LMS in Higher Education: Analysis of the Effect of a Critical Factor 'Faculty Training'

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***Abstract*—**The purpose of this research is the analysis of the impact of ICT-related training in the adoption of a learning management systems (LMS) for teaching practicesby faculties in a higher education institution. Based on comparative analyses the impact will be obtained by the number of LMS courses created and managed by participants in ICT for teaching workshops and those who have not attended to any workshops. Involving near 1320 LMS courses and 265 faculties, the results evidence that(i) faculties who have not attend any workshop present a larger distribution of empty courses and (ii) faculties who have attended three or more workshops managed a higher distribution of courses with a considerable level of use intensity, when compared to the others groups. These findings supportthe idea that faculty training is a crucial factor in the process of LMS integration in higher education institutions and that faculties who have been enrolled in three or more workshops develop a higher level of technical and pedagogical proficiency in LMS.

***Keywords*—**Higher Education, Faculty Training, LMS, Comparative Analyses

I. Introduction

THE vertiginous expansion of the web and related advancements in technological equipment, in conjunction with limited budgets and social demands for improved access to higher education, has produced a substantial incentive for universities to get involved in technology-integration projects both for administration and financial management, research enhancement and modernization of teaching and learning processes.

Until now, universities have been static in their structure and instructional models. However, the need for more professional qualifications and updated knowledge has never been higher, and this in conjunction with the need for attracting new publics and, therefore, for a geographically broaden learning,have prompt universities to embrace information and communication technologies (ICT) and e-learning initiatives as a reaction to the internal and external changes.Indeed, e-learning programs have enabled universities to expand their current geographical reach, to capitalize on new prospective students and to establish themselves as global educational providers [1].

Many have advocate that the challenge to universities in the 21st century is not to decide if they should have ICT for teaching-enrichment projects and online learning program, but to decide how to design and implement them. For many institutions, the adoption of online media means that their faculty members not only need to start becoming familiar with this new tools and systems, but also to understand and adopt new ways of conceptualizing teaching and learning in higher education [2].

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A. Faculty training: A critical factor for technology integration in higher education

Any innovation process in an organization presents to be a complex and multifactorial process in which different aspects must be guaranteed in order to achieve success. Integrating ICT and promoting e-learning initiatives in conventional higher education institutions is an innovation process, therefore a significant number of interrelated variables need to be considered.

In 2003, Levy identified six areas that should be carefully addressed by universities when considering the possibility of planning ICT integration and online distance learning programs: vision and plans, curriculum, staff training and support, student services, faculty and copyright and intellectual property of materials [3]. Finley and Hartman also discussed similar issues such as clear vision, faculty skills and knowledge and departmental culture which were identified as barriers to the integration of technology into faculties' graduate courses [4].

Discussing the adoption process of ICT in higher education teaching, Kirkup and Kirkwood identified as relevant the appropriation of ICT tools by higher education teaching staff, as well as the following contextual factors: organizational culture, teaching and assessment practices, competing priorities and the interaction of ICT with other tools and systems already used on campus [5]. Schauer, Rockwell, and Fritz (2005) also indicated as key factors: faculty commitment and skill development, technology integration and support, financial issues, student engagement and support, quality control for courses and outcomes assessment, compliance with regulations and legal matters [6].

A more recent study, focused on comparative analysis of failures and success experiences of higher education institutions in embracing online education initiatives and identified as crucial factors adequate planning, investment in marketing and in students' recruitment, financial management, quality assurance, student retention, faculty development and innovative online course design and pedagogy [7].

All these studies addressed staff development or faculty training as a critical and imperativeissue. And this aspect seems to be seen as an institutional responsibility more than an individual responsibility. In an online survey answers by 237 north-american professors, near 70% agreed that technology training was universities responsibility [8] a sentiment that may come from the fact that most universities set up new and complex technological infrastructure without any (or very little) input collected from faculties [9].

As higher education institutions continues the rush to embrace technology-delivered learning opportunities, one requirement may be finding effective ways to prepare faculty

for what life will be like on the other side of this transformation [10]. An investment in faculty development is essential for delivering quality online learning programs. However in the beginning of 'information technologies movements', limited consideration was given to authentic faculty training [8]. So today, an increasing pressure is felt by higher education institutions to rapidly provide their faculties appropriate professional development initiatives, sufficiently engaging and attractive, in an appropriate form and time [2].

