective, specifically in coursework, suggest that the use of internet-based LMS is not necessarily correlated with student’s satisfaction. Obviously, there is a need to further examine the way LMS is affected by the learners’ profiles, in an effort to incorporate the latter information in the enhancement of its design. This sets the basic rationale for the current study, as explained in details in the following section. Subsequently, the methodology used, along with study design, participants’ characteristics, data collection and implementation issues are included in the succeeding section. Next, results from the research study are reported, followed by discussion about the optimization processes that need to be considered for the further enhancement of LMSs according to the learners’ profiles previously presented, giving also some future research directions. Finally, the paper ends with the main research conclusions.

Research rationale

The rational of this study was to assess students’ needs and to identify and understand their profiles, in order to optimize the quality of online teaching and learning, in a specific b-learning context within a LMS environment. In this way, the learners’ profiles could shed light upon some specific issues concerning the key factors of the LMS structure and reveal the weaknesses and drawbacks that need further consideration.

Usually, a LMS under the b-learning perspective includes structural parts that assist a managerial administration of the knowledge carriers, realized through an interactive learning environment (see Figure 1). Apparently, a set of mediators is also necessary to assist the handling of the interactions of the users with the LMS. To this end, mediating tools that, amongst other, foster users’ inter/intra-actions, collaboration, training, communication, data logging and sharing information are included in the LMS (see Figure 1). The role of the LMS is to increase the efficiency of the b-learning that is received by its users, i.e., learners (explicitly) and teachers (implicitly). If we consider the learners’ profiles as an additional source of information, then optimization processes could take place that could be fed into the LMS and, by affecting some structural elements, could increase the efficiency of the outputted b-learning to the receivers. This is schematically presented in Figure 1, where the depicted block-diagram shows an ordinary LMS with its inputs and output, combined with an additional branch (included in the dashed rectangular) that controls the LMS output (efficiency of b-learning).

The motivation to focus upon the learners’ profiles as a first priority was drawn from the fact that the whole process of b-learning is actually designed for them and they are the main receivers of knowledge through their interaction with the LMS environment (individually and/or within groups). Hence, their role in the latter could be approached twofold, i.e., as simple users (passive mode) and as contributors to the enhancement of the LMS functionality by identifying points of improvement and expressing their opinions after its use (active mode). Considering the information from the active mode, the LMS becomes more functional and encourages learners’ participation and contributions. In a step further, teachers’ profiles could also be incorporated, yet with a reference to the learners’ ones, as there is a kind of cause-effect dependency among them (see further analysis on this issue at the discussion section).
As the learners in the active mode act as a kind of feedback to the LMS, their profiles were approached with care, eliminating any potential subjective bias, fostering the objective dimensions that lie in their responses. To this end, a specific methodological approach was adopted that handles multivariate categorical data acquired from the learners, as described in the succeeding section.

**Methodology**

The methodology adopted here for acquiring learners’ profiles combines both qualitative and quantitative evidence in a synergistic way, i.e., using qualitative data for understanding the rationale and theory underlying relationships revealed in the quantitative data and, in turn, avoiding any false impressions and subjective interpretations from qualitative data.

The qualitative evidence was based on a semi-structured face-to-face interview of the learners in the active mode, with questions previously validated from experts in the field. The interviews were structured in four distinct parts, hereafter designated as Categories. Category 1 enabled the characterization of the communication tools used in the LMS environment (*LMS Moodle tools*), Category 2 aimed to analyse the potential benefits of the LMS concerning the collaborative and interactive network (*Potential strengths*), Category 3 aimed to understand the concerns about the use of LMS (*Weaknesses*), and Category 4 intended to retrieve data regarding the students’ expectations to future LMS usage (*Students’ suggestions*). The combination of the qualitative data from Categories constructs the data space, which reflects information about the students’ satisfaction with the use of the b-learning in the LMS environment, their perception of it and the instructional strategies/tools were used. The qualitative data space is then subjected to quantitative analysis using the content analysis software MAX Qualitative Data Analysis (MAXQDA, http://www.maxqda.com) to develop a classification/coding system, i.e., construction of the quantitative data space. The latter, then, was coded into a large number of subcategories, reflecting both the research questions and the themes which emerged from a close analysis. The coded data produced were statistically explored and articulated using the statistics analysis software SPSS18 (http://www-01.ibm.com/software/analytics/spss/). A Multiple Correspondence Analysis (MCA) was then conducted, since it is considered a useful technique for the structural analysis of multivariate categorical data and is also suitable for reducing the dimensionality of the original
categorical variables set (Benzecri, 1992). In fact, the MCA is a factorial method that displays categorical variables in a property space, which maps their associations in two or more dimensions. From a table of \( n \) observations and \( p \) categorical variables, describing a \( p \)-dimensional cloud of individuals \((p < n)\), the MCA provides orthogonal axes to describe most of the variance of the whole data cloud. The fundamental idea is to reduce the dimensionality of the original data thanks to a reduced number of variables (factors), which are a combination of the original ones. The MCA is generally used as an exploratory approach to unearth empirical regularities of a dataset (Benzecri, 1992).

