EVALUATING E-LEARNING READINESS IN A HEALTH SCIENCES HIGHER EDUCATION INSTITUTION

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ABSTRACT

An e-learning readiness evaluation is critical to the success of an e-learning strategy, identifying issues that should be considered before and during an e-learning intervention. This paper describes a model to evaluate the e-learning readiness of a Higher Education Institution and reports the results of its application in ESTSP, a Porto's Allied Health Sciences Higher Education Institution. Documentation review, observation and two questionnaires were applied to collect data. The first questionnaire gathered information about students' skills, their access to equipment and perceptions on e-learning. 273 students answered the questionnaire resulting in 17% response rate. Professors' questionnaire gathered information about ICT usage and skills, access to equipment and e-learning experience. 29 professors answered the questionnaire, almost half (49%) of ESTSP's full time professors. It was found that student's access to computers and Internet, one of the major initial concerns, was not as low as initially expected. Yet, this doesn't attenuate the need to invest in infrastructures, which lack was identified by professors and students. Together with the financial dimension, this is an area were ESTSP has a low e-learning readiness. Faculty skills are also an issue to consider.

KEYWORDS

e-Learning, e-Readiness, Evaluation, Case-study, Strategy, Higher Education.

1. INTRODUCTION

Information and communication technologies (ICT)' importance in education is widely recognized as an instrument to improve the quality of teaching and learning activities (UP 2004). The adjustment of the learning process to modern society's perspectives and to the latest technologies is recognized by Higher Education Portuguese Ministry (MCIES 2005). ICT integration in Higher Education (HE) is viewed as a mean to guarantee the adequacy of the exit profiles and to contribute to the graduated employability (Cardoso et al. 2003).

E-learning, as defined by the European Commission (2001), is "using new multimedia technologies and the Internet to improve the quality of learning by facilitating access to facilities and services as well as remote exchanges and collaboration". Its practice helps promote mobility, lifelong learning and European dimensions of HE, some of the main lines of action of the Bologna process (Ministers 1999).

Relevant to the success of an e-learning implementation is the assessment of an organization's readiness for e-learning (Aydın and Tasci 2005, Borotis and Poulymenakou 2004, Kaur and Abas 2004, So and Swatman 2006). E-readiness is defined as the capacity to obtain benefits from the use of ICT (Choucri et al. 2003, EIU 2003). Therefore, an e-learning readiness assessment measures the ability of an organization to take advantage of e-learning. Borotis and Poulymenakou (2004) define it as "the mental or physical preparedness of an organization for some e-learning experience or action".

This paper presents a case study of an e-learning readiness evaluation, which occurred in ESTSP, a Porto's Higher Education Institution (HEI) dedicated to allied health sciences education. ESTSP joined Porto's Polytechnic Institute (IPP) in July 2004, and has 13 undergraduate programmes: Laboratorial Analysis and Public Health (LA), Pathological Anatomy, Cytology and Tanathology (PA), Audiology (AU), Cardiopneumology Technologist (CP), Pharmacy (PH), Physiotherapy (PT), Nuclear Medicine (NM), Neurophysiology Technologist (NP), Radiology (RA), Radiotherapy (RT), Environmental Health (EH), Speech and Language Therapy (ST) and Occupational Therapy (OT). Faculty members are organized in 20 scientific areas, one for each programme and other 7 areas: Biomathematics, Biostatistics and Bioinformatics (BB), Functional Sciences (FS), Morphological Sciences (MS),

Chemical and Biomolecular Sciences (CS), Social and Human Sciences (SS), Physics (PS) and Health Management and Administration (HM).

The need of a Learning Management System (LMS) to support blended learning and new pedagogical paradigms was stimulated for several reasons. Among these are: Bologna Declaration, students' pressure to have pedagogical materials online, the demand of students' ICT competencies in their academic and professional activities, the improvement of students' engagement towards study, the simplified access to pedagogical contents and the potential adjustment of e-learning to individual learning styles.

Initial thoughts on this process rouse several concerns like: Do students have the necessary infrastructures to access the LMS? Do faculty need a LMS? Do faculty feel blended-learning may be useful to their courses? Do faculty have access to the necessary hardware and software to produce digital pedagogical contents? Do faculty have the necessary skills to use a LMS and produce the appropriate pedagogical contents? Does ESTSP has human resources to support a daily LMS administration? All these concerns triggered the need for an e-learning readiness evaluation as a first step in the definition of ESTSP's e-learning strategy.