However, a clear notion about the real impact of staff development initiatives is still lacking. Some studies advocate their indispensable benefits [3, 5, 8] others strongly suspect of any realdevelopment in faculties practices. These studies highlight that faculty embraces technology more often for administration process and researchactivities and less frequently for delivering instruction. Plenty faculty members do not integrate technology into their curricula systematically[9, 10, 11, 12] mainly because most staff development programs have been short-term initiatives, poorly designed, developed by non-specialized trainers with few pedagogical competences and technocentric approaches.

II. Research Context: University of Lisbon

Founded in 1911, the University of Lisbon (UL) had, in 2010/11, 23 756 students and 2020 faculties enrolled in one of the 282 courses available in different scientific areas.

The University is organized into five strategic areas: Arts and Humanities (which integrates the Faculty of Fine Arts and Faculty of Letters), Health Sciences (which integrates the Faculty of Pharmacy, Faculty of Medicine and Faculty of Dental Medicine), Science and Technology (Faculty of Science), Legal and Economic Sciences (Faculty of Law) and Social Sciences (which integrates the Institute of Social Sciences, Faculty of Psychology, Institute of Education and Institute of Geography and Territorial Planning).

One of the strategic guidelines in the UL focus on the use of technologies in teaching and research as well as on the development of e-learning initiative.

In 2010/11, UL presented its E-learning program which aims to (i) promote the use of learning management systems, (ii) sensitize and empower the faculties in the use of virtual learning environments as well as in the optimization, management and development of online educational content, (iii) foster and give support to the development of curricular units, so as to increase UL´s offer of e-learning courses, and (iv) monitor and investigate the b-learning and e-learning practices in the University, bearing in mind the need to increase its knowledge, to improve its quality and to develop tailored innovative solutions.

To support the design of the blended and/or distance courses, the e-Learning Program developed a pedagogical model that is based in four principles: (i) resource based-learning to promote student-centered teaching approach through a combination of specially designed learning resources and interactive media and Technologies; (ii) flexibility and autonomy, where the student benefits from the flexibility of time and space of the courses and blended learning initiatives and e-learning, (iii) interaction and collaboration, where the interaction of students with peers, faculties, resources and technologies selected to support blended/fully online learning initiatives is seen as encouraging factors to the development of collaborative work amongst the students with the use of different media, and online communication tools (synchronous and asynchronous), and (iv) e-moderation, that acts as a mean of promoting active student participation in the online community [13].

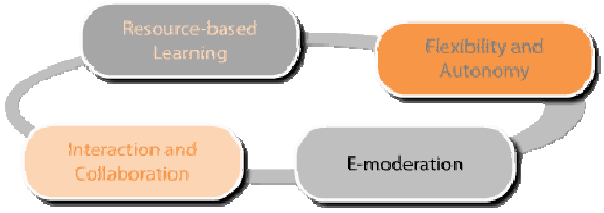

Fig. 1 E-learning Program Pedagogical Model

The University of Lisbon E-learning Program has four core areas of action which enable its practical execution: (i) publicizing and dissemination that include actions to divulge the intentions and objectives of the programs implementation, (ii) training, which includes developing 'ICT for teaching-related' workshops, specifically designed for faculties and researchers, that take place for the development of skills needed in the use of technology and online systems, (iii) support services and systems, which correspond to the maintaining of infrastructures to support the use of the implemented online systems for teaching purposes and (iv) monitoring and assessment related to the developed strategic actions to monitor on-going operations, as well as regular evaluation of processes and achieved results.

A. Learning Management System: Moodle at UL

One of the more central action of E-learning Program is the integration of a learning management system (LMS)into teaching and learning practices in higher education.

At the University of Lisbon the learning management systemimplemented is the Modular Object Oriented Dynamic Learning (Moodle), because it´s an open source platform with possibilities to change and modify and customize blocks, resources and activities according to the academic public and their needs. In the other hand, Moodle was already used in some colleges as a support tool to face-to-face classes before the beginning of the E-learning program in 2010.