The characteristics of the participants in the study, along with some implementation issues are described in the succeeding subsection.

### Participants’ characteristics & Implementation issues

In order to get a holistic overview of how the LMS has been used to potentiate the b-learning, the perspectives of the students of five different courses (Sport Sciences, Ergonomics, Dance, Sport Management and Psychomotor Rehabilitation) offered by a public Higher Education Institution (HEI), i.e., Faculty of Human Kinetics, University of Lisbon (Portugal), were acquired via the aforementioned interviews. These courses reflect the core of the curriculum of the specific HEI, involve a high number of students each academic year and offer a distinct LMS-based b-learning environment.

In an effort to select the learners’ sample as objectively as possible, from a total of around 800 LMS undergraduate users, two distinct groups were formed according to the frequency of LMS usage, i.e., the most active students (Group 1, 18 students) and the less active ones (Group 2, 18 students), resulting in a total number of \( n = 36 \) selected undergraduate participants. In this way, the diversity between the learners’ groups is taken into account in the data space (deviant sample) [27]. This selection was based on the available data from LMS website, considering three usage indicators that refer to: (i) number of views, (ii) number of contributions and (iii) total activity in the LMS environment. In general, the more and less active students were selected in each course, according to number of hits, i.e., total access, allowing to differentiate between Group 1 (Median; Inter-quartile Range [75%-25%] = 2856.5; 1290.3) and Group 2 (Median; Inter-quartile Range [75%-25%] = 737; 623). It should be noted that the distribution of the number of participants for each LMS-based course was similar across the two groups. Moreover, the concept of a random sample was not adopted here, since although it provides the best opportunity to generalize the results to the population, is not the most effective way of developing an understanding of complex issues relating to human behavior (Marshall, 1996).

From the 36 undergraduate participants involved in the study, 61% of them was female, while their age ranged from 18 to 48 yrs (mean±standard deviation = 22.05±5.44 yrs). Data were collected at the end of the first semester of the academic year 2010/2011 (January), whereas the 53% of these participants (19) started to use the LMS (i.e., made their first access) in the academic year 2009/2010. In fact, 33% (12) of them made their first entry in September 2009 and 47% (17) reached their peak activity during the 5-month period, from January to May 2011 (see Table 1). All participants used b-learning via LMS Moodle (http://moodle.org/) for at least 6 months.

