World Academy of Science, Engineering and Technology
International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering Vol:6, No:6, 2012

Innovation, e-Learning and Higher Education: An Example of a University' LMS Adoption Process

Ana Mafalda Gonçalves, Neuza Pedro

***Abstract*—**The evolution of ICT has changed all sections of society and these changes have been creating an irreversible impact on higher education institutions, which are expected to adopt innovative technologies in their teaching practices. As theorical framework this study select Rogers theory of innovation diffusion which is widely used to illustrate how technologies move from a localized invented to a widespread evolution on organizational practices. Based on descriptive statistical data collected in a European higher education institution three years longitudinal study was conducted for analyzing and discussion the different stages of a LMS adoption process. Results show that ICT integration in higher education is not progressively successful and a linear process and multiple aspects must be taken into account.

***Keywords*—**e-learning, higher education, LMS, innovation, technologies

I. Introduction

THE evolution of ICT has changed all sections of society and these changes have been creating an irreversible impact on education. This raises new expectations towards higher education institutions, which, to win new audiences and meet the challenges posed by technology in the economy and society, need to reassess their role and seek new practices in order to meet the requirements of the 21st century.

The fast technological evolution and the emergence of Web 2.0 enabled new ways to create, develop and deliver educational content in diverse and innovative formats. This increasing pace of change led to the progressive development of online distance learning.

The fast 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 introduce e-learning programs [1].

Until now, universities have been static in their structure and instructional models. However, demand for more professional qualifications and the need to geographically broaden learning may prompt universities to introduce e-learning initiatives. Also, the increased revenue of independent educational providers has produced a real threat to the very existence of the traditional university.

The integration of ICT in an educational context and its use in promoting innovative forms of education is now a reality in the European context, specifically in the European Higher Education Area (EHEA).

Ana Mafalda Gonçalves is with Instituto de Educação, Portugal e-mail:ana.goncalves@campus.ul.pt

In Portugal, higher education institutions (HEIs) have developed programs to stimulate distance learning initiatives, most of them focused on the use of learning management systems (LMS) as a supplementary support to face-to-face classroom learning and fewer focused on developing blended or fully online courses.

In different institutions, different programs have been designed and implemented and the range of diffusion and efficiency of these innovative programs has also diverged. Few studies are yet available where the process of implementation of e-learning programs for HEI, in its different stages, is openly described. This study tries to address this issue by providing a description of the University of Lisbon's experience in the innovative diffusion process of implementing an e-learning program since its early stages.

Procedure for Paper Submission

II. Rogers´ Theory of Innovation Diffusion

Even today, in the traditional campus-based technology-enriched learning of universities, web-based teaching and e-learning tends to be seen as an innovative project for which exploratory theories of innovation are usually addressed.

In this domain, Rogers' theory emerges as a widespread framework for understanding the process of innovative diffusion [2]. Presented as a theory of innovation diffusion, it has been frequently used to illustrate how technological innovation move from localized invention to widespread use (or rejection). It describes the Innovation Decision Process (IDP) as a process that occurs over time and that can be structured in five specific stages: knowledge, persuasion, decision, implementation and confirmation [3].

The knowledge stage occurs when an individual, or other decision-making unit, is exposed to an innovation and gains some understanding of how it functions. Rogers argues that even if individuals are exposed to an innovation, such exposure will have little effect unless it is perceived as (i) relevant to individual satisfaction needs and (ii) consistent with the individuals' attitudes and beliefs.

The persuasion stage occurs when an individual forms a personal attitude towards the innovation, favorable or unfavorable, based upon its perceived characteristics. Therefore, persuasion is influenced by information sought from peers, mostly from peers whose opinions appear to be more convincing. The decision stage occurs when an individual engages in activities that lead to a choice to adopt or reject the innovation.

The following stage, adoption, is related to the decision of making use of the innovation as to see it as the best course of action available. In contrast, Active rejection means deciding not to adopt the innovation and Passive rejection, also referred as non-adoption, consists of never really considering its use.

Up to this stage, the innovation process has only taken place at a cognitive level, being that only the implementation stage involves an overt behavior. The implementation stage occurs when the individual puts the innovation into use.

Finally, the confirmation stage occurs when an individual seeks reinforcement of the decision already made, or reverts to the previous decision to adopt or reject the innovation, normally if exposed to incongruent messages about the innovation. Each stage in the innovation decision involves a potential rejection point. Rejection can occur even after a prior decision has been made to adopt the innovation, which is called discontinuance [3].