The use of learning management system in education can be very advantageous for faculties teaching practices and students learning: (i) the use of LMS allow a variety of interactive activities that can meet learners´ diverse needs because the LMS can provide to faculties a diversity of activities to his student; (ii) LMS can improve the teaching and learning process mainly be increased access to course content and more efficient communication between faculties and students [14]. Provide anytime and anywhere access to students; (iii) Support online assessment incorporate a variety of tools that can promote metacognitive strategies including self-monitoring, time personal management, focus, and planning individual learning objectives [14].

Research shows that infusing education technology resources, such as a LMS, may assist faculty with managing courses and organizing content to engage students and decrease planning time, thus supporting the instructional process [14].

Moodle was installed for faculties and institutes of University of Lisbon in 2007/2008 but only in 2008/2009 the process of dissemination of this online environmentbegan and the E-learning program as a formal initiative, started in 2010.

In fig.2 it´s possible to see the total number of LMScoursesin eachacademic yearexamined, as wellas the rate ofgrowth.In 2008/09, 148 LMS courses were opened, in the Moodle platform at the University of Lisbon, and in 2009/10 580 LMS courses a growth of 292% was resisted. In the first year of the e-learning program in UL, 1442 LMS courseswere created and a growth of 149% was achieved,when comparing to the previous academic year.

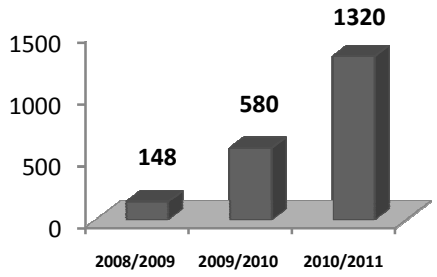

Fig. 2 Total number of LMS courses by academic year

III. Data Collection Procedures

In this comparative study, each LMS course identified in the LMS platforms of the UL was analyzed, considering the last two academic years. This study measured different types of data from each LMS course: (i) number of active users (faculties and students), (ii) number of faculties, identifying as *teachers* in Moodle and as participants in 'ICT-for-teaching' workshops; (iii) number and type of *resources* and *activities* used in each course and (iv) courses intensity of use. The intensity of use variable was operationalized in the following categories:

.'No activity' – The LMS course is empty and no actions were developed in it.

.'Moderate activity' – The LMS courses only provides *resources* for consultation.

.'Considerable activity' – The LMS courses provides materials(*resources*) for consultation but offers the possibility of developing other interactive actions (*activities*) to the participants.

As previously referred, one of the core actions of E-learning program is the promotion of workshops for support faculties competences in use of ICT in teaching and learning(e-skills) in faculties (and researchers) of UL. In 2009/10 nearly 30 workshops were developed covering differentthematics.

Using LMS for Teaching I-Initial (W.I) – Designed for faculties and researchers with the purpose of promoting basic skills in the use oflearning management system for teaching activities.

. Using LMS for Teaching II-Advanced (A.W) – Designed for faculties and researchers with the purpose of promotingadvance skills in the use of learning management system for teaching activities.

. Designing and structuring online courses (D.S.O.W) - Designedfor faculties and researchers forpromotethe required skills for designing and structuring online LMS courses.

. Others Workshops – Designed for faculties and researchers to promote competences to pedagogically explore web 2.0 tools.

Therefore,the level of faculties attendance to the 'ICT-for-teaching' workshops was also analyzed. In this case, the data collected from the workshops attendance lists were analyzed to identify: (i) faculties' staff who have been involved in one or more development workshops, (ii) the workshops each teacher or researcher took part in; (iii) the semester during which they took their first workshop; (iv) and who had created and managed LMS courses.

The two analysis of this two variables (LMS courses and 'ICT-for-teaching' workshops attendance) aims to analyze the impact of training in the adoption of LMS for teaching practices. The impact will be obtained based on the number of participants in ICT for teaching workshops who did create and manage LMS courses for teaching purposes and the total amount of LMS courses generate by those courses, meaning, created by faculty members who participated in ICT for teaching workshops.

In the research, it was analyzed manly frequencies, percentages distribution of the different variables but Pearson's chi-squared test was also calculated to exploresignificant differences between groups.

