Matching eLearning Services and Training Processes

ALEJANDRO ORERO & JOSE M. ARIAS
Grupo de Ingeniería de Organización (GIO)
Universidad Politécnica de Madrid (UPM)
Avenida de la Complutense, s-n, Ciudad Universitaria, Madrid 28040
SPAIN

Abstract: - This paper analyzes the reasons for customization in eLearning. These involve the organizational, pedagogical and psychological dimensions. Based on the previous analysis, an instructional design framework is proposed in which personalized services are pointed out as critical success factors for the implementation of quality strategies in computer-based training. In line with this approach, the GIO-UPM learning design methodology is presented, as well as some examples of its application.

Key-Words: - Customization, Instructional design, Learning management systems, Quality services, Successful case studies, Educational processes

1 Introduction

Recent research shows an underlying relationship between learning technologies and educational scenarios; while certain content management systems (such as Mamboserver) support behaviorist approaches, others (e.g. Wikis) are intended for constructivist environments [1]. This example makes clear that there is no universal platform for every training methodology, and gives rise to the following question: Which are the design constraints for an eLearning application? In other words: What has to be taken into account in order to implement a successful educational software solution?

This paper intends to partially answer these questions by means of an investigation of some factors which have been identified as severe determinants of eLearning platforms development. As a result of this analysis, an instructional design methodology is proposed, and the GIO-UPM case study is presented in accordance with it.

2 Learning Design Parameters

The determinants of eLearning platforms design which have been identified can be grouped into three dimensions or perspectives, as depicted in Fig.1: organizational, pedagogical and psychological. The organizational dimension takes into account the strategic importance of education in the public administration, the private sector and the academic world. The pedagogical dimension involves learning results, processes and conditions. Finally, concepts such as satisfaction, ease of use and usefulness are considered as part of the psychological dimension. An analysis of each dimension is presented below.
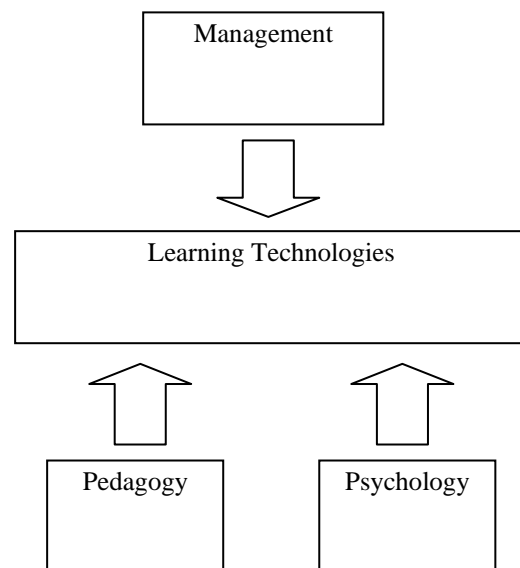

Fig.1: eLearning Design Perspectives

2.1 Organizational Perspective

According to an extrapolation of the results of several studies, eLearning considerably reduces the cost of instruction and either reduces instruction time by about one third or increases the effectiveness of instruction by about one third [2]. Consequently, the application of Information and Communication Technologies to training is not only useful in the corporate sector, but also in the administration and the academia, as it dramatically reduces the opportunity costs of the learners.

In this context, a framework for the implementation of eLearning strategies is needed.

Approaches such as the recent Quality Development Cycle seem to be useful for this purpose.

2.1.1 Quality Development Cycle

The Quality Development Cycle (QDC) states that quality development in eLearning takes place as a sequence of four steps, which involves a needs analysis, a decision process, a realization phase and incorporation phase [3]:

1. In the needs analysis phase, the organization examines the requirements for quality in eLearning. These needs are linked to the overall objectives of the organization in which the learning strategy is going to be implemented.

2. As a result of the decision phase, an already existing or newly developed quality strategy is chosen to meet the previously defined needs for quality development. Consequently, this step involves the selection or the creation of an eLearning platform customized to the requirements identified during the previous phase.

3. During the realization phase, the quality strategy is implemented into the organization. Critical analysis and assessment constitute an integral part of this step.