The attributes of an innovation influence its rate of adoption. Rogers identified five characteristics of an innovation that need to be considered: relative advantage, compatibility, complexity, trialability, and observability [2]. He defined these characteristics as follows. Relative advantage describes the degree to which an innovation is perceived as better than its absence; potential adopters must be convinced that the innovation will serve their needs better than what is currently in place. Compatibility is the degree to which an innovation is consistent with the existing values, beliefs, past experience, and needs of the potential adopter. Familiarity with the innovation relates to the level of acceptance and consequent adoption. Complexity is the degree to which an innovation is perceived as difficult to understand and to use. Humans tend to avoid pain and difficulties and tend to embrace changes that bring them a sense of comfort. The more user-friendly the innovation content is, the greater its acceptance and possible adoption. Trialability is whether an innovation provides the opportunity to be previously tested, and finally, observability is the degree to which the benefits of an innovation are visible, meaningful and measurable.

Innovations that are perceived as having greater relative advantage, compatibility, trialability, observability, and less complexity will be more rapidly adopted [3]. Considering LMS integration in higher education institutions, Rogers' theory highlights the fact that the ability of faculty motivation to go the extra mile in the acquisition of technology integration skills is largely determined by their perceptions of their attitudes, perceptions, previous beliefs and values considering technology-integration in today's teaching, as well as its identified advantages, level of complexity and required effort.

Considering the different pattern of response to innovation or level of innovativeness, Rogers identified 5 categories of adopters which can be applied to LMS adoption by faculties: (1) the innovators, (2) the early adopters, (3) the early majority, (4) the late majority, and (5) the laggards. These categories follow a standard deviation curve, very little innovators adopt the innovation in the beginning (2,5%), early adopters making up for 13,5% a short time later, the early majority 34%, the late majority 34% and after some time finally the laggards make up for 16%.

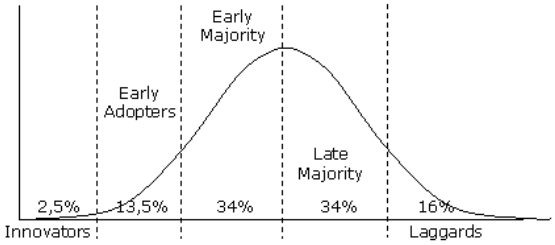

Fig. 1 Rogers Adoption/Innovation Curve (adapt from http://www.valuesdmanagement.net)

Rogers' theory also reveals three important ways in which the adoption of interactive communications differs from that of previous innovations: (i) a critical mass of adopters is needed to convince the "mainstream" professors of the technology's effectiveness, ii) regular and frequent use is necessary to ensure success of the diffusion effort and (iii) technology is a tool that can be applied in different ways and for different purposes and is part of a dynamic process that may involve change, modification and reinvention of individuals' practices and beliefs [3]. Rogers' theory also evidences that innovation adoption is not only defined at an individual level, but it is also a collective, organizational process. Individuals' decisions always rely upon the subjective evaluation of how an innovation was conveyed to other individuals. This dependence on peers' previous experiences puts the diffusion process core in a modeling. The diffusion theory argues that, since opinion leaders directly affect the tipping of an innovation, a powerful way to promote the diffusion of an innovation is to favorably affect the attitudes of opinion leaders. Therefore, interpersonal communication channels, even in wide organizations, are the more effective mechanism for diffusion of an innovation in this case.

Many studies have used Rogers' diffusion model as a theoretical basis for assessing ICT integration in faculty teaching practices [2, 5, 4]. Overall, research findings showed that faculty members would get involved in technology integration if (i) they feel it is consistent with their beliefs and teaching style, (ii) they feel they are knowledgeable and competently skilled to use it, (iii) they are supported and rewarded for doing so, and (iv) they can see how it is pedagogically useful.

III. The Context of Research E-Learning Program at the University of Lisbon

Today's fast-paced global world calls for lifelong learning, continuous training, constant academic and professional updating, as well as the development of autonomous, responsible and flexible professional skills and learning practices. The University of Lisbon seeks to accompany these changes by promoting educational initiatives that incorporate and react to the demands of today's reality. In this context, the University of Lisbon's strategic plan focuses on the use of technologies in teaching and research as well as in the development of an e-learning initiative.

In 2010/2011 the University of Lisbon presented the e-learning program, a project with the purpose of promoting the use of ICT in teaching, learning and research, as well as promoting training initiatives in e-learning.

The implementation of the University of Lisbon's E-learning program is based on a pedagogical model that serves as a coherent framework towards creating and designing ICT-enriched conventional classes in blended or fully online courses, both in graduate and post-graduate programs [6].

