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# **[ ONLINE LEARNING IN ERGONOMICS AND OCCUPATIONAL RISK PREVENTION: FACING THE URGENCY AND DIVERSIFICATION OF A MASSIVE LEARNING DEMAND ]**

## Contenido

<b>1</b>	<b>INTRODUCTION</b> .....	<b>3</b>
<b>2</b>	<b>ONLINE LEARNING OVERVIEW</b> .....	<b>5</b>
2.1	ORGANISATIONAL PERSPECTIVE .....	7
2.2	PEDAGOGICAL PERSPECTIVE .....	9
2.3	TECHNOLOGICAL PERSPECTIVE .....	11
2.4	SOCIO-CULTURAL PERSPECTIVE .....	13
<b>3</b>	<b>FACING THE URGENCY AND DIVERSIFICATION OF THE CURRENT LEARNING DEMAND</b> .....	<b>15</b>
3.1	ENABLING UNIVERSITY-BUSINESS EXCHANGE .....	16
3.2	INTEGRATING FACE-TO-FACE AND ONLINE LEARNING STRATEGIES .....	20
3.3	KEEPING INSCRIPTIONS ALWAYS AVAILABLE .....	21
3.4	MODULARISING, REUSING AND ADAPTING CONTENTS .....	23
<b>4</b>	<b>REFERENCES</b> .....	<b>24</b>

# 1 Introduction

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The increasing growth of the Internet and other advances in information and communications technologies is redefining the economy, changing the way of living, working, producing and making business (Tapscott and Caston 1993; Castells 1996; Tapscott 1998; Tapscott, Lowy et al. 1998; Gates 1999; Turban, McLean et al. 2002). These fast-paced changes are forcing workers to update their knowledge and skills at a high speed too, resulting in a massive, diversified and urgent learning demand. Concerning to occupational risk prevention, each member of the organisation has to be trained according to the specific risks of his/her workplace. Temporary workers need to receive urgent training –may be during the weekend- before starting risky tasks in his new destination. Occupational risk prevention professionals need to develop multidisciplinary competences, but they have different learning needs because they have different backgrounds. All these claims for adaptation rarely could be satisfied with the traditional learning and training systems. Consequently, the principles and objectives of the educational systems may be questioned, and new strategies and methodologies should be conducted to fit to the organizations and market needs (Hanna 1998; Harasim 2000; Leibowicz 2000; MacDonald, Stodel et al. 2001; Nichols 2001; Laurillard 2002).

A demand-driven approach implies that learning institutions increase the opportunities of access to training designing flexible learning structures where organizations and learners can decide what, when and how to learn in order to satisfy their needs and make it compatible with their professional, social and personal activities (Moran and Myringer 1999; Collis and Moonen 2001). Flexibility issues can be related to time and place, but also to content, entry requirements, instructional strategy and course delivery and logistics. Nevertheless, although this approach seems to be the future of learning, the attempts to offer the learner more flexibility derive in complex tasks to implement and result in new conflicts and constraints that need to be examined (Collis, Vingerhoets et al. 1997). Therefore, administrative, pedagogic, economic and philosophical implications of flexibility should be considered from the perspective of the different stakeholders, namely the instructors and education institutions, the learners, the members of the organisation who wants training and other support staff (Johnston 1999; Earle 2002).

It is also obvious that information and communications technologies are the major enablers of flexible approaches to learning and training. In the last two decades the convergence of these technologies with education has generated a broad set of terms like e-learning, technology-based learning and Web-based training among others. These terms are defined and used differently by different organisations and user groups. In addition, their use is constantly changing, as the applications of technology into education evolve. One of the more generalised definitions of e-learning refers to it as the delivery of content via all electronic media, including the Internet, intranets, extranets, satellite broadcast, audio/video tape, interactive TV, and CD-ROM (Urdan and Weggen 2000). Yet, e-learning is defined more narrowly than distance learning, which would include text-based learning and courses conducted via written correspondence. Online learning (or Web-based Learning) constitutes just one part of the e-learning universe and describes learning via Internet, intranet, and extranet.

Since its inception, distance education has been at the forefront of adopting new technologies to increase access to education and training opportunities. Distance education theorists (Moore and Kearsley 1996; Taylor 1996) hold that, in his history, the field has evolved following four generation stages: first, the Correspondence Model based on print technology; second, the Multi-media Model based on print, audio and video technologies; third, the Telelearning Model, based on applications of telecommunications technologies to provide opportunities for synchronous communication; and fourth, the Flexible Learning Model based on online delivery via the internet. Although the latter approach is still gaining strength a fifth generation of distance education, the Intelligent Flexible Learning Model, is already emerging based on the further exploitation of new technologies (Taylor 2001). The relevance of the Internet, and consequently online learning, in current and future learning approaches is clear since it is the core element of the three latter generation stages.