4. Finally, the incorporation phase relates to the modification of activities that have to be performed by the individual actor of the organization as a result of the QDC.

The QDC is graphically represented in Fig.2, in which the cyclic nature of the process is shown.
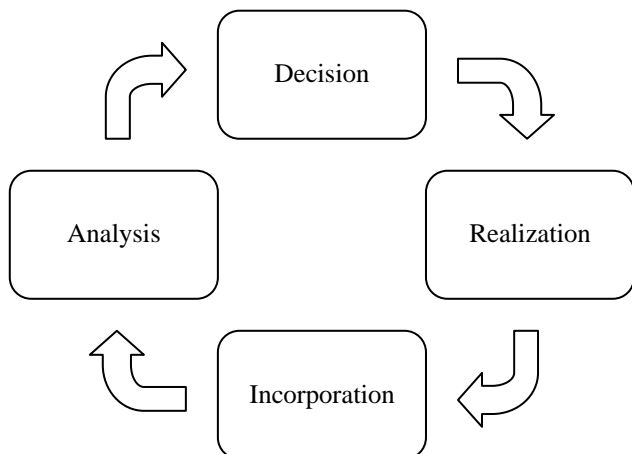
Decision

Analysis

Realization

Incorporation

Fig.2: Quality Development Cycle [3]

The QDC provides a general methodology for the implementation of computer-based training strategies, but maybe its main contribution from the point of view of an instructional designer is the concept of analysis (and the corresponding evaluation which takes place during the realization phase and serves as

feedback of the correctness of the analysis), which will be proposed as the first step of our design methodology in section 4. This is the reason why we find it important to present an insight into the guidelines of educational needs analysis.

2.1.2 Kirkpatrick's Taxonomy

The levels of Kirkpatrick's model, which are depicted in Fig.3, have become a recognized learning evaluation instrument in the organizational setting. Consequently, this tool is also useful for design, in the sense that the critical issues that lead to a successful assessment are in fact the factors that need to be considered for a correct development.
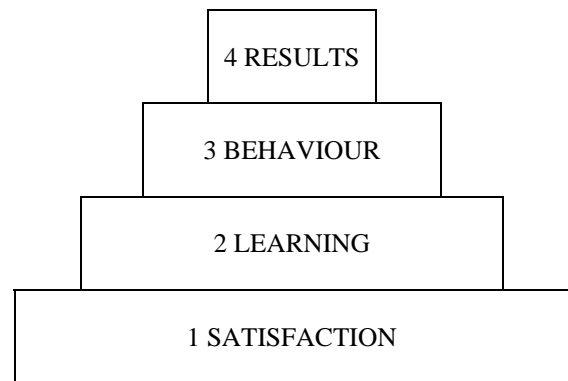
4 RESULTS

3 BEHAVIOUR

2 LEARNING

1 SATISFACTION

Fig.3: Kirkpatrick's hierarchy [4]

Kirkpatrick's model includes four levels of training evaluation [4]:

1. Reaction: an assessment of learner satisfaction. Level 1 data collection is generally carried out by means of a simple questionnaire, whose purpose is to find out if learners enjoyed the training experience and whether they believe it is relevant. A typical relevancy question might be related to the expectation of the learner on its work performance improvement as a result of the learning experience.

2. Learning: an assessment of learning. Data for level 2 evaluations are usually collected by analyzing and comparing pre-course and post-course assessments.

3. Behavior: an assessment of behavior change. Level 3 data sources include line managers' observations and follow-up interviews with learners [5].

4. Results: an assessment of results. Level 4 data measure impact on performance. Some examples of these indicators are production costs per unit, on-time provision of products, customer satisfaction levels, etc.

Kirkpatrick's model can be applied to eLearning as a particular case of training. The final objective of

a computer-based training strategy is generally related to the fact that some of the results at level 4 have to be changed. In a business setting, these may include response times to service calls, market share, company image and reputation, etc. In an academic scenario, these outcomes may be related to the expected educational impact of a teaching institution, which can be determined by the demands of the market or the society.