This paper presents a model to evaluate an HEI's e-learning readiness (Section 2), followed by a description of this case study data gathering techniques (Section 3). Next, some of the main results are presented (Section 4) and their discussion is made in Section 5 towards an e-learning readiness evaluation. Conclusions and lines of future work are presented in the last section.

2. HEI' E-LEARNING READINESS EVALUATION MODEL

Several models to evaluate an organization's e-learning readiness are already defined in the literature (Borotis and Poulymenakou 2004, Broadbent 2001, Chapnick 2000, Haney 2002, Kapp 2003, Minton 2000, Rosenberg 2000, Worknowledge 2004). The model proposed by Borotis and Poulymenakou (2004) was defined based on four predefined models (from Rosenberg, Chapnick, Haney and Worknowledge) and tries to eliminate the lack of congruence in predefined components of e-learning readiness through the definition of seven dimensions: Business, Technology, Content, Training Process, Culture, Human Resources and Financial.

Borotis and Poulymenakou's model wholeness, resultant of four models unification, justifies its adoption, with some changes, in this study. Their model is applicable to any type of organization and, when applied to a HEI, some adjustments should be made. For example, the Training Process dimension should be eliminated as it refers to the organization capacity to organize, analyze, design, develop, implement and evaluate an educational module, which are core competencies of an HEI. Along with this, a few other changes were also made, resulting in the model presented in Figure 1.

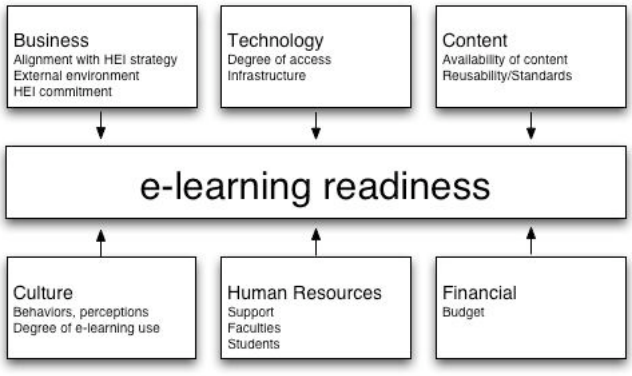

Figure 1. E-learning readiness dimensions (adapted from (Borotis and Poulymenakou 2004))

The **Business** dimension refers to the alignment of the e-learning strategy with the HEI global strategy and goals and with the external environment (as legal obligations and dependencies with other organizations) and to the level of commitment and support of HEI top-level administration. The **Technology** dimension focuses on the HEI technologic infrastructure and on the degree of access to the infrastructure and to the Internet. The **Content** dimension is related to the availability of existent content, its format, levels of interactivity, reusability and interoperability. The **Culture** dimension concerns the HEI's habits and perceptions towards e-learning adoption and use. The **Human Resources** dimension refers to the availability and skills of everyone involved in the e-learning experience (the administrative/support team, faculty and students). At last, the **Financial** dimension analyzes the HEI's budget allocation to the e-learning strategy.

Each dimension evaluation will be qualitative in one of three categories: low, medium and high readability. To classify the HEI in each dimension, Rosenberg's rating scale (Rosenberg 2000) will be used. The levels 0 ("No evidence of any positive initiative or result in this area") and 1 ("Little

evidence, but there are potential improvement opportunities") match a low classification. The levels 2 ("Initiatives underway but progress is fleeting") and 3 ("Initiatives underway with some sustainable success probable down the road") correspond to a medium classification. The levels 4 ("Reasonable success achieved; now the challenge is to keep it going in the right direction") and 5 ("Approaching sustainability – perhaps even a best practice") match a high readability.

3. DATA GATHERING METHODS

Several data gathering methods were used: documentation review, observation and surveys through questionnaires. Business and Financial dimensions involved documentation review and its critical analysis. All other dimensions were evaluated through observation and two questionnaires. The diversity of techniques allows a more integrated and coherent analysis.

The **observation** goal was to collect data concerning ESTSP human and ICT resources and to evaluate ESTSP web server's usage by professors to support their classes. This evaluation was done manually for all professors with a web server account. For each web page, the number of courses with online support was counted along with the available features (syllabus, lectures, classes schedule and topics, grades, announcements, readings).

The **student's questionnaire** gathered information about students' skills on computer and Internet use, access to suitable equipment and perceptions on e-learning. Students were asked, through the institutional email system, to fill a questionnaire available on the Web. Simultaneously, computer science professors also asked students to answer the questionnaire in their classes.