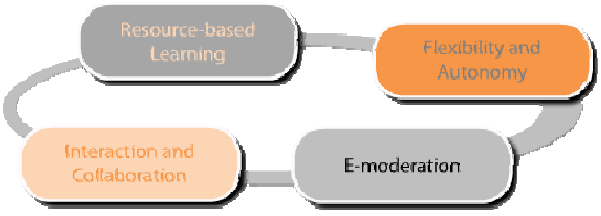

Fig. 2 E-learning Program Pedagogical Model

The proposed model is based on four main principles that underpin and regulate actions and intentions:

(i) *Resource based-learning*, for the design and organization of programs, courses and curricular units in blended or fully online learning environments. In this context, the Australian National Council of Open and Distance Learning [7] highlights the Resource Based Learning as "defined as an integrated set of strategies to promote student-centered learning in a mass education context, 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 initiatives in blended learning and/or e-learning, where it is possible to access contents, communicate and interact with the remaining participants at any given time or place. The temporal flexibility allows participation and deferred, reflected and organized communication, while giving access to updated information.

(iii) *Interaction and collaboration*, where the interaction of students with peers, teachers, resources and technologies selected to support blended/full online learning initiatives are seen as encouraging factors for the development of collaborative work amongst students. In this perspective, the use of different media and online communication tools (synchronous and asynchronous), will be perceived as a priority in the design of digital learning environments, allowing: (i) adaptation to different learning rhythms and styles, (ii) development of collaboration skills, as well as (iii) interaction between all the agents involved in the educational process.

(iv) *E-moderation*, which acts as a means of promoting for each student active participation in the online community of e-learning, the discovery of individual learning needs, development of autonomy, commitment, metacognition, reflective and critical analysis competences [8].

The University of Lisbon's E-learning program presents four core areas of action which enable its practical execution: (i) publicizing and dissemination (ii) staff training, (iii) support systems development and (iv) monitoring and evaluation activities.

Publicizing and dissemination include actions to divulge the intentions and objectives of the program's implementation. Such activities include: (i) active sessions to divulge the university's learning management system (Moodle) and other e-learning solutions, (ii) strategic and articulated support meetings for colleges, departments and research groups, (iii) the organization of thematic web conferences and other scientific events, and (vi) social networking. Training is another area of significant relevance in this strategic plan. Hands-on small groups, workshops specifically designed for faculties and researchers, take place for promoting the development of the required skills needed for the use of educational technology and online systems (e-skills). The area of support services and systems development corresponds to the maintaining of technical infrastructures that support the use of the implemented online tools and systems. The development of strategic actions to monitor and access ongoing operations, as well as regular evaluation of processes and results, take place in order to ascertain the adequacy and effectiveness of the plan of action.

IV. The Study

With one of the core actions of the program "E-learning in the UL" being the monitoring and evaluation of the practices of b/e-learning at the University of Lisbon, regular data collection of the statistics of use of the Learning Management Systems at the University of Lisbon is conducted.

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

A. Method

This study aims to analyze, through a descriptive perspective, the process of LMS adoption in a European university, the University of Lisbon. Founded in 1911, the university had, in 2010/2011, 23756 students and 2020 faculties enrolled in one of the 282 courses available in different scientific areas throughout the 11 faculties and institutes.

In table I it is possible to see, throughout the three academic years at study, the total number of faculties and students.

TABLE I
Total Number of Faculties and Students (Academic Year)

Academic Year	Faculties	Students
2008/2009	1797	19233
2009/2010	1856	22844
2010/2011	2020	23756

Considering the last three academic years (2008/09, 2009/10 and 2010/11) this longitudinal study tries to analyze the growth of online LMS courses and the level of use of the e-learning platforms at the University of Lisbon.

More specifically, this study presents the evolutional process of growth (number of LMS courses created and active users) and the pattern of use, in a global perspective and in different scientific areas: Arts and Humanities (which integrates the Faculty of Fine Arts and Faculty of Languages), 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). Another variable in this study is the 'intensity of use' which was operationalized in the following categories:

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

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

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

V. Results

Data collection procedures included the identification of LMS courses available in each faculty and institute of the University of Lisbon (then grouping them by strategic area) and the evaluation of the intensity of use registered in each LMS course. Note that only visible LMS courses were considered and analyzed.

In this data collection process four platforms of the University of Lisbon were considered: *http://elearning.ul.pt (University of Lisbon), http://moodle.fc.ul.pt (Faculty of Science), http://mocho.di.fc.ul.pt (Department of Information Technology - Faculty of Science) and http://meduc.ul.pt (Institute of Education) [9]*.