As industry reports show, organisations are aware of the power of online learning -being the most important driver to bring the right information to the right people at the right time- and a growing industry marketplace has emerged around it (Rutenbur, Spickler et al. 2000). In broad terms, the overall learning marketplace can be divided into three main categories (content, services and technology) and serves three main markets: academic, consumer and corporate. In the academic market, campus-based higher education institutions are increasingly adopting blended learning approaches, where classroom face-to-face learning strategies are integrated with online learning experiences. Blended learning can begin the necessary process of redefining higher education institutions as being learning centred and facilitating a higher

learning experience (Garrison and Kanuka 2004). In the consumer market, the information and communication technologies are progressively integrated in society everyday activities, and the acknowledgement of their benefits is commonly extended. Finally, in the corporate market several factors -the globalisation of the economy, the need for skilled workers, the reliance on technology-based systems to manage human resources and a mind-shift perceiving training as a benefit- impulses organisations to invest in online learning and to integrate it with other organisational processes and systems (Marquardt and Kearsley 1999; Crocetti 2001; Driscoll 2002; Lytras, Pouloudi et al. 2002).

The purpose of this paper is to provide a discussion of the opportunities and challenges of applying online learning strategies to face the urgency and diversification of the current learning demand. Based upon the two-year experience of the Universitat Politècnica de Catalunya offering online learning in ergonomics and occupational risk prevention, some of the capabilities of the online condition are discussed and critical issues and implications for the design, evaluation or selection of a learning management system are addressed. The discussion is preceded by an overview of the inquiry field in order to situate and show the scope of online learning.

## **2 Online learning overview**

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In the research field, the literature on the potential of the information and communication technologies to support meaningful educational experiences has been well documented. Nevertheless, less effort has been done in the achievement of steady and common theoretical principles to support e-learning, and online learning in particular. Some authors begin to manifest their concern about this lack of theory, putting their attention in the debate and development of the theoretical underpinnings of e-learning (Meyen, Aust et al. 2002; Nichols 2003). According to Reeves (2000; 2003) contemporary conceptions of instructional technology range from an absolute “measurement” perspective (Merill, Drake et al. 1996) to a completely relativistic “constructivist” perspective (Guba and Lincoln 1989). The former is based in the belief that if anything exists it can be measured and that there is an objective reality existing apart from the beliefs of those who seek to reveal its nature. Advocates of this perspective concentrate seeking better and better instruments to perform finer and finer measures of that ultimate reality. In sharp contrast, constructivists are focused on seeking

better and better ways of sharing understandings of the world and view as irrelevant the prediction and control so integral to the measurement perspective.

In addition, some authors claim for a more use-inspired research where researchers are focused in developmental goals and hold the dual objective of developing creative approaches to solving real problems in real contexts and at the same time constructing a body of design principles that can guide future development efforts. This kind of research is referred to as developmental research (Reeves 2000; Reeves and Hedberg 2003), design experiments (Brown 1992; Collins 1992) or formative research (Newman 1990; Reigeluth and Frick 1999).

Much effort has been done in defining a framework that includes all the key issues to consider in an e-learning project (Dringus and Terrell 1999; Khan 2001; MacDonald, Stodel et al. 2001; Pahl 2003). One of the most well-known e-learning frameworks is Khan's octagonal framework (Khan 2001), which classify web-based learning issues in eight main categories: institutional, pedagogical, technological, interface design, evaluation, management, resource support and ethical. The purpose of the framework is to avoid relevant factors be overlooked in the design and development of online learning experiences. Khan's octagonal framework shows the scope and multidisciplinary character of the online learning field, which is being studied from different perspectives and with different goals.

In this paper, the eight main categories proposed by Khan have been reshaped into four main perspectives: organisational, pedagogical, technological and socio-cultural. We consider that in broad terms these four perspectives and their interrelations have guided the study and practice of online learning. Much research works can be situated in the axis' that link the different perspectives and often concern to more than one interrelationship. To give an example, in her book *"Rethinking university teaching: a conversational framework for the effective use of learning technologies"*, Laurillard (2002) works in the axis that link the pedagogic and technological perspectives when analysing the potential contributions of the different media in each type of academic conversation that should be established between learner and teacher in a meaningful learning experience. Further, in the same book, she moves in the axis that links the pedagogic and organizational perspectives when she extends her conversational framework to the global context of a higher education institution, towards a learning organization model.

## 2.1 Organisational perspective

The more knowledge becomes the basis of work, the more the true excellence of organisations depends on the way its employees and leaders work, on their degree of commitment and responsibility, on their capabilities and on the support they receive. Therefore, a company's key to success resides not so much in its financial capital, but in its capacity to treat knowledge, corporate knowledge, be it explicit or tacit (Drucker 1993). This perspective leads to another concept of capital, the intellectual capital (Brooking 1997; Edvinson and Malone 1997), which represents the overall of the individual capacities, knowledge, abilities and experiences of the corporate members, and the relations, strategies, systems and infrastructures that the organisation has created to support and manage its human capital and core business.