The positive change of the results at level 4 sets conditions on the behavior of the learners at the third level. This, in turn, determines the training content of the eLearning courses at the second level. The appropriateness of the learning contents should have a positive impact on the relevancy of the instructional experience perceived by the trainees at level 1, thus providing a high learner satisfaction.

Especially for business environments, it is important at this point to carry out an analysis of the expected return on investment with the aim to assure that the monetary value of the performance results exceeds the cost of the training [6].

2.1.3 Organizational Design Parameters

As a result of the organizational analysis, now it is possible to determine the main organizational factors that affect eLearning design. These are mainly related to the organizational objectives, which may involve production costs, on-time provision of products and services, customer satisfaction levels, company image and reputation, etc.

2.2 Psycho Pedagogical Perspective

The psychological and pedagogical dimensions of Fig.1 represent in fact the first and second levels of Kirkpatrick's model, which means that to a certain extent, the psycho pedagogical dimension is determined by higher level decisions which take place at the third and fourth levels. The contribution of the psycho pedagogical dimensions to the design of learning technologies is explained below.

2.2.1 Pedagogical Dimension

There are three basic components which can be used to analyze every learning situation from a pedagogical perspective [7]:
1. The learning results, also called content, which is what is learnt or what changes as a result of learning.
2. The learning processes (or how those changes occur), which make reference to the learner's cognitive mechanisms that make possible those changes.

3. The conditions of learning, or the type of practice which takes place in order to activate those learning processes.

Depending on the desired result, it is necessary to activate certain processes, which require in turn certain conditions. The activated processes are internal to the learner, and they can only be observed through their consequences. Therefore, the only thing that the teacher can do to facilitate the learning of the trainee is to create a determined set of conditions in order to activate the adequate mental processes.

Consequently, the analysis of the learning situations starts with the results, continues with the processes and ends with the design of the adequate learning conditions. Conversely, the teachers can only determine the conditions in which the learning takes place, which influence the learners' mental processes, thus producing the desired outcomes. These analysis and intervention mechanisms are shown in Fig.4.
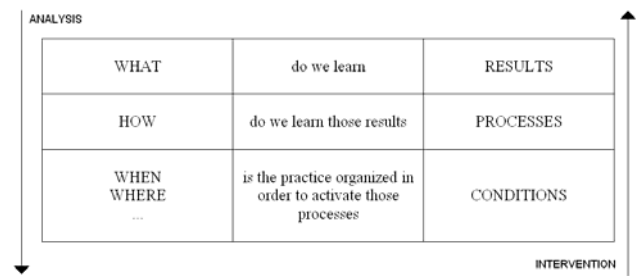

Fig.4: Learning conditions, processes and results [7]

Learning processes can be characterized according to different variables, some of which are the levels of reflection, experience and social interaction [8]. For instance, behaviorist approaches are in general unreflective, information-based and individualistic, while constructivist learning tends to be reflective, experience-based and interactive.

Several classifications of learning results exist. However, it is not the purpose of this paper to be exhaustive in this sense. It is enough to take into account that these different knowledge products can be traced to different learning processes and conditions, and that in an eLearning environment, these conditions are determined by the services of the platform which is used to carry out the training.

2.2.2 Psychological Dimension

Learner satisfaction is the first step towards a successful learning experience, as it can be derived from Kirkpatrick's taxonomy. Satisfaction involves factors such as perceived relevancy (which is strongly linked to perceived usefulness) and ease of use, both

of which are key components of the Technology Acceptance Model, as it is shown in Fig.5.

In fact, empirical evidence exists regarding the relationship between perceived usefulness and ease of use, on the one hand, and attitude towards eLearning platforms, on the other hand [10]. To this regard, it is important to pay attention to factors such as computer literacy, which has been found to be a significant predictor not only of the perceived ease of use, but also of the perceived usefulness [11]. This example shows that individual learner characteristics may play an important role in attitude towards computer-based training systems usage.
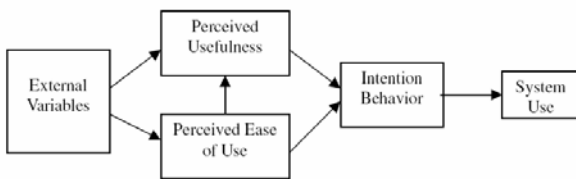

Fig.5: Technology Acceptance Model [9]

2.2.3 Psycho pedagogical Design Parameters
From the previous analysis, it is possible to conclude that learning results constitute an important psycho pedagogical factor of design, as they determine the services of the platform which is used to underpin the corresponding training process. In this context, the levels of reflection, experience and social interaction in the underpinned processes become important conditioning parameters of the eLearning services.