A. LMS courses and users growth rate

Moodle was installed for the institutes and faculties of the University of Lisbon in 2007/2008 (although a previous system did exist) but, only in 2008/09 did the process of dissemination of this online environment begin and the E-learning program as a formal initiative started in 2010. The following results focus on three academic years: 2008/09, 2009/10 and 2010/11.

In fig. 3 it is possible to see the total of LMS courses opened in each academic year examined, as well as the rate of growth.

In the academic year of 2008/09, 148 LMS courses were opened in the Moodle platform and in 2009/10 580 LMS courses were available. A growth of 292% was registered. In the first year of the E-learning program in the UL, a total of 1442 LMS courses were created and a growth of 149% was achieved, when comparing to the previous academic year.

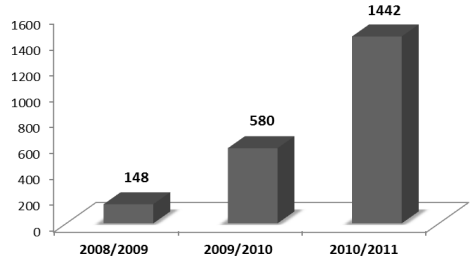

Fig. 3 Total number of LMS courses in UL by academic year

Considering the total number of faculties and students in the University of Lisbon, table II presents the number and percentage of faculties and students registered in UL platforms throughout the three academic years in study[1].

TABLE II
NUMBER OF UL FACULTIES AND STUDENTS REGISTERED IN MOODLE BY (ACADEMIC YEAR)

Academic Year	Faculties	Students
2008/2009	73	1044
2009/2010	282	3893
2010/2011	794	7999
Percentage of Moodle user (considering UL total numbers)		
2008/2009	4%	5%
2009/2010	15%	17%
2010/2011	39%	34%

As it is possible to see, the number of faculties and students increased from year to year. It can be observed that from 2008/09 to 2009/10 the platform of the UL grew 14% in the number of faculties registered in Moodle platforms. Students had a growth of 12%. In the first year of implementation of the E-learning Program (2010/11) the percentage of faculties and students registered in Moodle platforms had a remarkable growth, 24% and 17% respectively.

A clear progression in the percentage of faculties and students of University of Lisbon that have registered on Moodle platforms can also be found. Faculties progress from 4% to nearly 40%and students progressed from 5% to 34%, in two academic year.

In order to get a clear view of the distribution of Moodle courses at the University of Lisbon by different scientific areas, the number of LMS courses per strategic area was also calculated.

As presented in fig.4, all strategic areas over the three academic years reveal a remarkable growth. The area of Science and Technology presents the highest growth rate.

[1] Note that the moodle platform http://mocho.di.fc.ul.pt (Departament of Informatics) was not considered in this collected data.

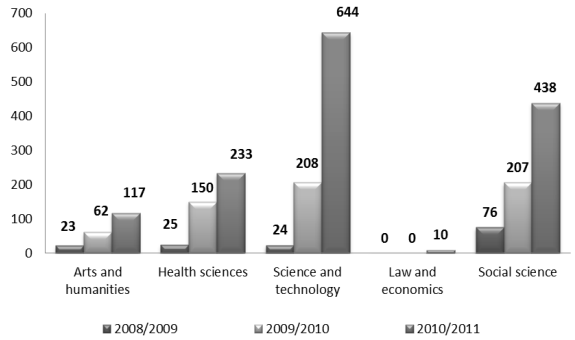

Fig. 4 Total number of LMS courses by strategic areas

Comparing 2009/10 with 2010/11, it can be stated that the growth rate was also quite high.

It can be observe that from 2008/09 to 2009/10 the strategic area of Science and Technology had a growth rate of 570%, followed by Health Sciences with a growth rate of 476%. The strategic area of Legal Economic Sciences didn't present any significant growth between the academic years of 2008/09 and 2009/10 although better results were found in 2010/11 when 10 LMS courses were opened. The other strategic areas, Social Sciences and Arts and Humanities, had a growth rate of 172% and 170% respectively.

In 2010/11, the Science and Technology strategic area was the one that had the greatest growth rate (300%), followed by Social Sciences (111%). The other strategic areas, Arts and Humanities and Social Sciences had a growth rate of 88% and 55% respectively (fig.5).