273 students answered the questionnaire what results in a 17% response rate. This low response rate may be caused by the inaccessibility of students to the ESTSP's official mailing system, introduced in2005, to which students have to request access.

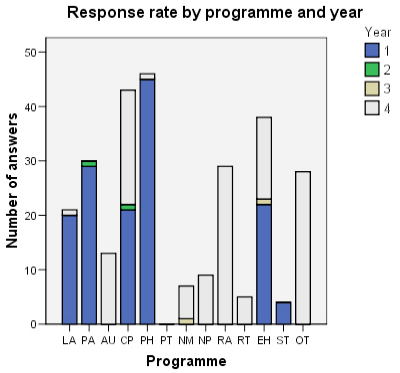

Figure 2. Number of answers by year and programme

As it is possible to see in Figure 2, answers are mainly from 1st and 4th year students (only 2 students in the 2nd and 2 students in the 3rd year answered the questionnaire). These are the years where programmes have computer science's courses what suggests that answers to this questionnaire were mainly given in classes. The response rate in the 1st year is 24% and in the 4th year is 38%. The almost inexistent number of answers in the 2nd and 3rd years impedes further and more specific analysis in these years, which will not be considered in the analysis made by curricular year. Excluding Physiotherapy, all programmes have students that answered the questionnaire.

Professors' questionnaire gathered information about ICT usage in courses, ICT skills, access to suitable equipment and e-learning experience. Professors were asked to answer this web available questionnaire through the institutional email system. 29 professors answered the questionnaire, a 24% response rate in all ESTSP's professors and a 49% response rate in ESTSP's full time professors. In five scientific areas any professor answered the questionnaire. The area with more answers is the Biomathematics, Biostatistics and Bioinformatics one, which is not odd as it is the area of computer science teachers.

4. RESULTS

4.1 Infrastructure

In terms of ICT infrastructures, students often complain about the lack of computers to work when they are out of classes. Effectively, ESTSP has 3 classrooms with a total of 58 computers, whose access is only restricted to classes. Out of classes, students only have access to a small number of computers (around 8) that reside in ESTSP's library.

All HEI's buildings have access to Internet through wired network. Currently, only two of the buildings have wireless Internet access. The third building is now being equipped with a wireless network. Since January 2004, ESTSP has a web server that can be used by faculty and students.

4.2 Access to computers and Internet

Against initial expectations, a large proportion of students have access to computers and Internet during the week (Table 1). As expected this proportion is bigger in the weekend (a large proportion of students aren't from Porto). In the week, this proportion is lower in 1st year than in the 4th year. Internet access is not as widespread as computer access. Yet, most students have Internet access during the week.

Students have access to computers and Internet mostly at home (Table 2). As expected, in the 4th year, students have a greater proportion of accesses from work (4,7% against 1,4%) and fewer accesses from other places (1,6% against 7,1%). Besides home, school and work, students have access to computers in public spaces, family houses and others HEI, which were aggregated in *other places*. Regarding Internet access, *other places* are essentially public spaces.

Table 1. Proportion of students with access to computer and Internet during the week and weekend

		Week	*Weekend*
Computer	Global	86,1%	94,9%
	1st year	76,6%	95%
	4th year	96,1%	95%
Internet	Global	64%	78,8%
	1st year	59,6%	79%
	4th year	70,3%	79%

Table 2. Proportion of students with access to computer and Internet, during the week and weekend, at home, school, work and other places

		Week	*Weekend*
Computer	Home	82,8%	96%
	School	25,3%	0,7%
	Work	2,9%	1,1%
	Other places	4,4%	2,6%
Internet	Home	58,2%	78,4%
	School	36,6%	3,7%
	Work	3,3%	3,3%
	Other places	12,1%	12,8%

4.3 Web server's use to support courses

From 61 professors with web account, only 12 (20%) have a personal web page and from 307 existing courses, only 33 (10%) have some sort of support in ESTSP's web server. Most common features are lectures, readings and course's syllabus (Figure 3). In Figure 4, it is possible to verify that almost half courses' web pages only have 2 features. Seven web pages had all the analyzed features.

