

Web-based Learning and Teaching – Opportunities and Challenges for Higher Education

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Abstract

Open and distance learning at the higher education level is a central issue of today, and seems to be a strong contribution towards the democratisation of access to learning. The advanced information and communication technologies (ICT) together with several applications offer new perspectives, such as the e-learning, networked learning and other ICT enabled environments.

However, these new approaches to the teaching/learning process are still at an immature stage – if their adoption represent opportunities, it also brings in new challenges. Although some of these concepts exist for several years, there is still no clear understanding on the way these approaches will evolve and become current and useful practices. Aware of the potential of these new dimensions of teaching and learning that ICT can enable, the main concerns of the Polytechnic Institute of Cávado and Ave (IPCA) in the promotion of quality in the teaching/learning process are based on the exploitation of ICT in two ways: (1) democratising the access to the information, assuring a permanent enrichment of knowledge to the community of teachers and students and (2) enabling innovative teaching and learning practices and processes.

The paper discusses the exploitation of ICT potential in the teaching & learning process in higher education, draws the actual situation of ICT usage in the teaching & learning in Polytechnic Institute of Cávado and Ave (IPCA), introduces its expectancies and identifies and discusses the *Strengths, Weaknesses, Opportunities, and Threats* associated to Web-based learning and teaching technologies using a SWOT analysis. Finally it proposes / discusses an action plan to align IPCA with the recent developments in the domain, supported by the identification of a set of critical success factors.

Keywords: e-Learning. Flexible Learning. Distance Learning. e-Learning in Higher Education.

1 Introduction

Today, a confluence of factors such as (1) the economic globalisation and integration, (2) the impact of technological developments, (3) the growing demand for sustainable development and (4) the emerging work systems are having a strong impact on organisations, on society and on individuals.

Information and communication systems and technologies are an essential infrastructure for competitiveness of other economic sectors, and the basis for trade, provision of services, production, transport, education and entertainment [1]. They are now one of the major driving forces of change, allowing the transformation of the organisations into global networked structures, with processes extended through continents, creating markets and systems not just global and distributed, but virtual, in a new perspective of a global, networked and knowledge-based economy [3], creating a huge role of opportunities, and simultaneously of challenges to the organizations and to the society.

Organisations of every stripe try to respond to the challenges by adapting their strategies and activities, i.e., restructuring to align themselves to the new requirements of the changing economy. Information and communication systems and technologies are the support of concepts as distributed systems, computer supported cooperative work, telework, electronic commerce, electronic marketplaces, teleoperation, virtual prototyping, concurrent engineering, some forms of open and distance education, etc.

Distance education (web-based) seems to be a contribution towards the democratisation of learning access. According to several authors, [5, 10] the most relevant advances in distance education over the past three decades have been in the university sector, where Open Universities represent an attempt to establish fully integrated distance-teaching systems. However, the new approaches to learning, such as the flexible and distance learning are still at an immature stage; although some of these concepts exist for several years, there is not yet a clear understanding of the way these approaches will evolve and become useful and common practices.

IT innovations are stimulating the growth of markets for educational services and the emergence of for-profit competitors, which could change the higher-education enterprise [8].

This contribution discusses the potential of ICT in the learning and teaching process in higher education, and the main tendencies related with the exploitation of its potential, in section 2. Section 3 makes a brief presentation of IPCA, the Institution to which the authors are affiliated, and highlights its actual situation in terms of ICT usage in teaching and learning. Section 4 identifies the *Strengths, Weaknesses, Opportunities, and Threats* associated to Web-based learning and teaching technologies using a SWOT analysis. Section 5 characterises the project of Web-based learning and teaching under development at IPCA and section 6 identifies the main critical success factors, which are of broad applicability. Finally section 7 concludes the paper.

2 Learning and Teaching in Higher Education - In search of Flexibility/Excellence

The university as a community of scholars surrounded by pupils and auditors no longer exists, and in fact no longer has a future as far as teaching is concerned. The university as an institution is in a transitional phase. Today we have large educational institutions with bureaucratic administrative cultures, beneath which is an organization of independent professionals, all of whom act as if they are mentors. This construction is no longer in tune with reality. Fortunately, teaching methodology in higher education is becoming a growing topic of concern around the world, and that concern is having an impact. However, universities will only be able to solve the major challenges that they have long faced by making creative use of ICT.[4]

The instructor-centred, professorial university was a context well suited to the hierarchical society of the 19th and much of the 20th centuries. The new reality is that the contexts in which people live, work and learn have acquired another dimension in the form of a virtual world in which every organization and individual creates their own virtual context. [4].