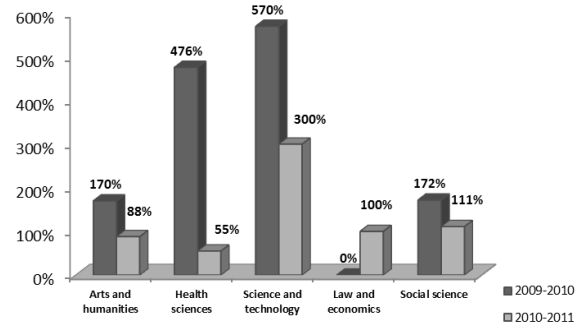

Fig. 5 LMS courses rate of growth by strategic areas

A. LMS Courses in intensity of use

The total number of LMS courses in the platforms of the UL was classified by the level of use of the different features available on the Moodle platform.

To be able to rate the intensity of use of the courses, the following categories were defined:

'No activity' – The course exists but no actions were developed in it.

'Moderate activity' – The course provides resources for consultation.

'Considerable activity' – The courses provides resources for consultation and offers the possibility of participants developing other interactive activities.

In fig.6 it is possible to see that in 2008/09, the majority of courses (66%) in the platforms of the UL presented a considerable level of use and only 12% didn't register any activity. In the two following academic years, the usage rate of the courses changed. In 2009/10, 42% of courses registered a moderate level of activity and 34% registered a considerable level of activity. In a parallel analysis with the previous year, an increase of 12% in the percentage of courses without any activity can be found, but more relevant was the increase registered in the percentage of courses that revealed moderate or considerable level of intensity of use (76%).

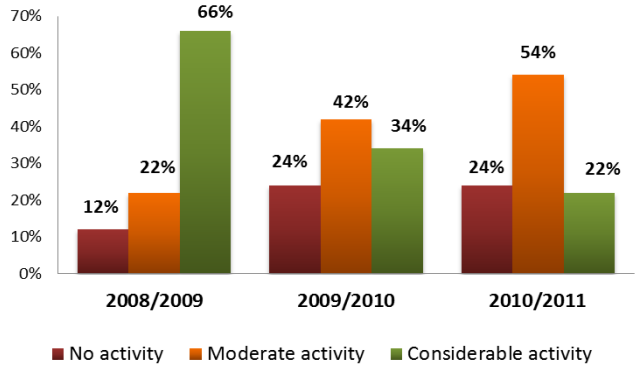

Fig. 6 LMS courses use by academic years

In the academic year of 2010/11 the number of LMS courses increased from 580 to 1442, but the distribution of results didn't change significantly. 76% of the courses show a moderate or considerable level of activity. The majority of the LMS courses of the platform of the University of Lisbon introduced already a moderate level of activity (54%). In other words, 12% more than in previous year. However, while the percentage of LMS courses with no apparent activity stayed the same, the percentage of subjects with considerable activity decreased by 12%.

In order to get a more specific view of the intensity level of each LMS course of the platform of the UL, the activity rate of the courses per strategic area, in the three academic years, was also analyzed.

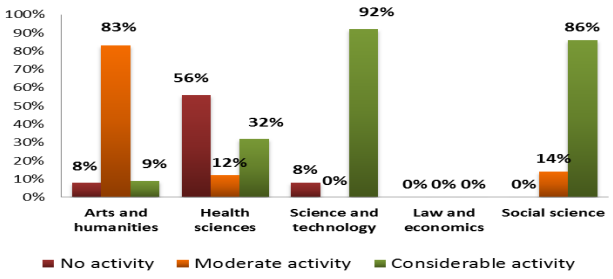

Fig. 7 LMS course intensity of use in 2008/09 by strategic area

As it is possible to verify with the data presented in fig.7, that in 2008/09, there were few strategic areas with a high percentage of courses registering considerable activity. The area of Science and Technology was the one that registered the highest percentage of courses in those conditions (92%), closely followed by Social Sciences (86%). Arts and

Humanities was the area with the highest percentage of subjects with moderate activity (83%) and the area of Health Sciences registered the highest percentage in the number of subjects with no activity (56%), considering the fact that no courses were created in the Law and Economics area.

In 2009/10 there were few differences in the activity rates. It is possible to see that the number of LMS courses with moderate activity grew in some strategic areas and the number of courses with no activity decreased.

Arts and Humanities continued to be the one that registered the highest number of LMS courses with moderate activity (87%), followed by Science and Technology (62%). Social Sciences registered the highest number of LMS courses with considerable activity. Health Sciences continued to be the strategic area that registered the highest number of LMS courses with no activity (63%).