<table>
<thead>
<tr>
<th>Categories/Time period</th>
<th>Number of students (n = 36)</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First access in LMS (academic year)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008 / 2009</td>
<td>2</td>
<td>5.56</td>
<td></td>
</tr>
<tr>
<td>2009 / 2010</td>
<td>19</td>
<td>52.78</td>
<td></td>
</tr>
<tr>
<td>2010 / 2011</td>
<td>15</td>
<td>41.67</td>
<td></td>
</tr>
<tr>
<td><strong>First entry in a subject (month, year)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>September, 2008</td>
<td>2</td>
<td>5.56</td>
<td></td>
</tr>
<tr>
<td>September, 2009</td>
<td>12</td>
<td>33.33</td>
<td></td>
</tr>
<tr>
<td>October, 2009</td>
<td>5</td>
<td>13.89</td>
<td></td>
</tr>
<tr>
<td>November, 2009</td>
<td>1</td>
<td>2.78</td>
<td></td>
</tr>
<tr>
<td>January, 2010</td>
<td>1</td>
<td>2.78</td>
<td></td>
</tr>
<tr>
<td>September, 2010</td>
<td>10</td>
<td>27.78</td>
<td></td>
</tr>
</tbody>
</table>
The acquired interviews were initially audio-recorded and followed by a verbatim transcription, i.e., thirty-six protocols were obtained through the interview transcriptions (Student01-Student36) and formatted so they could be fed in the MAXQDA software. Three interviews were also chosen randomly for the purpose of testing the coding reliability. Furthermore, the first three dimensions of MCA that explain most inertia and have high eigenvalues were kept. This follows what Benzecri (1992) suggests, noting that this limit should be fixed by user’s capacity to give a meaningful interpretation to the axes he keeps by checking eigenvalues and the general meaning of dimensions. In addition, the threshold value for the weighted correlations adopted in the MCA to perform dimensionality reduction was equal to 0.5, so only the important variables to be considered per dimension. Finally, the combination of qualitative and quantitative analyses established a methodological triangulation (Denzin, 1970; Fielding, 2009). In the section that follows, analysis results are described in details.

**Results**

The content analysis using MAXQDA software performed in the interviews allowed to associate a set of items, i.e., Subcategories, to each Category (defined in Methodology Section). Subcategories in each Category emerged as the most important topics from the interviews corresponding to Text Units (TU). The latter were codified as a unit of meaning, a word, a phrase or a paragraph, using the semantic criteria in a hermeneutic interpretation. The emerged Subcategories per Category along with the corresponding total TU are tabulated in Table 2.

**Table 2. Subcategories per Category that emerged from the content analysis of interviews using MAXQDA software, along with the corresponding total text units (TU)**

<table>
<thead>
<tr>
<th>Category</th>
<th>Subcategory</th>
<th>TU Total</th>
<th>TU (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMS Moodle tools</td>
<td>Quiz</td>
<td>6</td>
<td>2.38</td>
</tr>
<tr>
<td></td>
<td>Wiki</td>
<td>10</td>
<td>3.97</td>
</tr>
<tr>
<td></td>
<td>Webmail</td>
<td>24</td>
<td>9.52</td>
</tr>
<tr>
<td></td>
<td>Forum</td>
<td>31</td>
<td>12.30</td>
</tr>
<tr>
<td></td>
<td>Label</td>
<td>13</td>
<td>5.16</td>
</tr>
<tr>
<td></td>
<td>Files/resources</td>
<td>50</td>
<td>19.84</td>
</tr>
<tr>
<td></td>
<td>Chat</td>
<td>13</td>
<td>5.16</td>
</tr>
<tr>
<td></td>
<td>Glossary</td>
<td>8</td>
<td>3.17</td>
</tr>
<tr>
<td></td>
<td>Assignment</td>
<td>44</td>
<td>17.46</td>
</tr>
<tr>
<td></td>
<td>Linkability to other systems</td>
<td>53</td>
<td>21.03</td>
</tr>
<tr>
<td></td>
<td>total</td>
<td>252</td>
<td>100.00</td>
</tr>
<tr>
<td>Potential strengths</td>
<td>Teacher-student interaction</td>
<td>36</td>
<td>14.52</td>
</tr>
<tr>
<td></td>
<td>Courses at postgraduate level</td>
<td>2</td>
<td>0.81</td>
</tr>
<tr>
<td></td>
<td>Sharing information</td>
<td>17</td>
<td>6.85</td>
</tr>
<tr>
<td></td>
<td>Content repository</td>
<td>59</td>
<td>23.79</td>
</tr>
<tr>
<td></td>
<td>Organization</td>
<td>20</td>
<td>8.06</td>
</tr>
<tr>
<td></td>
<td>Efficiency in learning</td>
<td>9</td>
<td>3.63</td>
</tr>
<tr>
<td></td>
<td>Communication</td>
<td>31</td>
<td>12.50</td>
</tr>
<tr>
<td></td>
<td>Accessibility</td>
<td>19</td>
<td>7.66</td>
</tr>
<tr>
<td></td>
<td>Usability</td>
<td>28</td>
<td>11.29</td>
</tr>
<tr>
<td></td>
<td>Self-regulated learning</td>
<td>15</td>
<td>6.05</td>
</tr>
<tr>
<td></td>
<td>Collaboration</td>
<td>10</td>
<td>4.03</td>
</tr>
<tr>
<td></td>
<td>total</td>
<td>248</td>
<td>100.00</td>
</tr>
</tbody>
</table>