The emergence of virtual institutions is directly linked to the development of, and access to, IT and ICT infrastructure, and is contributing to overcome the socio-economic and geographical disadvantages in acquiring skills and knowledge

Many people believe information technology will introduce structural changes to the universities, both in the organisational domain as in the research and learning domains. While university administrative activities have been transformed by IT (for example, student and faculty communications), other higher-education functions have remained more or less unchanged, like teaching for example, which continues to follow a classroom-centred, seat-based paradigm [15]. IT makes it possible to teach and learn in ways that are much different to how we do now, providing

the infrastructure in which the subject matter can be found, student tasks can be performed and the communication and collaboration required to learn can take place [4].

The report by the National Research Council [15] warns academe against “complacency in the fast-paced technological developments from virtual universities” [11].

As in earlier periods of change, the university will have to adapt itself to this changing economy, while protecting its most important values and traditions, such as academic freedom, a rational spirit of inquiry and liberal learning [15]. Adaptation to change means to identify the challenges, the opportunities, and to reshape the roles and the activities, in order to align the university missions with the requirements of the society in the changing economy. Scholarly communities will shift from physical campus to virtual and globally distributed ones.

In recent years the definition and application of open and distance learning has been evolving in parallel with the arrival of newer and intelligent technologies [2]. According to a Commonwealth of Learning evaluation report on virtual education [6], the label virtual is widely and indiscriminately used and it is frequently used interchangeably with other labels such as open and distance learning, distributed learning, networked learning, web-based learning, and computer learning. Another Commonwealth report [7], clarifies that Open and Distance Learning embraces any or all of the concepts and practices of open learning, flexible learning, distance education, online learning and e-learning, and virtual education.

The peer-to-peer (p2p) model is not new and despite its problems in the beginning of its use in the academia - generalized copyright violation and uncontrolled usage of the computational resources and the institution bandwidth, which are used in entertainment and non productive activities [21] - a strong interest and curiosity in academic environments for such applications is raising [18]. Projects like Edutella [16], Comtella [20], and specially Lionshare [13]. Developments like Elena [12, 17], brings p2p to the arena of large scale sharing of resources in the academic world.

Other area of rapid development and unpredictable consequences to the world of learning and teaching is the Open Access Movement [19] and the growing of Institutional Digital Repositories [14]. The purpose is to give free access to all and speed up the scientific information production-consuming cycle. At the moment this movement is centred in the scientific publication but in a near future we must start to think about teaching materials. The movement of Open Access is raising several questions to the actual copyright schema. The question is who must adapt to whom?

3 Brief History of IPCA in Pursuing Learning and Teaching Excellence

Higher education is living a period of change. The new models are here, technologies also, and flexibility is a main requirement for everyone.

Polytechnic Institute of Cávado and Ave has been pursuing, since its creation, a strategic plan for promotion of quality in teaching and learning, with the aim of overcoming the actual constraints every higher education is facing, with the reduction of demand (traduced by the reduction of the number of students), and with the concern of aligning its offer with the requirements of the economical and social environment / the labour market (in order to qualify people for the labour market), with high standards of quality and scholar success.

This concern started in 1998 and was firstly equated in a project called “Quality Promotion Programme”. This project focused the application of ICT as the main support tool for teaching quality in the institute.

Its main guidelines are:

- To explore the ICT application on teaching activity following three main principles: free information access, adequate equipment and new methods on teaching process.
- To adequate and improve the class technical support.
- To develop and implement student support services.
- To promote the students integration on business environment and labour market.
- To promote the transparency and auto-evaluation of proper teaching results.

Actually IPCA works on its *Virtual Campus* project, answering to national Electronic University (eU) initiative. Focusing the same Quality goal, this project will prepare the institute to be technically equipped for next learning and teaching process requirements, as well as to prepare their teachers for the emergent e-learning challenges. Chapter 5 will shortly describe this project.

4 A SWOT Analysis

SWOT (Strengths, Weaknesses, Opportunities, and Threats) is a tool of situation analysis, used in the preliminary stage of strategic decision-making [9], where it provides the basic framework for strategic analysis. SWOT generates lists or inventories of Strengths, Weaknesses, Opportunities and Threats. These lists are used by organizations to conceive strategies that fit their particular anticipated situation, their capabilities and objectives.

Strengths and Weaknesses are analysed from the internal perspective and the Opportunities and Threats from the external. The objective is to transform the Threats in Opportunities.