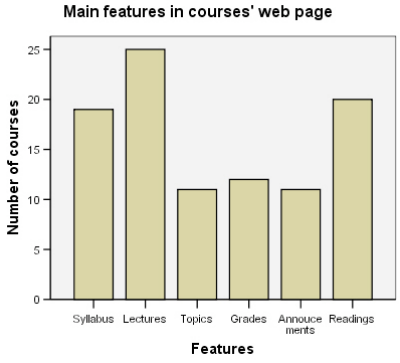

Figure 3. Main features in courses' web pages

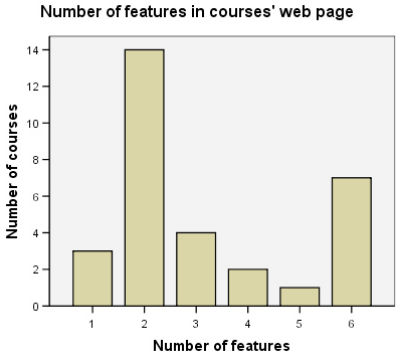

Figure 4. Number of courses per number of features

4.4 ICT's use in the teaching/learning experience

48,3% of faculty members who answered the questionnaire said they already used ESTSP's web server. Web server's usage distribution by scientific area can be seen in Figure 5. In 8 of 14 areas with answers, there is at least one faculty member that has used the web server.

No professor picked the option "It's not relevant for the teaching/learning experience" as a motive to not use the web server. The justification most given is the lack of skills (73,3%), followed by

information lack/no knowledge about it (40%). 26,6% justifies it for the lack of time. Students' difficulties on web page's access were also a motive presented by one professor.

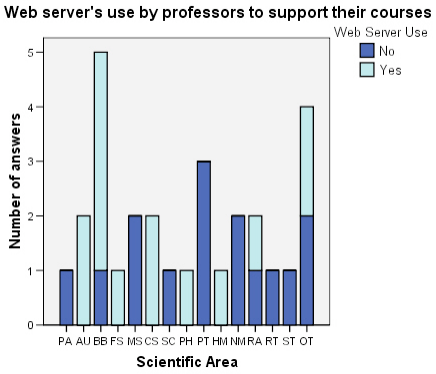

Figure 5. Number of professors that use ESTSP's web server to support their courses, by scientific area

With the number of courses taught and the number of courses in which ICT like PowerPoint presentations and computer applications were used, it is possible to verify that the majority of the professors use ICT in all their classes (83%). Only one professor (that taught only one course) hadn't used ICT in his courses.

Four scientific areas have professors that don't feel the need to use more extensively ICT. 79,16% of professors that would like to do a more extensively use of ICT, point out the lack of infrastructures and equipment as their obstacle. 37,5% of these professors complained about lack of time and 29,16% about lack of skills.

4.5 Students' perceptions on e-learning

The majority of students have never heard the term e-learning (51,7%). This proportion is bigger in the 1st year (59,6%) than in the 4th year (43%).

Features most valued by students are the access to assignments information such as goals, delivery dates and grades (90%) and web access to lectures (88,5%). The calendar was considered useful by 62,1% of the students and communication tools (like chat and discussion forums) by 27,9%.

There is a generalized opinion that e-learning features contribute positively to the teaching/learning experience. 50,9% of students thinks this statement is right and 48% thinks it is very right. Only 1,1% (3 students: 2 from the 4th year and 1 from the 1st year) consider this a wrong statement.

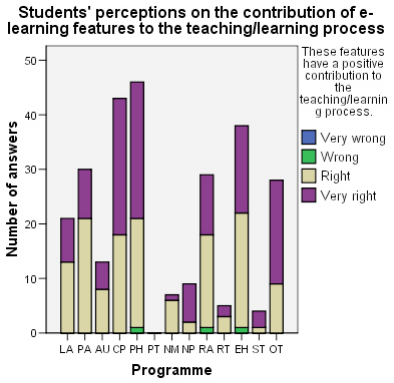

Figure 6. Contribution of e-learning features to the teaching/learning process

As it is possible to see in Figure 6, five programmes (Cardiopneumology, Pharmacy, Neurophysiology, Speech and Language Therapy and Occupational Therapy) have a large proportion of students that have choose the option Very Right instead of Right. All the other programmes have a majority of students choosing the Right option. Eleven students expressed that e-learning features (essentially lectures, grades and announcements) should be available on the web in every course. Two of them also said ESTSP should have online academic services such as courses enrollment.

4.6 Professors' perceptions on e-learning

72,4% said they had no previous experience with e-learning. Only five scientific areas have professors with e-learning experience (Biomathematics, Biostatistics and Bioinformatics, Chemical and Biomolecular Sciences, Physiotherapy, Health Management and Administration and Radiology). Lectures access is the e-learning feature most valued (69% of professors think this is a useful feature). Assignments are the next feature most valued (62,1%), followed by Chat (55,2%), Announcements and Forums (both with 51,7%) and by Online Examinations (37,9%).