**Weaknesses**

- Students’ low ICT knowledge: 63, 22.99%
Technical issues | 36 | 13.14
Online safety | 8 | 2.92
Age and sociocultural differences | 20 | 7.30
Teachers’ low ICT knowledge | 46 | 16.79
Lack of time | 8 | 2.92
High number of students | 17 | 6.20
Teachers’ beliefs, subject matter | 43 | 15.69
Techno-pedagogical knowledge | 33 | 12.04

Total | 274 | 100.00

Student suggestions

Multi-tool systems | 20 | 13.07
Content reorganization module | 20 | 13.07
Formative feedback | 19 | 12.42
Faculty training | 34 | 22.22
Students’ ICT training | 13 | 8.50
Assessment tasks | 34 | 22.22
Others | 13 | 8.50

Total | 153 | 100.00

Note. Results for each individual Category are described next.

Category 1: LMS Moodle tools

As specified in Table 2, in the LMS Moodle tools category, 252 TU in total were codified. The Subcategory “Linkability to other systems” was the dimension most valued by the students (TU = 53, 21%), followed by the Subcategory “Files/resources” (TU = 50, 20%) (Table 2). In this context, the use of other systems (e.g., class mail, blogs) is reinforced by several of the interviewed students, for instance: “Class mail is restricted to students and teachers do not have access to it. We usually use the LMS to upload documents, sometimes to communicate with teachers. The LMS is an official system and class mail is a more informal online environment, which allows sharing some information or class notes privately” (Student05). Therefore, the LMS seems to be more used as a content repository rather than a collaborative learning environment. Student36 reinforces this perspective when he states: “Basically, I use the LMS to download subject contents, pdf documents, lecture notes or slides.”

Category 2: Potential strengths

In turn, concerning the Potential strengths category, (248 TU in total, Table 2), the Subcategories most valued were “Content repository” (TU = 59, 24%) and “Teacher-student interaction” (TU = 36, 15%), as indicated in Table 2. Similarly, students exposed relevant advantages in using a distance learning system, e.g., to support asynchronous collaborative activities and/or to provide meaningful opportunities of self-regulated learning (Table 2). For instance, some students revealed: “The LMS is very important to download documents, slides, study notes, which help us a lot […] it is extremely convenient and easy to use.” (Student21), and “I usually use the LMS to download documents, music, videos […] information that we really need to write our essays.” (Student07). It was also possible to infer that students consider the LMS Moodle as a social media tool; as reported by one student: “[…] the LMS is an easy way to communicate with teachers, e.g., to submit and share documents.” (Student04).

Category 3: Weaknesses

In the Weaknesses category, 274 TU in total were classified (Table 2). The Subcategory “Students’ low ICT knowledge” includes the highest TU values (TU = 63, 23%), followed by the Subcategory “Teachers’ low ICT knowledge” (TU = 46, 17%) (Table 2). Accordingly, the lack of ICT knowledge of both students and teachers tends to appear as an important limitation. In this context, two interviewees considered that: “In terms of interaction, I do
not know how to use correctly some tools available online learning platform. I know that the LMS has many potential tools, like chat rooms or discussion forum, which allows us to interact and share information with colleagues. But, I only use the LMS to download slides presentations, lecture notes or supplementary texts” (Student11); “Some teachers indicate potential advantages in the use of the LMS and others are much more reluctant to use it, because they only post presentation slides (used in face-to-face sessions) in the platform. I think that the main reason why they prefer to use traditional teaching activities is technophobia, the lack of time, and some do not know how to use the online tools.” (Student23).