4.1 e-Learning in Higher Education: a SWOT Analysis

The main strengths and weaknesses of the new technologies and applications to support/complement the teaching/learning process in higher education institutions and the main opportunities and threats associated to its exploitation, are summarised in Table 1.

Strengths	Weaknesses
<ul style="list-style-type: none">- Flexible access to information resources.- Easier connections between teachers and students.- Actualised information- Guidance to study	<ul style="list-style-type: none">- Difficulty to attract participants.- Requires skills to produce quality contents.- Requires time – in synchronous activities.- Requires teacher’s availability and motivation
Opportunities	Threats
<ul style="list-style-type: none">- Competitive pressures- Technology accessibility to everybody, from home or campus.- Integrated initiatives (e.g. Campus Virtuais, ...)- Cooperation between institutions- Partnerships in teaching and research projects- Mobility (post-graduations, student placements, etc.)	<ul style="list-style-type: none">- If dosing between models is not adequate everything can fail.- If the teacher does not “answer”- Deficient services integration- Inability of continuing follow-up of the new developments in the field of Open Access and scientific publication in general.

Table 1: *e-learning* in higher education institutions – a SWOT analysis

4.2 Application to IPCA

IPCA is installed in temporary lodging, distributed by different buildings, which configures a real situation of a higher education campus in terms of spatial /physical distribution, as all the main functional units are physically separated.

In this context, it is fundamental to expand these services to all the Institution, as well as to maintain the quality and projection of its education system. As major aims to reach, IPCA proposes to continue its effort of effective implementation and integration of all the services provided, via Web in its Intranet and Internet and to develop and/or adapt academic contents susceptible of being shared and globally distributed and, consequently, to create means to position the Institution in the national and international higher education community.

As main phases that will drive the implementation of all this process, we identify the need to invest in:

- Training of teachers and students to this new education paradigm;
- To create and/or adapt the services of the Polytechnic and didactical contents in order to be permanently available via Web to all the intervenients at the Institution;
- To stimulate all the academic community to the acquisition and utilisation of portable computers;
- To assure Internet accessibility and consequently to all the internal services provided, both inside the perimeter of the Institution and the access from external points.

5 Learning and Teaching in IPCA: The Project

In this section, we introduce the e-IPCA Project and the authors' understanding of a framework for the e-learning environment that IPCA intends to have implemented to support its pedagogical activities.

5.1 About e-U:

The e-U (Electronic University) project is based on a network of *virtual campus*, designed for the creation of online university services, the production and sharing of academic contents and the setting up of university communities.

With e-U, Portuguese students will have access to classes, R&D papers and articles, student papers, grades, bookshops and academic administrative services online, as well as access to the *internet* through a broadband wireless LAN.

Everything is available with a mobile device (laptop, pocketPC, etc.) from any point within the university campus.

That's why e-U is one of the most innovative university initiatives in Europe and is now a case study for companies as Intel, Cisco or Microsoft.

The e-U program is one of the main keys of the Portuguese Information Society strategy, that is being developed by UMIC (Innovation and Knowledge Society Unit), a unit created under the direction of Portuguese Presidency of the Council of Ministers.

5.2 The e-IPCA Project

To the Polytechnic Institute of Cávado and Ave (IPCA) the *Virtual Campus initiative* is seen as the technical solution to be implemented under the framework the *Programme ON (Operação Norte) – Initiative e-U*, an integrated initiative, involving Services, Contents, Applications and a Mobile Communications Network (inside and outside the Polytechnic) to students and teachers of higher education, that incentives and facilitates the production, access and share of Knowledge.

Our recently approved project - e-IPCA – will make possible the concretisation of the project of integration and delivery of services, the distribution of academic contents, the access to the globally distributed and shared academic contents and, consequently, conditions to “place” the Institution in the national and international community of knowledge.

This project involves fundamentally the implementation of different solutions of integration of global services of the Institution, availability of contents and processes on the Web and implementation of an e-learning platform as support to the actual learning and teaching system. It consists of:

- A comprising Wi-Fi communications infrastructure
- A safety and authentication system
- An integration applicational system
- An e-Learning platform
- A supporting process to the development of digital contents.

The project will be implemented in three main phases:

Phase 1 - Wi-Fi communications infrastructure

This phase will regard:

- The implementation of the wireless network solution;
- The creation of an authentication system of the users, that enables mobility between the several “Virtual Campus” at national level;
- The availability on the Web of all processes inside IPCA in order to interconnect students, teachers and services, as well as the corresponding installation of the applicational platforms and delivery of a set of minimal services.