From the organisational perspective, learning and knowledge management are interconnected concepts, and their interrelationship should be considered in the definition and establishment of learning strategies. According to Argyris and Schön (1978), '*organisational learning*' involves both responding to changes in the internal and external environment by detecting and correcting errors (single-loop learning) and resolving incompatible organisational norms by setting new priorities and weightings, or by restructuring them together with the associated strategies and assumptions (double-loop learning). Learning in organisations research has proliferated in the last decade of the twentieth century, specially influenced by the publication of 'The Fifth Discipline' of Senge. Senge work has popularised the term '*learning organisation*' referring to "*organizations where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning to see the whole together*" (Senge 1990)

While traditional learning is centred in the acquisition of the knowledge or abilities needed to perform tasks, in the learning organisation, the main goal is the development of the individual in a collective and daily process. According to Nonaka and Takeuchi (1995), there are four types of knowledge creation and conversion within an organisation: socialization (from tacit to tacit), internalisation (from explicit to tacit), externalisation (from tacit to explicit) and combination (from explicit to explicit). Knowledge management implies the provision of tools and strategies that help these four types of knowledge conversion.

Most authors consider that e-Learning takes a broad, strategic perspective on corporate learning and that the efficiency of an e-learning strategy depends both on the learning and teaching performance and on the knowledge management capabilities of the environment and its integration with the other organisation processes and systems (Marquardt and Kearsley 1999; Zwart and Resnik 2000; Crocetti 2001; Rosenberg 2001; Lytras 2002; Lytras, Pouloudi et al. 2002; McKay and Martin 2002).

Another relevant issue concerning researchers and practitioners from the organisational perspective is the development and management of the online learning and knowledge management strategies. As Morrison and Khan expose, *“an e-learning system should be meaningful not only to learners, but also to all stakeholder groups, including instructors, support services staff, and the institution”* (Morrison and Khan 2003). The design and maintenance of an online learning initiative covers a wide range of processes and requires the work and engagement of different groups of stakeholders. In addition, as in any project, there are time, resources and budget constraints. E-learning projects management, evaluation and identification of critical issues and success factors are three of the major concerns that follow the inception and definition of online learning strategies.

Some authors conceive evaluation as a systematic process that should be focused on the decisions that must be made during the design and use of interactive learning systems (Reeves and Hedberg 2003). From this point of view, evaluation must be addressed with different goals and at each stage of the lifecycle of a project, including functions such as reviews, needs assessment, formative and effective evaluation, impact and return on investment (ROI) studies (Phillips and Phillips 1994; Reeves and Carter 2001) and maintenance evaluation (Reeves and Hedberg 2003).

Findings of research works focused in the identification of critical or success issues (Lieblein 2000; Benson Soong, Chuan Chan et al. 2001; MacDonald, Stodel et al. 2001; McGorry 2003) reveal that online learning institutions should consider learners as ‘education customers’ in a competitive marketplace, where they will compare quality, services, tariffs and convenience of the different learning providers. In this context, learning institutions will have to be prepared to offer not only teaching and learning quality but the best administrative, academic and technological resources and services.

Finally, e-learning projects and experiences are always involved in evolution and change issues, regarding either contents or technological, pedagogical or organisational aspects. Change factors are inherent to online learning projects since programs or systems requirements are usually volatile (i.e., they may evolve or appear during the development, implementation or evaluation). A change-based methodology should be able to anticipate changes and reflect them in the program or system design (Pahl 2003).

## 2.2 Pedagogical perspective

From the pedagogical perspective, one of the main concerns is to use technology strategically to design meaningful learning experiences according to the different educational paradigms. While learning theories provide the psychological and philosophical background of learning strategies and methodologies, instructional design constitutes a systematic approach to the design of learning processes.

Although there is a wide range of learning theories, behaviourism (Pavlov 1927; Watson 1930; Thorndike 1932; Skinner 1953) and cognitive theories -constructivism in particular (Bruner 1966; Piaget 1969; Vigotsky 1978; Jonassen 1991; Dewey 1997)-, have had a major influence in instructional design. Each theory has different implications in issues such as contents structure and organisation, navigation and usability criteria, learning activities, strategies and evaluation.

Furthermore, the analysis of the cognitive (how we construct, process, store and retrieve knowledge) and the psychological (emotions and intentions) factors involved in the learning processes reveal that there are individual differences in the way people assimilate knowledge and learn. Martínez (2001) identifies at least four learner orientations: the transforming, the performing, the conforming and the resistant learner. In consequence, the assumption that it is possible to find a unique design that can satisfy all learner needs falls in the naivety and claims for flexibility in learning and teaching strategies are emerging.

Instructional design has its origin in 1965, with the publication of *"The conditions of Learning"* from Robert Gagné. From then to now, a great deal of instructional design theories and models have appeared (Reigeluth 1983; Dick and Carey 1990; Rothwell and Kazanas 1992; Kemp, Morrison et al. 1996; Passerini and Granger 2000). An instructional design model is a representation of the design process, which shows its main stages and elements and their

relationships, providing designers and practitioners with a systematic guide to approach course, learning program or system design. Most models coincide in the main activities presented in the generic ADDIE model (Analysis, Design, Development, Implementation and Evaluation) (Driscoll 2002) but differ in the dynamics between the activities, being the actual trend situating the evaluation in the centre of the design process (that is to say, evaluating continuously) and conducting an iterative cycle of the other activities (Dringus and Terrell 1999; Reeves and Hedberg 2003).

Another important issue to consider from the pedagogical perspective is the interaction between learner and teacher and the evolution of their roles and competencies derived from the use of information and communication technologies in the education processes. The more the integration of the technology in the learning and teaching system, the more the changes required in the teacher and learner roles and competencies. This evolution comes from the Internet capabilities of information access, navigation and interaction, helping the paradigm shift: from teacher-centred learning to learner-centred learning (Kearsley 2000).