IV. Results

A. Learning Management System Courses at UL

First, it is important to present the evolution of the number of existing LMS courses, considering their different levels of use intensity. In 2009/10, the year before the implementation of the e-learning program in the UL, there were 439 LMS courses with moderate and considerable levels of use. After the program's first year, this number of virtual classrooms increased to 883, which represents an increment of 2,01times considering the value of the previous year (table I).

TABLE I
NUMBER OF LMS COURSES

Lecture year	Total of courses	Courses with moderate and considerable use level
2009/2010	580	439
2010/2011	1320	883

B. ICT for teaching workshops

The following table presents the total number of faculties involved in the thematic workshops. During the year 2010/11 the number of faculties and researchers who participated in

ICT for teaching workshops was 265, representing 13% of the number of UL academic staff.

TABLE II
VOLUME OF ATTENDANCE IN WORKSHOPS (N=265)

Workshops	Frequency	Percentage
Initial W. (I.W)	204	77,0%
Advanced W. (A.W)	53	20,0%
Structure design W. (SdW)	18	6,8%
Others Workshops (O.W)	43	16,2%
1 Workshop		
I.W	146	52,0%
A.W	22	7,8%
S.D.W	12	4,3%
O.W	21	7,5%
2 Workshops		
I.W + A.W	37	13,2%
I.W + S.D.W	3	1,1%
I.W + O.W	6	2,1%
A.W + S.D.W	6	2,1%
A.W + O.W	6	2,1%
S.D.W + O.W	0	0,0%
3 or more Workshops		
I.W + A.W + S.D.W	8	2,8%
I.W + A.W + O.W	2	0,7%
I.W + S.D.W + O.W	0	0,0%
A.W + S.D.W + O.W	2	0,7%
I.W + A.W + S.D.W + O.W	13	4,6%

Data presented of table II evidences that faculties and researchers of University of Lisbon, mainly attended to the workshop designed for faculties and researchers with the objective to promote basic skills in use of the platform Moodle (77%). Yet, some teachers and researchers who have attended to the Initial Workshop have attended also have taken the Advanced Workshop, which has the objective to promote advanced skills in use of the platform Moodle.Even though, the percentage values evidence that faculties most commonly attended only none workshop.

Only a reduced percentage of the faculties (8,8%) who attended the workshops were involved on three or more of the training initiatives.

C. Getting the mix: LMS Courses from ICT for teaching workshops

In order to analyze the impact of faculty training in the LMS courses adoption for teaching purpose the data of faculties attendance to ICT-for-teaching workshops and the use of courses in Moodle platform were crossed in 2010/11.

TABLE III
IMPACT OF WORKSHOPS IN LMS COURSES (C)

Variables	Frequency	Percentage
With courses – Workshop 1st semester (n=265)	134	50,6%
No courses – Workshop 1st semester (n=265)	47	17,7%
With courses – Workshop 2nd semester (n=265)	43	16,2%
No courses – Workshop 2nd semester (n=265)	41	15,5%
Courses – participation in workshops (n=883)	281	31,8%
Courses – no participation in workshops (n=883)	602	68,2%

The majority of faculties participated in workshops during the first semester (181), 73% of whom have indeed managed LMS courses during this academic year. In the second semester the number of faculties and researchers who participated in the workshops decreased to 84 and only 51% of these managed their virtual classroom. The percentage of faculties who participated in workshops and have effectively created and managed LMS courses for teaching purposes in 2010/11 was 66.8%.

Looking backwards at the number of LMS courses which presented moderate or considerable levels of use and confronting this data with the number of participants in the ICT for teaching workshops, it is possible to see that 31.8% of the total amount of LMS courses was developed by faculties who participated in the workshops developed in 2010/11.

D. The amount of workshops taken: the effect on the intensity of use level

Besides the analysis in the number of courses created and managed by teacher who have and have not attended to the workshops, it is important to understand the impact of that participation in the intensity level of use in each course three groups of LMS courses were formed (no activity, moderate activity and considerable activity).