Category 4: Students’ suggestions

Regarding the Students’ suggestions category, referring to optimization of the LMS use, 153 TU in total were classified (Table 2). The Subcategory “Faculty training” and the Subcategory “Assessment tasks” symbolize the highest amount of TU coded in this category (TU = 34, 22%) (Table 2). These issues were highlighted by the perspective of a student when he states: “I think that they [the teachers] need to develop technological knowledge, probably through faculty training, and so that they can develop activities using different tools, such as wikis, discussion forums [...] or create learning sequences, such as a Learning Activity Management System activity.” (Student32). Still another student indicated that: “The use of the LMS should be mandatory, teachers should stimulate the use of the platform by defining assignments, the participation in discussion forums (as mandatory) consequently, students would be more motivated to use the LMS.” (Student34).

MCA Dimensions identification

In Table 3, the results of the MCA are presented, using all categorical variables considered in the content analysis of interviews, in order to reduce the dimensionality of the Subcategories reported in Table 2 and better understand their relations. Thus, the MCA technique allowed for the clustering of the Subcategories into three different students’ profiles regarding the LMS use, namely Interactive learning environment (Dimension 1), ICT teachers’ beliefs & differentiation (Dimension 2), and Students’ Training (Dimension 3), considering those Subcategories per Dimension that their weighted correlation exhibits values > 0.5 (denoted in bold in Table 3). The Cronbach’s alpha (α) was considered to determine the reliability and to assess the internal consistency of the dimensions presented above (Benzecri, 1992), and the obtained values were .96, .94 and .93, for Dimensions 1, 2 and 3, respectively. This indicates a good internal consistency and reliability in the definition of the learners’ profiles. Based on these findings, the latter and the corresponding optimization processes (Figure 1) are discussed in detail in the succeeding section.

Table 3. The discrimination measures per variable and Dimension derived from the MCA

<table>
<thead>
<tr>
<th>Variable (Subcategory)</th>
<th>Dimension 1</th>
<th>Dimension 2</th>
<th>Dimension 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Webmail</td>
<td>1.657</td>
<td>.112</td>
<td>.056</td>
</tr>
<tr>
<td>Chat</td>
<td>.876</td>
<td>.164</td>
<td>.387</td>
</tr>
<tr>
<td>Teacher-student interaction</td>
<td>1.363</td>
<td>.323</td>
<td>.177</td>
</tr>
<tr>
<td>Sharing information</td>
<td>.861</td>
<td>.433</td>
<td>.028</td>
</tr>
<tr>
<td>Self-regulated learning</td>
<td>.650</td>
<td>.014</td>
<td>.342</td>
</tr>
<tr>
<td>Accessibility</td>
<td>1.192</td>
<td>.239</td>
<td>.341</td>
</tr>
<tr>
<td>Efficiency in learning</td>
<td>1.225</td>
<td>.056</td>
<td>.001</td>
</tr>
<tr>
<td>Teachers’ beliefs, subject matter</td>
<td>.060</td>
<td>5.637</td>
<td>.106</td>
</tr>
<tr>
<td>Lack of time</td>
<td>.036</td>
<td>.356</td>
<td>.619</td>
</tr>
<tr>
<td>Linkability to other systems</td>
<td>.228</td>
<td>.436</td>
<td>2.075</td>
</tr>
<tr>
<td>Glossary</td>
<td>.192</td>
<td>.030</td>
<td>.647</td>
</tr>
<tr>
<td>Students’ ICT training</td>
<td>.291</td>
<td>.097</td>
<td>.894</td>
</tr>
<tr>
<td>Usability</td>
<td>.334</td>
<td>.496</td>
<td>1.643</td>
</tr>
<tr>
<td>Collaboration</td>
<td>.030</td>
<td>.091</td>
<td>.376</td>
</tr>
<tr>
<td>High number of students</td>
<td>.021</td>
<td>.138</td>
<td>.122</td>
</tr>
<tr>
<td>Label</td>
<td>.323</td>
<td>.188</td>
<td>.174</td>
</tr>
</tbody>
</table>
Note. The Subcategories per Dimension that their weighted correlation exhibits values > 0.5 are denoted in bold. The values exceeding 1.0 have no physical meaning, since they are produced from some missing values in the qualitative data. To this end, they should only be considered as indicators of strong dependence of the specific variable to the corresponding dimension.