In a classroom face-to-face session the learner adopts a basically passive attitude and his learning is focused to the absorption of the concepts that the teacher is transmitting. The latter, sets the pace and stimulates learner participation and learner-to-learner interaction when he considers it appropriate. As the degree and weight of the online activities in the whole learning process increases, the learner attitude becomes more active. In this situation, he has to avoid being isolated, seeking the interaction with the teacher and with the other learners. This attitude change -from almost observer to actor- requires a parallel change in his competencies; that is to say, acquiring abilities such as planning, time management, writing communication, confidence in technology handling, taking initiative and developing attitudes such as participation and sharing intention, self-motivation, and perseverance.

On the other hand, the teacher has to be able to change his communication strategies and evolve towards a guiding and leading attitude, stimulating group dynamics and providing learners with different degrees of autonomy and opportunities to learn in their own learning style (Collison 2000). In addition, he has to develop instructional design competences to define contents, activities and resources in a wide range of formats (electronic documents, asynchronous and synchronous communication tools, simulations, audio and video sequences, etc.), with different levels of interactivity and decide which combination of formats fit better each learning goal.

Professor Laurillard, in her book *“Rethinking university teaching: a conversational framework for the effective use of learning technologies”* (Laurillard 2002), explore the learner-teacher interaction issue, proposing a model that describes all types of interaction that have to be established between both in a meaningful learning experience: *“it must operate as an iterative dialogue; which must be discursive, adaptive, interactive and reflective; and which must operate at the level of descriptions of the topic; and at the level of actions within related tasks”* (Laurillard 2002). In the same book, Laurillard analyses the efficiency and contribution of the different medias to each type of interaction defined in her conversational framework.

### 2.3 Technological perspective

Online learning, like any discipline that involves the design, development and use of technology-enhanced environments, is also concerned about the understanding of human-computer interaction (HCI), the design of user interfaces and the usability of information and communication systems.

The main goal of human-computer interaction research is to study the interaction between one or more human beings with one or more computers to improve the security, utility, efficiency and usability of computer systems (Dix 1998; Carroll 2002; Jacko and Sears 2003). The user interface embraces the overall of system methods and devices which support physical, perceptive or conceptual interaction with the user (Mandel 1997; Shneiderman 1998; Carroll 2002; Eisenhauer, Hoffmann et al. 2002). Microelectronics development is causing the proliferation of smaller and cheaper microprocessors, with sensors and wireless communication capability. In addition, the Internet provides de capability to interconnect them, enabling a future where information processing will be distributed in many devices available throughout the physical environment reaching ubiquitous. The term ubiquitous computing (*pervasive computing*) was introduced in 1991 by Mark Weiser (Weiser 1991), then chief technology officer for Xerox’s Palo Alto Research Center. According Weiser, technology is only a medium and must evolve towards the ‘transparency’, helping the user not to focus in it but just in the task he is performing.

User interface design is a multidisciplinary field that covers de work of software engineers, ergonomists, designers, psychologists, anthropologists and other disciplines researchers. The

success of a computer system depends deeply on the quality of the interaction between the system and the users. The quality of this interaction is represented by the usability of the system, which the ISO 9241-11 standard defines as *"the effectiveness, efficiency, and satisfaction with which specified users achieve specified goals in particular environments."* According to Nielsen (1993), the usability of a system can be measured by five attributes: learnability (it should be as simple to learn as possible), efficiency (it should be as efficient as possible to increase productivity), memorability (it should be easy to remember for future use), errors (it should have as few errors as possible to ease use) and satisfaction (the user should feel a high level of satisfaction when using the system). Therefore, in the underpinnings of usability there is a user-centred approach which seeks understanding of the user, his context and his tasks, involving him in each stage of the interface design (Norman and Draper 1986; Garrett 2002). Seen as a global issue, usability needs to be addressed during the all lifecycle of the product, system or service.

Nevertheless, effectiveness, efficiency and satisfaction are not easy to be reached, and the design of user interfaces is a complex problem that requires a structured and systematic process that requires the selection and development of analysis, design, implementation and evaluation strategies and techniques (Myers 1993; Mandel 1997; Dringus and Terrell 1999). Web systems design, which obviously includes e-learning systems design, is experiencing a marked trend towards user-centred design, iterative flux of the design activities, and rapid prototyping to get users feedback and detect usability problems from the early stages of the project design. This iterative approach helps reducing the expensive changes cost -in time and money- generated when the revision and correction of problems takes place only at the end of the project.

In broad terms, e-learning systems can be divided in three main types of categories: learning and content management systems, communication and collaborative tools and authoring tools. The learning management systems (LMS), also called virtual learning environments or e-learning platforms among other terms, are especially interesting because of their integration capability, which converts them in the support of all learning processes and resources.