It is also necessary to provide the means to achieve high levels of perceived usefulness and ease of use. To this extent, training in the usage of the platform may become an important factor.

3 Instructional Design Framework
The instructional design framework proposed in this section integrates both the organizational and psycho pedagogical dimensions presented in the previous section. It is intended to be useful in organizational environments, in which the implemented computer-based training strategy has to be aligned with the objectives of the organization.

The proposed instructional design methodology, which is depicted in Fig.6, consists of five steps
1. Objectives: analysis and identification of the organizational outcomes of the training strategy.
2. Behavior: establishment of the behavioral change of the trainees which is required to achieve those outcomes.

3. Learning results: the contents of the training, which are intended to provide the expected behavioral change.
4. Learning processes: the pedagogical processes that have to be activated in the mind of the learners to achieve the expected learning results.
5. Learning conditions: the services of the platform that have to be implemented to foster the corresponding learning processes. The usefulness and the ease of use of these services are crucial factors in this phase.
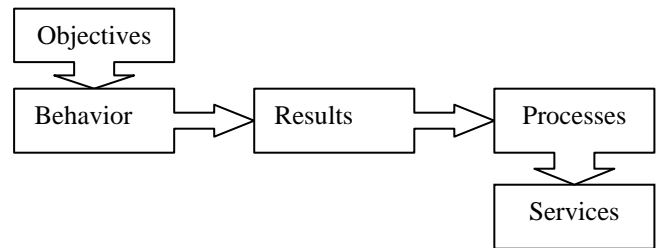

Fig.6: eLearning Design Methodology

In this context, flexibility becomes a critical issue. Personalized services are needed to adapt the technological solution to the requirements of the training processes, but also to the ones imposed by the roles of the different users of the platform.

4 GIO-UPM Design Methodology
The eLearning design procedure of GIO-UPM, which is in line with the instructional design methodology of the previous section, has given rise to several successful eLearning implementations in both business environments and academia. One of the critical success factors of the work carried out at GIO-UPM is the flexibility of its internally developed Learning Management System (LMS), which permits the creation, parameterization, storage and management of web services platforms customized to the needs of the organizations making use of them.

4.1 GIO-UPM LMS
The main application of the GIO-UPM LMS is the creation of eLearning environments, considering all the necessary aspects to develop, manage and deliver training courses through the use of the Internet technologies. The platforms that can be created and managed with this system represent the integration of different functionalities and can be adapted to the specific needs of every organization. Therefore, by means of this tool, any organization can customize its eLearning platform to its corporate image, specific

processes and way of doing e-learning in a flexible way, instead of conditioning the training actions and methodologies to the technological constraints of the learning technologies. The final objective of this management and support system is to improve the quality of the training and administrative processes, and to increase the efficiency and cost savings of the institutions which make use of it.

The structural concepts of the management and support system introduced above include profiles, services and the navigation tree.

4.1.1 Profiles and Services
Services can be related to files downloading, chat rooms, discussion forums, registration submissions, etc. The different profiles are characterized by the services to which they can access. Therefore, there is a relationship between profiles and services, in the sense that each profile can only have access to the set of services which are allocated to that profile, and in a certain way. For instance, it may be necessary for a user with a teacher profile to have access to the test edition and test follow-up services, while a user with a learner profile should only have the right to complete the test edited by the teacher.

Two users with the same profile could have a different scenario of accesses and functionalities available. Hence, customization is possible even at user level.

Once the platform is created, users can be allocated different profiles. Each user registered in the platform will have one profile.