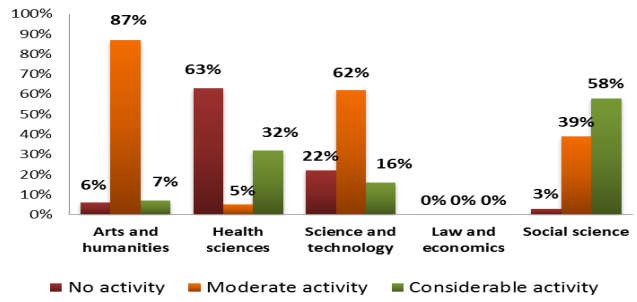

Fig. 8 Course intensity of use in 2009/10 by strategic area

In 2010/11 some changes could be found (fig.9). In all strategic areas, most courses registered moderate activity. The area of Law and Economics, that previously had no courses opened, registered the largest percentage of LMS courses in those conditions (70%), followed by Science and Technology with 60%. Social Sciences assumed the front row, with the highest percentage of courses with considerable activity (31%), followed by Science and Technology (24%). Arts and Humanities registered the highest level of courses with no activity, changing places with Health Sciences, which had assumed the highest percentage in the two previous years.

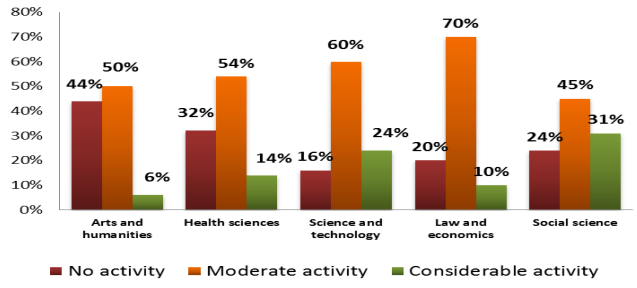

Fig. 9 Courses Intensity of use in 2010/11 by strategic area

VI. Conclusion

The results evidenced that, in the three academic years a significant growth was found both in the number of faculties and students registered in LMS as well as in the total amount of courses opened in Moodle platforms of the University of Lisbon.

The number of faculties' grew 10 times over the last three academic years and the number of students increased almost seven times. In 2009/10, nearly 40% of faculty members and 34% of students was registered as users in UL' learning management systems and a total of 1442 courses were opened in these online environments. These numbers support the idea that a clear diffusion on LMS adoption in teaching practices is been conducted in University of Lisbon. They also stimulates the idea that a long walk still needs to be developed, mainly because these processes started to been implemented in others higher education institutions, both in national and international context, 5-to-8 years before, a significant part of the road has already been walked, perhaps the most challenging part. Rogers' theory of innovation diffusion evidences that the beginning stage is one of the most difficult phases to overachieve because, in that phase, innovation lies as a localized invention only embraced by a slight part of individuals, being unknown, disregarded or depreciated by the majority of the institution [3].

Rogers' theory of innovation diffusion describes the way an innovation is adopted in group of individuals or entities as an analytically tractable distribution, similar to Gaussian distribution. His theory helps to understand and estimate the level of acceptance that can be expected in different moments in time. If a timeline was associated to individuals level of acceptance in an organization, in the early stage of innovation diffusion (lets day, for example, in the first year!) only near 2.5% of the individuals would accept it. In a second moment, (in the second year!) the number of individuals that would embrace the change as near 16%. In a third moment (third year!), the number would increase to 34%. The fourth moment, other 34% of individuals would embrace the change and finally, in a fifth and final moment, the last 16% of the group would also accept it. This hypothetical timeline can be used to make sense of the results found in this article.

Although this study only presents data from 3 academic years, the results clearly adjust to Rogers' distribution. In 2008/09 the percentage of faculties that were already registered in Moodle platforms was near 4%.Therebefore these faculty members can be identified as the "innovators". In 2009/10, that number grew to 15% and these faculties can be identified as early adopters. In 2010/11 that number increased to near 39%, and these faculties could be named the 'early majority' similar percentage was found in students.

Rogers suggest that innovators and early adopters who are the firsts to use any innovation, behave differently from early majority and later adopters. They are driven by intrinsic motivation, are willing to take risks and invest time and energy working with the innovation. The early majority are also interested in the innovations, but are more attracted to what the innovation can do for their current needs rather than the innovation per se. The last 16%, the laggards or resisters may never adopt the innovation willingly.

Considering Rogers model for innovation diffusion great number are expected to come in the following years but a small percentage of faculties might never embrace Moodle platforms for teaching purposes.

Some studies have evidenced that late adopters will inevitably be changed in the process of adopting a new tool, because these will inescapably lead to changes in the whole activity system [10]. However, other studies advocate that is not safe to extrapolate innovation acceptance from the actions and enthusiasm of early adopters in order to predict the use and impact on the larger scale. However, in much of the recent literature this appears to have been done regarding ICT-integration in education [10].