The proliferation of commercial learning management systems -such as WebCT and Blackboard in the academic market and Saba, Click2Learn<sup>1</sup> and others, in the corporate market- has originated the concern about course lastingness and systems interoperability. In response to this controversy, some software and education related organisations and groups, such as the Institute for Electrical and Electronic Engineers Learning Technology Standards Committee (IEEE LTSC), the Advanced Distributed Learning (ADL) initiative, the IMS Global Learning Consortium and the Aviation Industry CBT Committee (AICC), are working in the development of specifications and standards that could guarantee systems interoperability, access to learner tracking information and reusability of contents. In addition, they are developing new products and tools that will enable the creation of these interoperable resources and help the conversion of the current resources and systems (Collier and Robson 2002; Masie 2003). In fact, an e-learning standard is a set of common rules that specify how learning providers can design online courses and systems, so that the courses can be delivered in any system that fit the standards requirements and that any e-learning system could deliver a course designed following the standard specifications. To enable interoperability and reusability, contents are packaged in Learning Objects (LO) (Downes 2000).

Another current trend in the e-learning technology development is the implementation of educational open source systems, such as Moddle (Dougiamas and Taylor 2002; Dougiamas and Taylor 2003), ATutor, Claroline, Ilias, MIT dotLRN and CHEF, which has recently begun in the academic world (Olsen 2003). Open source software is free-cost and is distributed with its source code, so it can be modified and adapted to the concrete needs of each context. In addition, there is usually a community of developers who lead the maintenance and evolution of the system. Nonetheless, according to some authors and practitioners (Dalziel 2003), the frequent lack of a steady maintenance community and the complexity of the customisation process convert it in a risky option.

## 2.4 Socio-cultural perspective

Marshall McLuhan 'global village' prediction (McLuhan 1962; McLuhan 1964) could never be perceived as real as with the advent of the Internet. Advances in media, technology, and communications are transforming the world in a global market. In such a competitive market,

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<sup>1</sup> Click2Learn and Docent, another e-learning provider well known around the world, have converged in mars 2004 creating the new trademark SumTotal (<http://www.sumtotalsystems.com>).

organisations need to evolve developing the ability to innovate and learn (Harasim 1993; Rycroft 2003). Online learning is obviously a strategic tool to globalise learning when a corporate geographic diversification exists. However, a global audience implies cultural, social, linguistic, economic and religious diversity. In addition, in the same socio-cultural context there are individual differences in values, learning needs and styles, experiences, technology access and physical conditions. The overall of these diversification dimensions should be considered in the design and development of online programs and environments to avoid discrimination, confusions, offences or other barriers to the efficiency and meaningfulness of learning activities (Reeves 1997; Collis 1999; Marquardt and Kearsley 1999; McLoughlin 1999; icGlobal 2001; Rice, Coleman et al. 2001).

Some of the critical cultural diversification issues are cross-cultural communication, time concept, learning expectations, ambiguity tolerance, hierarchy and authority perception, gender perception and collaborative work ability (Rice, Coleman et al. 2001). Furthermore, geographic diversity adds the complexity of working with different time zones, which has to be considered in the agenda planning and in the synchronous activities communication (*Khan 2001*). Finally, the access to technology is far from equity, regarding both technological (technology infrastructure reaching the individual) and emotional conditions (personal attitude towards the technology). The term 'digital divide' ([DigitalDivideNetwork.org](http://DigitalDivideNetwork.org)) refers to the gap that exists between those people and communities who can effectively use new information and communication tools, such as the Internet, from those who cannot. Now, more than ever, unequal adoption of technology excludes many from reaping the fruits of the economy. Content and program designers should consider this gap and try to adopt strategies to improve information access, such as selecting technological resources with low bandwidth requirements or providing contents in alternative multimedia formats.

Since an online learning experience is based on a sense of community, ethics issues should be addressed to enable a civil and dependable interchange among participants, and norms of individual behaviour should be defined. Some of the major concerns are personal privacy, security and respect for the property of others (Witherspoon 2001). Learning systems and tools should guarantee personal information privacy, and users should be informed about the data registered by the system, its purpose, the way it will be used and till it will be stored (Gabb 2002). Users also should be warned if their interventions in online activities such as discussions and mailing lists, are accessible to internet search engines (Palloff and Pratt 1999). Security embraces issues ranging from electronic payment to student identification in

evaluation activities, requiring both technical protections and warning users about insecure actions (Khan 2001).

The research capability of the Internet makes easy to find information of any type and subject benefiting plagiarism. Others intellectual property issues are the use of copyrighted material and the debate about who is the owner -the author or the learning institution- of the material that has been developed within a learning program (Gerdson 2002). Finally, institutional ethics requires to the organisation be responsible for all the learning services provided, despite some functions could imply the intervention of other institutions through outsourcing or strategic alliances (Khan 2001).

### **3 Facing the urgency and diversification of the current learning demand**

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The integration of information and telecommunication technologies in learning processes, such as planning, development, administration and evaluation, results in new scenarios and opportunities that can be strategically managed to add value to the learning experience. A strategic approach requires first, consistency and coherence in goals and project planning, and second, ability and competence to detect and solve the new problems and conflicts derived from these new scenarios. Some of the opportunities that online learning offers for facing the urgency and diversification of the current learning demand are discussed below based upon the UPCplus project framework.