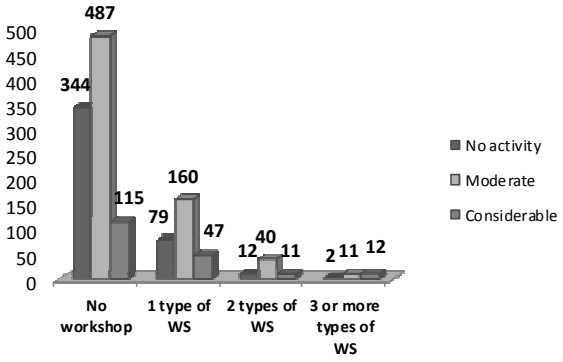

Fig. 3 Distribution of LMS courses according to intensity level and type of workshop attended

Considering this particular aim, three groups were formed (no activity, moderate, activity and considerable activity).

As observed in figure 3, the majority of LMS courses are created and managed by faculties who haven't attended any workshop. Pearson's chi-squared test was used to develop a comparative analysis of the distribution. Through it, is possible to see that they are significantly different according to the number of workshops attended (χ^2 (6)=41.385, N=1320, p<0,001). Results evidences that the proportions of individuals, according to their attendance in the workshops, reveal a different configuration in the intensity level of use (table 4).

TABLE IV
PEARSON'S CHI-SQUARED TEST (TYPE OF WORKSHOPS ATTENDED * INTENSITY LEVEL)

Crosstabulation TWA*IL		*N*	X^2 **(df)** ***p***
No+1+2+3 or ≥	No+Mod+Con	1320	**41.39 (6)0.000**
No+1+2	No+Mod+Con	1295	**15,19 (4) 0.004**
No+1+3 or ≥	No+Mod+Con	1257	**35,57(4)0.000**
No+2+3or ≥	No+Mod+Con	1034	**36,61 (4) 0.000**
1+2+3 or ≥	No+Mod+Con	374	**18,15 (4) 0.001**
No+1	No+Mod+Con	1232	**8.78 (2) 0.012**
No+2	No+Mod+Con	1009	**7.98 (2)0.019**
No+3 or ≥	No+Mod+Con	971	**29.69 (2)0.000**
1+2	**No+Mod+Con**	**349**	**2.00 (2)0.371**
1+3 or ≥	No+Mod+Con	311	**16.07 (2)0.000**
2+3 or ≥	No+Mod+Con	88	**8.93 (2)0.012**
No+1+2+3 or ≥	Mod+Con	883	**15.18 (3) 0.002**
No+1+2	**Mod+Con**	**860**	**1.32 (2) 0.533**
No+1+3 or ≥	Mod+Con	832	**15.18 (2) 0.001**
No+2+3or ≥	Mod+Con	676	**14.96 (2) 0.001**
1+2+3 or ≥	Mod+Con	281	**9.98 (2) 0.007**
No+1	**Mod+Con**	**809**	**1.25 (1) 0.269**
No+2	**Mod+Con**	**653**	**0.18 (1) 0.711**
No+3 or ≥	Mod+Con	625	**14.97 (1) 0.001**
1+2	**Mod+Con**	**258**	**0.03 (1) 1.000**
1+3 or ≥	Mod+Con	230	**9.43 (1) 0.004**
2+3 or ≥	Mod+Con	74	**6.93 (1) 0.014**

Looking deeper at the distribution of each group significant differences continue to be found which represent different proportions between each group, with the exception of these two:

- When we consider all levels of intensity and when the faculties who have created LMS courses have attended one or two types of workshops (χ^2 (2)=2.002, N=349, p=0,371);
- When we consider moderate and considerable levels of intensity and when the faculties who have created LMS courses have attended none, one or two types of workshops (χ^2 (2)=1.315, N=860, p=0,533).

The levels of significance propositionsidentified in Pearson chi-squared tests evidences that: (1) faculties who have attended one or two types of workshops have the same distribution in the level of intensity of use; (2) faculties who haven't attended any workshop have a larger distribution of courses with no activity comparing with the three groups; (3) faculties who have attended three or more workshops have a different distribution in the level of intensity of use, showing higher frequency distribution of courses with considerable intensity when compared to the others groups.

V. CONCLUSIONS

The e-learning program implementation happened at the same time as the doubling of LMS courses in the UL platform. There are many aspects that have contributed to this increment, namely the program implementation itself. Although this analysis should be addressed to another article and based on another type of data.

In this study we can say that the impact of the ICT for teaching workshops represents 31.8% of the LMS courses in the UL platform.