Phase 2 – Services integration and delivery

The second phase involves the delivery of all the services identified and described in the project and the complete integration of services and applications with the contents delivery online.

To the success of this phase depends on the constitution of a group to support the creation and/or adaptation of digital contents, supported by tools for transformation and integration of contents. It is intended to orient the persons involved in the process of contents development, namely the teachers, in the process of preparation of their didactical contents.

The adhesion to the information and communication technologies made available will be followed progressively, and included in the methods and processes, recurring to training measures *in loco* and specific.

Phase 3 – Support to e-Learning methodologies

In this phase it is intended to develop specific services to support e-learning processes to all the teachers, as well as supporting processes to framework /integrate the students. Training and sensitizing about e-Learning should have already started and the delivery of didactical contents: part of the programmatic contents of some courses, workshops and teaching synchronous processes will have their first manifestation.

development project, to develop a strategy and systems framework, prior to any technology acquisition. In this paper we have discussed the opportunities and challenges for higher education, using a SWOT analysis tool and presented the critical success factors associated to the adoption of e-learning in IPCA, which can be generalised to other higher education institutions.

6 e-Learning in Higher Education: Critical Success Factors

A teaching and learning support environment is made of its participants (teachers, students and members of the community in general), and hence its success or failure is dependent on their success or failure in the prosecution of their functions (teaching, learning, researching). The success depends on the ability to deliver value to the core interests of participants, all must get valued added.

There exist, in our opinion, a set of guiding principles to drive the deployment of successful environments to support to e-learning in higher education. In Table 2 it is presented the set of critical success factors, their definition or explanation and the expected results that each critical success factor can bring.

7 Conclusions

We believe that together with the traditional classroom model a truly multimedia-enabled interactive technology platform for an effective and efficient learning experience, allowing a self-paced mode of learning, complemented by web-based guidance from teachers can answer to the students' requirements of the present and of the future. It is important for institutions willing to embarking on an e-learning

Critical Success Factor	Definition	Expected Results
<i>Critical mass</i>	<ul style="list-style-type: none"> - The environment must attract and retain a critical mass of participants (students and teachers) – if possible, must attract all the institution and answer to their teaching/learning needs and supporting functions. - The environment must also attract the community outside the institution, at an international scale. 	<ul style="list-style-type: none"> - Larger volume of requests. - Attraction of participants. - Larger amount of contents.
<i>Contents</i>	<ul style="list-style-type: none"> - Quality and quality. - Organisation of the contents made available. - Actuality, etc 	<ul style="list-style-type: none"> - Attraction of participants. - Attraction of the external community. - Better satisfaction of participant's needs and expectancies, traduced mainly by learning success.
<i>Responsiveness and quality</i>	<ul style="list-style-type: none"> - Since the only certainty is change, the environment must be flexible enough to respond to internal and external changes, itself supporting agility. - The environment must be efficiently supported by a suitable information system and technology, assuring the capability of organising and acceding to the information. 	<ul style="list-style-type: none"> - Better response to the participants' requirements, traduced mainly by learning success.
<i>Usability and interaction</i>	<ul style="list-style-type: none"> - The effort towards a useable site, well assisted, able to track the user difficulties. 	<ul style="list-style-type: none"> - Participants' satisfaction, which find it easy to use.
<i>Trust</i>	<ul style="list-style-type: none"> - Establishing trust amongst learners in synchronous and asynchronous situations - Trust amongst students and teachers; students must believe on teachers' interest in participating and contributions both in synchronous and asynchronous environments, more than delivering learning materials. 	<ul style="list-style-type: none"> - Awareness of the effectiveness of the new learning processes.
<i>Expertise in contents development</i>	<ul style="list-style-type: none"> - Expertise to support teachers in developing attractive and valuable contents. 	<ul style="list-style-type: none"> - Participants' satisfaction. - Attraction of participants (students and teachers).
<i>Motivation</i>	<ul style="list-style-type: none"> - Encouraging collaborative learning between learners. - Encouraging teachers to prepare contents and to organise discussion situations and <i>fora</i>. - Encourage the outside/external community towards life-long learning) 	<ul style="list-style-type: none"> - Participants' satisfaction. - Attraction of participants (students, teachers and the external community). - Increased interaction (synchronous / asynchrony.) communication. - Larger amount of contents.
<i>Commitment</i>	<ul style="list-style-type: none"> - A strong motivation of contents producers (teachers) towards quality, actuality, organisation. 	<ul style="list-style-type: none"> - Larger adhesion of participants (mainly students).

Table 2: Critical success factors of e-learning environments in higher education

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