Two years ago, the Universitat Politècnica de Catalunya initiated the UPCplus project (Talavera, Álvarez et al. 2002; Talavera, Vyhmeister B. et al. 2004) with two main objectives: first, providing high-level continuous learning in ergonomics and occupational risk prevention to professionals and organisations, and second, analysing learning dynamics and requirements in the context of continuous education. Some of the online learning opportunities studied in the UPCplus project are enabling university-business exchange, integrating face-to-face and online learning strategies, keeping inscriptions always available and, finally, modularising and reusing contents. To conduct the research a prototype of virtual campus has been designed, implemented and evaluated in several contexts. This paper exposes the lessons learned and some of the critical issues identified and their implications in the design, selection or evaluation of a Learning Management System.

### 3.1 Enabling University-Business exchange

According to Meister, president and founder of an authoritative research and consulting firm called Corporate University Xchange ([www.corpu.com](http://www.corpu.com)), corporations are experiencing a shift from employee training to employee education as a result of the emergence of the knowledge economy. This mind shift leads to the concept of corporate university, which refers to the organisation strategic approach to educating employees, customers, and suppliers, linking organisation strategies to the learning goals of its audiences and fostering the development of not only job skills, but also such core workplace skills as learning-to-learn, leadership, creative thinking, and problem solving (Meister 1998; Meister 1998; Meister 1998). In fact, a corporate university is a portal within the organisation through which all education takes place.

Furthermore, businesses are managing education through strategic alliances and partnerships with universities to meet their needs and specific requirements for high-quality management education (Meister 2003). In the field of occupational risk prevention, strategic alliances are emerging between universities and health and safety insurance companies. In the framework of the UPCplus project, strategic exchange has been established with two well-known and established occupational insurance companies in the Spanish and Latin American marketplace. From the point of view of the occupational insurance institution, the university-business exchange is an important value driver since it provides the possibility to offer to its associated companies, and therefore to the employees of these, a high quality educational experience. From the point of view of the learning institution, the alliance with the insurance institution brings the opportunity to reach a wider audience with a little marketing effort.

The UPCplus project envisions university-business exchange as a network of corporate and university virtual campuses sharing learners, courses and enrolments. In this networked system, a corporate campus can offer to its audience both its own courses and those from other university or corporate campus. From other perspective, in the same course there can be learners from different campuses; that is to say, learners from different organisations and individual learners if the course is available to the public. In the envisioned framework, each learner access to the course from his respective campus.

In the UPCplus framework, there is a microstructure, which refers to the campus complexity, and a macrostructure, which supports intercampus relationships (Figure 1). The former deals with the internal requirements that an organisation -training institution or other business corporation- needs to organise and align its audience training and learning with its strategies and goals. Since groups with different learning needs compose audience, each campus can create and manage as many audience groups as considered necessary. A company could define groups to address the learning needs of each internal department, partner, client or provider. The macrostructure overlaps campus microstructure to enable course, learner and tracking exchange between the different campuses integrated in the network (Table 1).

Regarding the microstructure, the more critical issues to deal with are flexibility requirements and configuration capabilities of the virtual campus. Since each organisation has its own rules, strategies and goals, customisation is required in most of the learning portal and campus functions. Some typical customisation requirements refers to the user interface look and feel, the course catalogue organisation, the data registered, its management and tracking, and the learning policies governing the campus. In the campus designed, most of these adaptation possibilities are considered not only at the campus level but also at the audience group level. That is to say, a set of sub-campus can be created to fit the particular requirements of each audience group.

As far as the macrostructure is concerned, complexity lies in the synchronisation mechanisms that need to be developed to connect the campuses that compose the network.