Discussion

Learners’ profiles & optimization processes

Interactive learning environment (Dimension 1)

This dimension explains the type of learning environment valued by the students. Statistical results (eigenvalue = 10.510, inertia = .618) suggest that there is a highly positive relationship between the use of distinct – synchronous and asynchronous – communication tools (Webmail, Chat), the benefits of interaction (Teacher-student interaction, Sharing information), the sustainable education (Self-regulated learning), and the user-friendliness (Accessibility, Efficiency in learning).

In fact, interactive environments are determinant in distance learning as they may condition the success of the learning outcomes and the quality of online learning per se (Abrami et al., 2011; Muirhead & Juwah, 2004). Some researchers demonstrated that the creation of a learner-centered LMS implies particular interaction relations associated with online learning, namely, learning-interface, learner-self, learner-content, and learner-learner (Chou et al., 2010; Hirumi, 2009). Thus, the features of LMS will allow an adjustable and dynamic ecosystem that can integrate different interactive learning activities. Based on the students’ responses, the empowerment and continuous improvement of LMS interactivity may result in higher levels of students’ satisfaction; in their own words: “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.” (Student17). In this sense, interactive environments with a diversified and integrated approach may enrich and reinforce students’ intrinsic interest in academic online activities, namely to a motivational process promoting self-regulated learning. As a matter of fact, various authors have also demonstrated that the structure of learning communities is a particularly important issue that should be considered to develop processes of higher-order thinking and contextual learning (e.g., through social interactions) (Redecker et al., 2009; Zhao & Kuh, 2004). For instance, more recent interactive technologies, such as mobile social computing, can be integrated to encourage student communication, collaboration and creativity (e.g., micro-blogging, life-streaming, social tagging, podcasting, social networking, media sharing) (Gupta et al., 2009; Redecker et al., 2009). This can also contribute to understand and respond to both students’ social needs and cultural diversity. According to McGuire (1996), interactive learning environments represent a blend of both multimedia and hypertext, which integrate, for example, analogous/associative characteristics, accessibility, linkability, intuitiveness, and nonlinear organization. As a result, the combination effect of nonlinear, multisensory, and multimodal interactive systems seems to offer strong potential to expand b-learning scenarios.

ICT teachers’ beliefs & differentiation (Dimension 2)

This dimension recognizes the importance of teachers’ ICT knowledge in the LMS usage being solely constituted by one subcategory (Teachers’ beliefs, subject matter, eigenvalue = 8.846, inertia = .520).

 Teachers’ beliefs, particularly sociocultural beliefs, seem to represent a large role on how distance learners from different parts of the world interact with teaching and learning systems. In fact, certain internal constraints (e.g., teachers’ beliefs, teachers’ self-efficacy, teachers’ attitudes) and external constraints (e.g., access, training, local support) were identified as relevant barriers that influence the teachers’ ICT implementation efforts (Ertmer, 1999). Accordingly, both cultural identities and thinking processes have been highlighted as important obstacles to the integration of ICT in the educational context (Richards, 2004; Watson, 2001). Equally important, some studies have pointed out that only a few teachers are prepared to integrate ICT into their teaching activities, even though there is an increasing awareness of teachers as to the value of training as to ICT use (Dawes, 1999; Kirkup & Kirkwood, 2005). In students’ point of view, some differences in teachers’ behaviour are associated with ICT knowledge and
intrinsic motivation. An interviewee stated that: “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” (Student32). There is also evidence that, the disciplinary differences are critical factors in the design and improvement of online courses (Arbaugh et al., 2010; Smith et al., 2008). For instance, distance learning in applied disciplines (e.g., Engineering, Nursing, Education) appears to be more diversified and more geared towards a community of practice, compared to the pure disciplines (e.g., Natural Sciences, Humanities, Social Sciences). In the context of b-learning, a constructive, optimistic, differentiated and proficient approach seems to require teachers with a highly resilient sense of personal and interpersonal awareness and openness to cultural change.