4.7 Student's computer and Internet usage habits and skills

The majority of students said they use the **computer** frequently (Figure 7). Only 1,8% consider to rarely use the computer and 0,7% say they never use it. The 2 students that claim to never use the

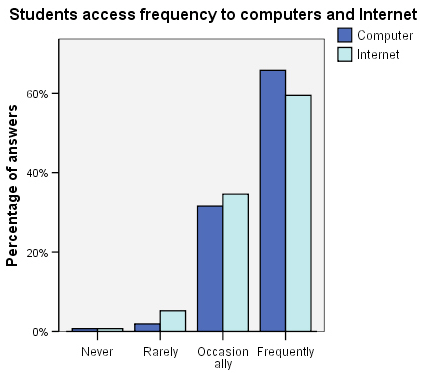

Figure 7. Frequency of access to computers and Internet

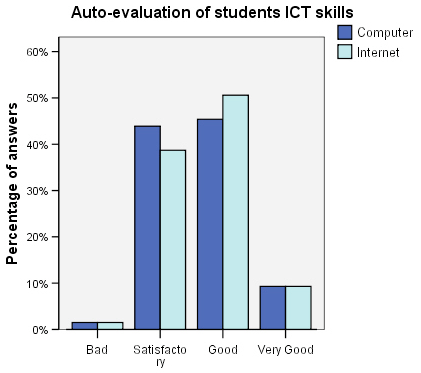

Figure 8. Auto-evaluation of students' skills in computers and in the Internet

computer are from the 4th year and the 5 students that use it rarely are from the 1st year. The difference between occasional and frequent use is more significant in the 4th year (73,4% use it frequently and 25% occasionally) than in the 1st year (58,9% use it frequently and 37,6% occasionally).

As happens with computers, most students use **Internet** frequently (Figure 7). In the 4th year, the proportion of users that use Internet frequently is bigger than in the 1st year (73,4% against 58,9%). On the other side, the proportion of students that use Internet occasionally is bigger in the 1st year (37,6% against 25%).

In terms of skills, as it's seen in Figure 8, the majority of students classify themselves as having good **computer** skills. Only 1,5% say they have bad skills (two of them 1st year students and two of them 4th year students).

The majority of students in the 1st year (48,2%) say they have good skills, while in the 4th year the proportion of answers (45,3%) was larger in the satisfactory level.

As happens with computers, most students say they have good **Internet** skills. The proportion of students that classify themselves as having very good skills is less preeminent in the 4th year (5,5 % against 12,8%) than in the 1st year.

Students use the computer to access Internet (90%), to work (86,8%), to play games (27,5%) and 2,6% said they use it to other things (listen to music, sound, video and image manipulation). This distribution is similar in 1st and 4th year students. The 4th year has a higher percentage of students that use it to work (90,6% in the 4th year against 83,7% in 1st year) and Internet access (93% in the 4th year against 88% in 1st year). On the other side, the games option has a small proportion of answers in the 4th year (23,4% in the 4th year against 30,5% in 1st year).

Almost all students (97,4%) say they use the **Internet** to search for information and to access email (82,4%). 39,6% said they use Internet to chat and 13,2% to play online games, proportion that is larger in the 1st year.

5. E-LERNING READINESS EVALUATION

Previous section results will be discussed next according to the dimensions presented in Section 2. In each dimension, two qualitative classifications (the one defined in Section 2 and Rosenberg's rating scale) are attributed. A summary of these classifications can be seen in Table 3.

As the e-learning technology will be used in a blended approach, the chances of facing legal barriers are less probable than in a pure e-learning approach. Yet, there are some aspects that must be accounted in legislation and in IPP's framing (for example: can a student be evaluated exclusively by a LMS online examination? How long do LMS records have to be kept?).

HEI top-level administration's commitment is crucial to the success of the e-learning strategy. Without its support and collaboration in a change plan to modify established practices, a full adoption can't be accomplished. In ESTSP, this commitment will be evaluated after the presentation of an e-learning adoption plan that will be defined after this e-readiness study.

According to what has been said, the **Business** dimension is classified with a medium (3) e-learning readiness.