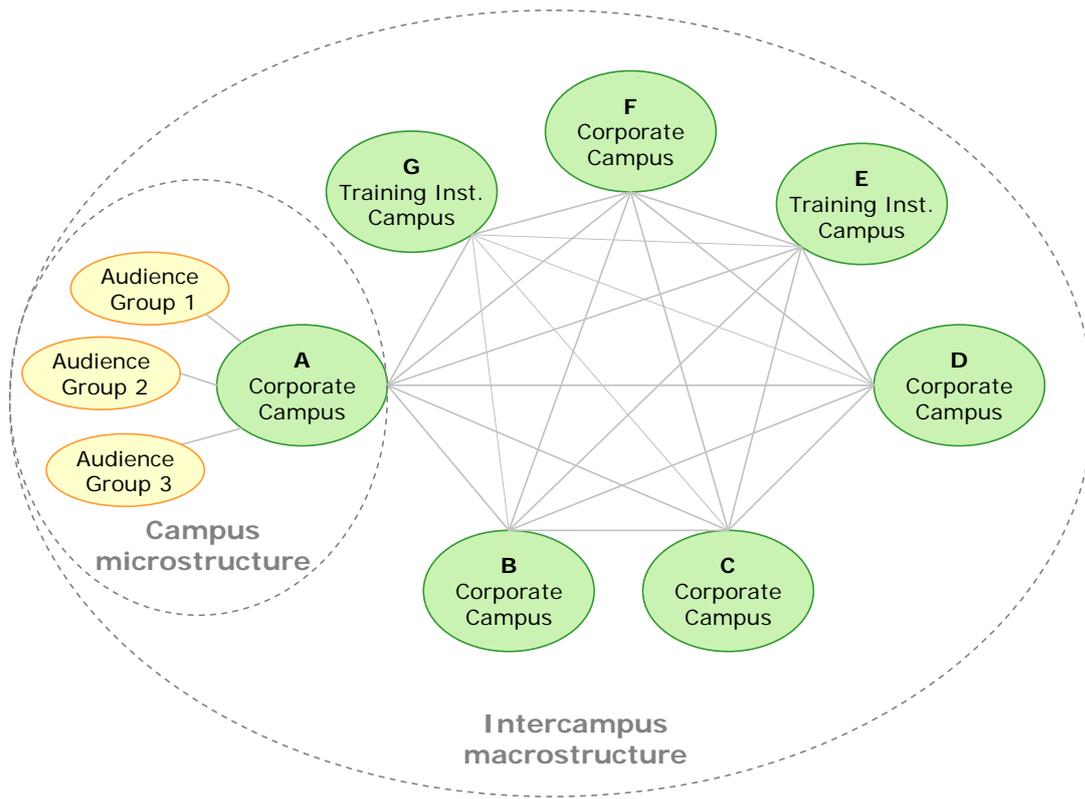


Figure 1 Microstructure and macrostructure complexities in the UPCplus framework

	Microstructure		Macrostructure
	Corporate campus	Audience group	
Description	It is an institutional learning portal and campus. Audience groups can be defined to manage the learning needs of each group of users.	A subset of campus users with particular learning needs.	It is a network of campuses operating at the same level. There are no hierarchy levels. Each campus manages its users, its audience groups, its courses and its inscriptions.
Course catalogue	It is composed by institutional courses and courses from other campuses.	It is composed by a subset of courses from the campus corporate catalogue.	Each campus decides which courses wants to make available to the other campuses.
Inscriptions	Institutional courses can receive inscriptions from users of the campus (including audience groups' members) and from users of other campuses. Inscriptions to other campuses courses may require validation from the campus who owns the course.	Group members can enrol to the courses assigned to the group. Inscriptions may require the validation of the audience group administrator and/or the validation of the corporate campus administrator.	A multiple-level validation process is required to manage intercampus enrolments. For example, when a member of an audience group enrolls to a course that belongs to another campus then it may require validation of: 1) the administrator of the audience group; 2) the administrator of the corporate campus to whom the group belongs; 3) the administrator of the campus to whom the course belongs.
Users access	Campus corporate site	A customised portal and campus may be created for each audience group.	Users access to the corporate campus site they belong to (even to access courses from other campuses).
Learning / Teaching & Tracking	Course teaching staff manage learning resources and activities and assist and track learners (no matter which campus or audience group they belong to)	The administrator of the audience group may need to access tracking and performance information about the members of the group.	All the users enrolled in a course (no matter which campus or audience group they belong to) can interact between them and access to the overall of course resources and activities. Different levels of tracking may be required.

Table 1 Microstructure and macrostructure relationships and functions

### 3.2 Integrating face-to-face and online learning strategies

One of the major concerns of teaching practitioners is to find the best solution to a given learning need. In this attempt, they usually combine face-to-face and online learning strategies to take advantage of the strengths of both approaches. The challenge is to determine which approach should help better each objective of the learning programme. Although some effort has been done in guiding the selection of the appropriate media (Masie 2002; Singh 2003; Garrison and Kanuka 2004), no application general principles and rules have been defined.

In the UPCplus project, three master degree programmes (Master in Ergonomics, Master in Occupational Risk Prevention and Master in Prevention Services Management – Executive programme) have been implemented combining online and face-to-face strategies. All these programmes are structured in several learning modules and follow a cyclic pattern.

In the executive programme, each module begins with a face-to-face session, which introduces the module objectives, contents and activities. Then individual and cooperative work is performed through the virtual campus, and finally a second face-to-face workshop is used to stimulate discussion on the topics and activities performed. This second session usually includes a conference that concludes the module. Face-to-face sessions are held on Friday (end of a cycle) and Saturday (beginning of the next cycle) and repeat every two weeks (length of the cycle). In order to stimulate human interaction in a more relaxed context, and profiting some of the face-to-face sessions, executive lunch meetings are organised. In these lunch meetings, students can share experiences and opinions with well-known authorities and experts on the fields of study. Apart from the modules completion, the master programme requires the development and presentation of a final project and a stage in a foreign country to contrast how others are dealing with the management of occupational risk prevention.

In the Occupational Risk Prevention and Ergonomics master programmes, face-to-face sessions are longer (they last three-four days and are held every one or two months) and are used to teach some of the module contents. The module requires also the completion of a set of online courses to complement and go deeper in some topics. Some courses are compulsory and others are optional. Students can select, between the optional online courses, the ones that adapt better to their learning needs according to their background, professional experience and future objectives. Since the orientation of these programmes is largely technical, online tools (<http://upctools.com>) are provided so that students can apply the

methodologies and techniques learned and, in addition, use them to face real problems in their real workplace during the programme lifecycle.

Other two face-to-face strategies considered are visiting companies and industries and participating in complementary technical workshops and conferences. Finally, online activities and resources are enriched with the base of knowledge managed by a specialised Internet portal (<http://prevencionintegral.com>) that supports one of the biggest virtual communities of occupational risk prevention professionals.