The majority of faculties and researchers focused their participation in workshops designed to promote the acquisition and development of basic technical and pedagogical skills for using LMS courses ina elementary level. It is also possible to understand that most faculties and researchers participated in only one workshop. This primary analysis indicates that participants are mostly focused in developing the essential skills required to use the LMS basic functionalities.

The more relevant findings in this study are related to the impact that the type of workshops attended has in the intensity level of use of the LMS courses. One of the conclusions of this study is that faculties and researchers who haven't attended any workshop have a high proportion of courses with no activity. These teachers probably felt the need to create their virtual classroom but, for different reasons,weren't able to use it and the online space stayed empty. The second conclusion from this study results is that those who have participated in one or two workshops seem to have the same distribution in the level of use. The lack of differences between these groups might be probably related to the fact that the groups of faculties, which has attended one or two workshops, mostly aim to achieve the same goals, meaning and to development consolidate basic ICT skills. Finally, the results indicate that the faculties who participated in three or more workshops do present a different distribution in the intensity level of use in their LMS courses. This result can lead to the conclusion that the enrollment in different training initiatives can promotemore solid and effective ICT-related competences. These courses have given faculties the opportunity to develop a higher level of technical and pedagogical proficiency in the use of the different online tools available in a LMS. As a consequence, considerable levels of intensity of use were found.

The results evidenced the idea that the faculty training factor is quite relevant in the process of the integration of LMS in Higher Education, as it encourages and eases the adoption and embracement of LMS for teaching purposes. These results therefore converge with other studies in the area [2,5,3,8,10]were faculty training reveals to be a crucial factor in ICT integration and in the implementation of e-learning projects in Higher Education.Moreover, this study supports the idea that faculty training works especially as a mechanism of promotion and its effect are more related to the quality of the use them with its quality of technology-mediated teaching practices. In fact faculty training presented limitative effects when the impact on the number of courses created was

analyzed, but presented significant results when the level of intensity of use was analyzed taken under analysis. The results also evidenced that the sporadic involvement in one or two educational initiatives, limited in time and focus (especially determined by the limited amount of time that faculty members have available for personal investment in professional training, and which is also related to the existence of limited support and recognition mechanisms) also presents limited effects on the quality of practices. In contrast, an attitude of serious investment in the development of competences in the area of ICT and teaching (and that is materialized in this investigation by the involvement in three or more workshops) reveals favorable effects in the quality of practices associated with ICT integration in higher education.

Some studies have reported that, among other things, increasing staff support, improving training facilities and providing faculty with more assistance and incentives could motivate faculty members to invest in using technology in their instruction and other professional activities. Although faculty training is consistently seen as a critical factor, in most higher education institutions, this issue is still poorly addressed. College pedagogy or faculty professional development, in general or more specifically the area of ICT-related skills, in commonly based of voluntary-work, that consists in the development of informal, episodic and self-paced training sessions, shortly conducted and sporadically offered [15].

In many higher education institutions, providing technical support and training for faculty is a challenge mostly due to the lack financial resources and of properly prepared staff. [16].

However relevant and useful, faculty training haven´t been seriously addressed. Best practices haven´t been efficiently shared and disseminated. Universities' staff development units, teaching and learning centers, e-learning and ICT offices tend to live encapsulated within their own university. In order to potentiate the development of more updated teaching practices in higher education institutions, faculty training needs to be considered. The way it impacts students' academic achievement, institutional quality and prestige, as well as the best models to design and address it are some of the areas that need more systematic and longitudinal research.

Educational technology research indicates that faculty training best practices are the ones based on the preferences, expertise level and particular needs of faculty members [17], but how it should be conducted in order to effectively prepare faculty is still unanswered.The development of different initiatives such as (a) large group seminars, (b) hands-on small group workshops, (c) individual mentoring, and (d) just-in-time support have been pointed out as having a positive impact on the faculty members abilities to use technology for teaching purposes[18, 19] what mechanisms could be implemented to increment the involvement of faculties in this initiatives is still waiting for being carefully analyzed.

In conclusion it's important to refer that the present study (although focused in a particular university and involving only a reduced number of participants) gathered relevant information and presented interesting results but mostly its intended to stimulate the development of further research in this area.

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