In this specific study, the results found in LMS courses intensity of use evidenced that although the adoption of LMS in teaching practices has been growing, with more LMS courses being opened and more users registered, the percentage of LMS with a considerable level of activity has been decreasing in University of Lisbon. In 2008/09, 66% of the courses revealed a considerable level of activity. That number decreased to 34% in 2009/10 and to 22% in 2010/2011. These numbers make suspicion about the fact that innovators, early adopters, late majority and laggarts doesn´t diverge only in their readiness for accepting innovation but they also receive it in different levels or by undertaking different approaches. Innovators and early adopters might accept innovation in a wide-open perspective, truly embracing it and taking from it all the possible outcomes. Laggarts or diedharders [11], in their resistance-to-change approach can agree to take innovation in their practices but might ends-up adjusting or diluting the innovation in the established practices and not the otherwise.

More longitudinal studies about ICT-adoption in higher education, that goes over long periods of time, need to be conducted in order to clarify if the level of acceptance of an innovation that aims to introduce improvement in the established teaching and learning practices tends to be inversely associated with the level of expansive transformation of the practices and of the all system of activity [12].

Still focusing on the LMS courses intensity of use, it was also possible to understand, through the data collected, that the majority of courses presented moderate levels of activity. It highlights the fact that faculties use Moodle more frequently to provide access to digital resources for students, e.g. Curricular syllabus, support content and study materials. Few courses has taken advantage of Moodle activities, offering students the possibility of developing online interaction in chats or discussion forums, self-monitoring their learning through online tests or Flash MX Learning Object (SCORM). This pattern of use is convergent with previous studies development in the field of ICT-integration in educational contexts [2, 5, 10, 13, 14]. The adoption of ICT higher education institutions daily practices has adapted the new tools to precedent teaching models and didn't implied direct and profound changes at a structural, pedagogical and social level. Higher education teaching practices as well as university structures are rigid and unproven, regarding the incorporation of technological advancements [15]. However, technology in general can act as a catalyst to combat the inflexibility of organizational structures.

With this study it was also possible to see that different scientific areas also revealed different levels of involvement in this program for organizational innovation. Although all strategic areas have presented an expansion of the LMS courses opened every academic year, some areas have progress in a very slow pace, more specifically Law and Economics area, closely followed by Arts and Humanities. For these specific areas, the attraction of key-persons might have a triggering effect. A powerful way to promote the diffusion of an innovation is to positively affect the attitudes of opinion leaders and, therefore, to take advantage of interpersonal communication channels that lies within the organizations [3].

In the opposite, Sciences and Technologies area presented the highest rate of courses opened in each academic year and consistently evidenced an increase in the level of courses intensity of use. Also relevant increments have been found in Social Sciences.

The differences in teaching and assessment practices as well as in the institutional culture [10] can justify the variances identified in each strategic area of University of Lisbon. In the last academic year, a close relationship with most of the institutions direction boards, made possible to define and implement different dissemination actions in each institute and faculty for promoting the involvement in the e-learning program, mostly for stimulating the adoption of LMS for teaching purposes and for planning b/e-learning course. Even though, the results evidences that more context-sensitive initiatives need to be designed. By nature, some scientific areas can be more open to ICT- integration while other can be more resistant. However, an organization program such as the e-learning program of University of Lisbon does not aim to contribute to intensify those differences but rather to attenuate them and promote a coherent and equitable movement of innovation and updating on teaching and learning practices.

The same principle of equity is required to be used regarding faculty members. Despite the fact that 39% of the faculties have already used UL' Moodle platforms, the major part of the professors have not yet access to a learning management system. Considering the current data an action plan must be developed to take advantage of faculty members' positive attitudes regarding innovation (including the relative advantage, compatibility, and simplicity attributes of LMS) and interpersonal communication channels (collegial communication), to diffuse instructional technology [2]. In that process, innovation and early adopters can be involved. Their proximity with other faculties, their revolutionary vision, their willing to take risks, their individually self-sufficiency, and ability to communicate horizontally must be used for dissemination process. [5].

As Rogers' theory suggest most of the faculties are how in the decision stage, still analyzing the cost and benefits of this online environments, perhaps some are already in the adoption stage, exploring the best course of action to take (adopt, actively reject or passively reject) [4]. New efforts are now needed to be made in order to promote the transition of this innovation from a cognitive level to a behavior level.