The design of a learning programme that combines face-to-face strategies with online activities

Regarding the virtual campus and the delivery, face-to-face sessions must be reflected and managed as well as the online activities. Some integration strategies may consider pre-session or post-session online work, discussion and information download among others. A course calendar or agenda can be used to show the beginning and the end of each learning module and activity and to specify other special deadlines. Icon and colour codes can help to distinguish the different types of activities. Evaluation strategies may also include online and face-to-face exercises and other criteria such as participation of the student in the different learning activities.

### **3.3 Keeping inscriptions always available**

As mentioned above, flexibility seems to be the key to align learning programs with individuals and organisations needs. In the time flexibility dimension, keeping inscriptions always available goes beyond the possibility to decide learning study dates and times within a course, bringing the opportunity to decide when to enrol to the course. Because of this entry time flexibility, learners that have just enrolled coexist with learners that have almost finished the course. Furthermore, group size may be continuously changing resulting in extreme conditions ranging from a unique learner to hundreds of them. Another consequence of keeping inscriptions always available is course lastingness. From course lifecycle perspective, once inscriptions are available course is continuously active, and periods of latency (no learners) alternate with variable size group periods.

Obviously, the variability in learners' progress and group size has to be considered when defining the pedagogical strategies and methodologies that will guide learning. Discussion groups and collaborative learning activities are critical since group size can vary drastically from one day to another. Knowledge management repositories could be a useful collaborative tool where contributions from learners that have finished (so they no longer can access the course) keep available to current and future learners.

In the two years of online learning within the UPCplus project, about one hundred short lasting courses - from one to three months - have been set with inscriptions always available. The UPCplus catalogue is opened to professionals and organisations that want to enhance its workers knowledge and abilities providing them high quality education. Entry time flexibility has been especially well received by individual learners that need to prove urgently they were capacitated in some subject topics. In fact, many of them accessed to the online course evaluation in their first week in the course and asked for the university certificate far from the end of the course.

High variability in group-size and latency periods have been observed and, apart from pedagogical implications, some organisational and management critical issues have been revealed and their implications in the design, selection or evaluation of a Learning Management System have been identified. Regarding to the teaching process, some of the learning environment features required to support group size variability are flexibility to open and close group activities according to group size possibilities, tracking alerts and flexible tutor assignment.

An efficient tracking alerts system should inform the teacher of events that require his intervention, such as 'new learner joins the course', 'learner has sent evaluation activity that has to be corrected', 'learner is about to finish the registration period without carrying out evaluation', 'there is a new intervention in a discussion activity' and so on. The possibility to configure some parameter alerts (for example, the number of days in the following alert: 'message not read after three days of being received') and the way the system will deliver it (in on-campus messages and alert icons, by email) avoid teachers entering the online campus to find this information and enables them to act rapidly when required. In the UPCplus project, the tracking alerts have also been extended to supervise teachers' activity and guarantee high training quality standards.

Flexible tutor assignments implies both having the possibility to manage multiple tutors and to change an assignment if needed. As group size increases, learners tutoring and assistance must be divided among different teachers or tutors. Tutor re-assignment is also required since lastingness of the course may face teaching staff changes and holiday periods. Another lastingness challenge is updating course contents and structure, process that should be performed in a latency period.

### 3.4 Modularising, reusing and adapting contents

While keeping inscriptions always available is an attempt to increase time flexibility, modularising and reusing learning contents and resources concerns with content flexibility, promoting high-speed new courses creation and finer adaptation to the audience needs.

Modularising means creating sets of learning resources (contents, activities, evaluations, etc.) that can be grouped to create learning courses and programs. The modularising process requires defining strategies to create, manage and maintain the different set of resources, and to manage course creation and update. Learning standards provide specifications, mechanisms and tools to package and describe learning objects. Using these specifications, course set up could be almost as simply as letting learning providers just copying a zip file in the appropriate folder. However, when the learning process requires the teacher adopting an active attitude, providing new resources and activities in response to the group progress and feedback, alternative strategies should be defined to enable teachers to continuously interact with learning resources.

In the UPCplus project, the university quality requirements impose that each meaningful learning module has a tutor or teacher assigned, who will assist learners in the subject understanding and internalisation. Modularisation and reusability has been implemented regarding both contents and learners assistance and guidance. In consequence, courses in the UPCplus learning management system are created from module templates. In a module template, contents, activities, evaluation criteria and teacher are defined. Course structure is created selecting one or more module templates and grouping them if required. When selecting a module template to incorporate it in a course, a copy of the template is performed and the general information can be modified to fit better the requirements of the audience. Once the course is created, mechanisms that enable module templates and course modules

synchronisation are needed to both, be able to incorporate in the template the changes performed during the course progress and, on the other hand, be able to update course module with changes performed in the module template. In addition, this synchronisation process should be done selectively and when considered appropriate.

Finally, modularising and reusing capabilities of the learning management system foster the extension and variety of the learning offer, ranging from short lasting courses to master programs. Such a variety in dedication time and contents volume should be considered by the user interface structure, layout, functions and configuration capabilities, so that usability is guaranteed in both short and long lasting courses.

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