Students’ Training (Dimension 3)

This dimension identifies the relevance of training towards a proficient LMS usage. Considering the statistical results (eigenvalue = 8.013 and inertia = .471), there is a positive association between lack of time, the lack of interoperable systems (Linkability to other systems), the lack of technological knowledge (Students’ ICT training), and the LMS Usability.

The new dimensions of community and identity (Wenger, 1998; Zhou, 2011) that emerge in the globalization era justify new approaches in the design, implementation and development of the teaching-learning process. In fact, researchers have stressed that faculty members need more time to improve their experience in technology-based instruction, e.g., e-moderation (Salmon, 2004) and technology integration (Mishra & Koehler, 2006), with the purpose of improving technological, methodological and strategical knowledge for their own and for their students (Howell et al., 2004). From the students’ responses, it is clear that the lack of time to explore the potential of the LMS Moodle is still a major limitation. One of the interviewees assumed 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” (Student11). Hence, ICT knowledge, in the context of online learning environments appears to represent an emerging need, requiring “a new set of skills for most educators and learners” (Simonson, 2005, p. 284). In an extension to this, Oh and Park (2009) argued that the lack of faculty motivation and enthusiasm to integrate technology into their distance education courses may represent the most important challenge for the implementation of effective blended teaching. Unexpectedly, the results of a study revealed that more than 36% of students surveyed consider not needing supplementary training in the use of ICT in their online courses (Kvavik & Caruso, 2005). However, according to Kenny and Pahl (2009), in an active learning approach, learning is often associated with knowledge acquisition and skills training, hence students would achieve better learning performance and higher levels of satisfaction if they are adequately trained for the effective LMS usage.

Specific considerations

In this research, students expressed, in general, a positive attitude towards the use of LMS Moodle, and the b-learning courses appear to ensure contextual-specific needs due to their inherent openness and flexibility. On the other hand, results point out the importance and need to create supportive environments for a more comprehensive blended structural design (e.g., based on techno-pedagogical skills) (Bates & Sangrà, 2011b; Sarirete et al., 2008), in order to harmoniously improve and sustain the learning processes and institutional contexts.

As for the methodology used in this study, the MCA seems to represent a useful technique to identify profiles and their interdependencies, and to show the structural complexity of data from a large number of categorical variables. The application of this technique allowed identifying three distinct learners’ profiles: (i) interactive learning environment-oriented, (ii) ICT teachers’ beliefs-oriented and (iii) students’ training-oriented. Once identified these profiles, one can adjust online instructional strategies in order to respond to their specific needs, bearing in mind that “engaged learning is a collaborative learning process in which the teacher and student are partners in construction knowledge” (Conrad & Donaldson, 2010, p. 8). Under this complex and multifaceted scenario, the evolution and understanding of theory and practice of truly interactive, adaptable, and co-participative b-learning environments seems to be able to guarantee interpersonal engagement, promoting and cultivating a proficient community-centered practice approach.
As already mentioned (Research rationale Section), in an effort going a step further, teachers’ profiles would also be incorporated in the process of enhancing the LMS environment towards more effective b-learning. Nevertheless, teaching practices on students’ learning lie in the sense of cause-and-effect relationships, with the teachers playing an active and direct role in the students’ acquisition of knowledge (Brophy & Good, 1986; Leinhardt & Smith, 1985). Consequently, teachers’ profiles should not be approached independently from the learners’ ones, but, rather, in relation to them, under the concept of teacher’s efficiency in producing desired learning outcomes to learners in a LMS-based b-learning environment, fostering the use of a variety of appropriate representational systems, examining the concept through conceptually focused and cognitively challenging tasks, and ensuring active involvement of the students within the process of knowledge construction. A research effort at this direction is within the immediate research plans of the authors.