In that process, staff training assumes a relevant role [11]. Staff development initiatives, specifically hands-on workshops, where (i) ICT-for-teaching related competences are stimulated and (ii) online learning environments and webtools are explored, can promote great levels of acceptance to innovation. In Moodle training sessions the triability and observability can be increased, the level of complexity reduced. Because e-learning program' staff development initiatives does not focus only on technical proficiency but also promote the pedagogical-oriented skills and consider faculties beliefs, attitudes and motivation, higher level of compatibility and great perception of related advantage can also be expected.

E-learning Program is an explicitly assumed organizational strategy for innovation. It is an initiative that aims to take advantage of new technologies for (i) updating teaching practices, (ii) promoting organizational modernization, (iii) to ensure competitive advantage and internationalization. As an innovation-diffusion process the integration of new technologies in higher education institutions is not a progressively successful and linear process. Innovation diffusion process requires time to be accepted (or rejected) but mostly to gain stability and to be widespread in the organization.

Time tends, therefore, to assume a critical role when developing technology integration process in educational contexts. Research has pointed out that, regarding ICT-adoption time is a crucial factor. According to several studies, the use of information and communication technologies in educational contexts demands, in most cases, a significant investment of time and effort [12] [13]. Some authors certify that ICT-integration process, such as the implementation of a virtual learning environment, in educational institutions takes between 2/3 to 5 years for a full adoption and the establishment of new habits and routines. Innovation is only achieved when it is so naturalized in the organizational practices that it is absorbed and vanishes. It is not simple, not even when ICT is only addressed as an enriching supplement for conventional face-to-face classes and even less when new learning approaches, such as fully online courses are in stake.

REFERENCES

[1] [1] Volery, T. (2000). Critical success factors in online education. The International Journal of Educational
[2] Management, 14(5), 216-223.
[3] [2] Sahin, I., & Thompson, A. (2006). Using Rogers's theory to interpret instructional computer use by COE faculty. Journal of Research on Technology in Education, 39(1), 81-104.
[4] [3] Rogers, E. M. (2003). Diffusion of innovations (5th Ed.). New York, NY: Free Press.
[5] [4] Carr, V. H. (2001). Technology adoption and diffusion. Retrieved from http://www.au.af.mil/au/awc/awcgate/innovation/adoptiondiffusion.htm
[6] [5] Finley, L. & Hartman, D. (2004). Institutional change and resistance: Teacher preparatory faculty and technology integration, Journal of Technology and Teacher Education, 12(3), 319-337.
[7] [6] Pedro, N. Matos, J.F. Lemos, S. (2010). Technology and E-learning in Higher Education: a proposal for a pedagogical model. Paper presented at International Conference TIC EDUCA 2010. Lisbon: Institute of Education University of Lisbon.
[8] [7] RYAN, Steve; SCOTT, Bernard; FREEMAN, Howard & PATETL, Daxa; (2000). The Virtual University: The Internet and Resource-Based Learning. London: Sterling.
[9] [8] SALMON, Gilly; (2000). E-Moderating: the key to teaching and learning online. London: Sterling.
[10] [9] e-Learning Lab. (2010/2011). E-learning Program in UL: report activity. Retrieved from http://elearninglab.ul.pt/pagina/programa-e-learning-na-universidade-de-lisboa
[11] [10] Kirkup, Gill & Kirkwood, Adrian (2005). Information and communications technologies (ICT) in Higher Education teaching – a tale of gradualism rather than revolution. Learning, Media and Technology, 30(2), 185–199.
[12] [11] Macdonald, J. & Poniatowska, B. (2011). Designing the professional development of staff for teaching online: an OU (UK) case study. Distance Education, 32 (1), 119-134.
[13] [12] Lim, C.P. and Hang, D. 2003. An activity theory approach to research of ICT integration in Singapore schools Computers and Education [Online]. 41, pp49-63. Available from: Academic Search Premier http://www.library.dcu.ie/Eresources/databases-az.htm [Accessed 15 December 2008
[14] [13] Brimkerhoff, J. (2006). Effects of long-duration, professional development academy on technology skills, computer self-efficacy and technology integration beliefs and practices. Journal of Research on Technology in Education, 39, 1, 22- 43.
[15] [14] Fanklin, T., Turner, S., Kariuki, M. & Duran, M. (2002). Mentoring overcomes barriers to technologies integration. Journal of Computing in Teacher Education, 18, 1, 26-31.
[16] [15] O'Hearn, J. (2000). Challenges for service leaders: setting the agenda for the virtual learning organization. International Journal of Contemporary Hospitality Management, 12(2), pp. 97-106.