In terms of access to computers and Internet, one of the major concerns, the results are promising and help reduce some of the initial doubts. Yet, these results can't hide ESTSP's reduced number of computers available for students' use outside classrooms. Some students expressed their concerns

regarding Internet access, the reduced number of computers available at school and ESTSP's closing hours (that block student's access to computers after closing time). ESTSP needs to work towards 24/7 access to computer laboratories and make additional provisions for disabled students. In professors' point of view, infrastructures are also not sufficient to allow a more extensive use of ICT. In this scenario, the **Technology** dimension is classified with a low (1) e-learning readiness.

The results reveal that a large percentage of professors use ICT (like PowerPoint presentations and other computer applications) in all their courses. Together with the high occupation rate of ESTSP's projectors, suggests there is already a significant quantity of courses' content in digital format. Yet, there will have to be an effort to make these contents evolve to more interactive, reusable and interoperable versions. The **Content** dimension is thus classified with a medium (3) e-learning readiness.

It was pleasant to observe that 83% of the professors use ICT technologies in all their courses and that 10% of existing courses already have some kind of web support. Although 10% is not a high value, it's not bad considering the scientific areas of the majority of the professors, their lack of training in web page's construction and publishing, and considering the number of professors that are at partial time. An online LMS will certainly simplify the process of making contents available online, helping to increase courses' web support. Not surprisingly, web pages are mainly used to make lectures available to students.

The high number of students that have never heard of e-learning in the 1st year (almost 60%) was surprising. The majority of the students think e-learning features contribute positively to the teaching/learning experience and some remarked that e-learning features (essentially lectures, grades and announcements) should be available on the web in every course.

In professors, there is a large percentage that never had any experience with e-learning, what happens in several scientific areas. The possibilities to set online web lectures and assignments are the most valued features.

According to what has been said, the **Culture** dimension is classified with a medium (3) e-learning readiness.

Human resources can be divided in three groups: the team that will maintain and administrate the e-learning technology, professors and students. Presently (2006/2007) ESTSP has 122 professors, where 63 are at partial time and 1650 students. Two computer technicians are presently available to support the ICT infrastructure.

Computer science teachers will lead the e-learning strategy's implementation and, at initial stages, will handle LMS administration. However, with LMS's expansion, a support team will be needed to administrate the LMS and give support to professors and students. Professors will probably need this support, as the lack of skills was the justification most given to not use the web server and the third motive to not use ICT more extensively. It was positive to see that very few students never or rarely use the computer and the Internet and that very few students consider themselves as having bad skills using the computer or the Internet. Therefore, students will less likely need as much support as professors.

With the described context, the **Human Resources** dimension is classified with a medium (3) e-learning readiness.

The Financial dimension is probably the worst dimension in terms of e-learning readiness. At this moment no values have been revealed by top-level administration, but the predictions are not optimistic considering the difficult financial moment ESTSP is living. This will have to be accounted in the e-learning strategy definition and in the choice of the LMS to adopt. At this stage, the **Financial** dimension is classified with a low (0) e-learning readiness.

Table 3. ESTSP qualitative classifications in each dimension

Business	*Technology*	*Content*	*Culture*	*Human Resources*	*Financial*
Medium	Low	Medium	Medium	Medium	Low
3	1	3	3	3	0

6. CONCLUSIONS AND FUTURE WORK

As happens with any technology, a successful e-learning strategy needs more than choose/develop and implement a technology in the institution. To be successful, technology must be used in its fullness by all that benefit from it. In order to do so, there is a need for a strategy to reduce change's resistance in the organization leading to a full ICT integration. An e-learning readiness evaluation can help identify potential aspects that can be used to achieve what its goals and to know where it should invest.

In ESTSP's specific case, this study allowed to attenuate the concern about the lack of student's access to computers and to the Internet; detect the need of significant improvement of the technological infrastructures; identify the professors' need of ICT training and technological support and acknowledge professors interest and openness towards e-learning. Last, but not least important, it may be an instrument to convince the top-level administration of an e-learning strategy importance and to gather its approval. Their commitment would increase ESTSP's e-learning readiness in the business dimension and even in the financial and human resources readiness (for example, through the allocation of someone at full time to the project).

With this case study it was also possible to verify that the model defined is extensive, allowing an overall analysis of the organization e-readiness to e-learning. The data gathering methods were also useful to analyze each dimension and understand organization's strengths and weaknesses towards e-learning. It would be interesting to complement the student's questionnaire results with the opinions of the 2nd and 3rd year answers using their classes as a mean to get a larger number of answers.

To be fruitful, this study has to be integrated in an e-learning strategy that allows an organized, systematic and integrated approach to e-learning.

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