When reflecting on the mixed method (qualitative and quantitative) adopted here, the followings could be considered. Research adopting the quantitative approach (positivism paradigm) is said to be mostly numerical and is designed to ensure objectivity, generalizability and reliability (Smith et al., 1991). One important feature of quantitative techniques is that the process of data collection is distinct from analysis. Some techniques, such as interviews or observations, nevertheless, can be interpreted either quantitatively or qualitatively. In the latter case (phenomenological paradigm), qualitative approach deals with the way people experience phenomena in the world and define its meaning. In particular, Van Maanen (1983) defines qualitative methods as an array of interpretive techniques which seek to describe, decode, translate and otherwise come to terms with the meaning, not the frequency, of certain more or less naturally occurring phenomena in the social world. They are less structured, longer and have a more flexible relationship with the respondents so the resulting data have more depth and greater richness of context (Aaker et al., 2001). It also means that the potential for new insights and perspectives is greater. Nevertheless, the data compiled by this approach may also look very ‘untidy’ because of the researcher’s lack of control on them. For instance, it is impossible for a researcher to maintain the same discussion when interviewing various individuals. This is due to the fact that humans are often encouraged to talk about unrelated things from time to time. As a result, the analysis and interpretation of the data may be very difficult. Hence, when simultaneously dealing with the problem of generalising and understanding ideas, it is better to incorporate both approaches whenever possible (mixed case). The understanding of both paradigms helps identify the ways these divergent approaches complement each other. In this perspective, the qualitative data drawn from the semi-structured interviews fed into the MCA quantitative analysis, which in turn, assisted into ‘tiding’ them up in a way that could be then interpreted accordingly in terms of identifying the three distinct students’ profiles.

From the available total number of students that used the LMS environment, 36 were selected here to define the sample space. Perhaps the interview sample is not representative of the overall group of students at the university. In practice, however, the number of required subjects usually becomes obvious as the study progresses, as new categories, themes or explanations stop emerging from the data (data saturation) (Marshall, 1996). The adopted MCA analysis has shown that this data saturation phenomenon was also observed here after analyzing 30 interviews, justifying the selection of 36 participants as an adequate starting sample size. Naturally, expansion to larger data space could further shed light upon the examined issues and research efforts towards such direction are already initiated.

From an overall perspective, the current study is a small-scale exploratory study in trying to characterize and understand dynamics patterns of a public HEI within the LMS environment. In spite of this, the present study addresses in-depth relevant issues on educational processes in LMS-based b-learning environments, in the specific context of higher education, aiming at a more educated, interactive and collaborative online community. 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 (i.e., free online courses designed to be an all-inclusive learning experience) methodology are 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), already offered by the top 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.
Conclusions

A new perspective of LMS within the b-learning environment has been presented here, taking into account the learners’ profiles for the identification of potential processes that act as a feedback to the LMS and could further enhance the efficiency of b-learning. Using a semi-structured interview scheme, structured in four Categories related to communication tools, collaborative and interactive networking, usage and expectations in the LMS environment, respectively, learners’ profiles from 36 students of five different b-learning courses from a HEI have been identified with the combination of qualitative and quantitative analyses applied to the acquired interview data. In particular, the MAXQDA–based content analysis of the latter resulted in a set of Subcategories per each Category, which, then, they subjected to MCA for their clustering into three different students’ profiles (interactive learning environment, ICT teachers’ beliefs & differentiation, students’ training) regarding the LMS use. This multifaceted perspective identified the need for rethinking LMS structures within the b-learning environment as a means that: (i) allows an adjustable and dynamic ecosystem that can integrate different interactive learning activities, (ii) facilitates the teachers’ ICT acquaintance to foster their intrinsic motivation, and (iii) provides students’ training strategies, so they can achieve better learning performance and higher levels of satisfaction. The concept of involving learners’ profiles in the LMS perspective provides a more pragmatic approach in the role of LMS in b-learning environment, making it more realistic according to the students’ learning needs. In this way, the students could be involved in an active and engaging learning process during the courses, giving them interesting technical and educational solutions for self-organization and learning. On the other hand, the students’ profiles contribute to the forming of original learning scenarios and more functional technical approaches. The mutual connection between LMS and the students’ profiles supports the symbiosis between students’ informal learning and the obligatory formal learning process. Based on this knowledge, in future work, the proposed approach will be extended so it would incorporate also teachers’ profiles, providing a bilateral view of the role of the active inputs of the LMS, i.e., teachers and students, towards more interactive, adaptable, and co-participative b-learning environments.

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