4.1.2 Navigation Tree
The navigation tree shows the different services accessible to the potential users of the platform. Through the navigation tree, the structure of the generated platform is materialized. The navigation tree consists of a number of different branches. Each of these main branches can consist of another set of branches, and each of these secondary branches can consist on another set of branches, etc. If a branch does not consist of another branch or a set of branches, this means that this branch has a label or a set of labels associated to it. Each of these labels is associated to a service or set of services.

The visibility or invisibility as well as the temporal instants of the accessibility of the different parts of the tree can be declared for the different profiles and users. Also, different functionalities are shown for each label of the tree depending on the user navigating through the tree.

The declaration of the visibility and invisibility of certain parts of the tree seems to be very useful from the point of view of the different users, since not all the users should have access to all the parts of the tree. For instance, it seems to be necessary for a user with an administrator profile to access services related to the management area, for instance, in order to register and give access rights to new users of the platform. However, this management area should not be accessible to a user with a teacher or learner profile. Therefore, the management area, with all its associated branches and services, would be declared visible for a user with an administrator profile and it would be declared permanently invisible for a user with a teacher or learner profile.

An illustration of the navigation tree can be seen on the left side of Fig.7.
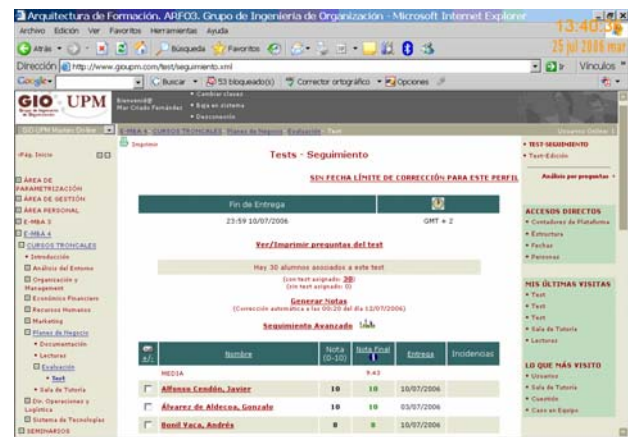

Fig.7: GIO-UPM platform screenshot

4.2 Design Application
The design methodology of the GIO-UPM starts with the identification of the training needs of the organization for which the eLearning platform is being implemented. These needs are in line with the organizational objectives and the desired behavioral changes derived from them. Afterwards, knowing which should be the learning outcomes, and taking into account the nature of the training processes that have to be implemented in line with the contents of the courses, the services of the platform are configured. No more and no less than the required services are implemented. This framework is coherent with the instructional design methodology proposed in section 3.

Following the platform design, the integration of the platform with the organizational processes of the institution for which the platform has been designed takes place. This is in line with the third and fourth steps of the QDC described in section 2.

Currently, the GIO-UPM eLearning customization system provides support at graduate and postgraduate levels to several Spanish universities (Technical

University of Madrid, University of Alcalá de Henares, University of Salamanca and Technical University of Valencia) as well as to several collaborative and business environments.

5   Conclusion

Different perspectives have to be considered for the design of an eLearning platform, of which the organizational and psycho pedagogical have been considered in this paper as a baseline for the implementation of computer-based training strategies in organizational environments. A design framework has been proposed based on the critical factors investigated from these perspectives.

Finally, the GIO-UPM LMS and design methodology have been presented as an example of implementation of eLearning platforms customized to the needs of the organization for which a computer-based training application has to be generated. This methodology is coherent with the instructional design framework previously presented.

One of the key features of the LMS developed by GIO-UPM is its flexibility. This flexibility, which permits to create any tree structure, makes possible the matching between the organizational training needs and the generated eLearning platform.

References:
[1] P. Baumgartner, Communication and Interactions in eLearning, [Conference Proceedings] *eLearning Conference – Towards a Learning Society*, Brussels: European Commission, 2005, pp. 120-130, http://www.elearningconference.org/

[2] J. D. Fletcher, Does This Stuff Work? Some Findings from Applications of Technology to Education and Training, [Conference proceedings] *Teacher Education and the Use of Technology Based Learning Systems*, Warrenton, VA: Society for Applied Learning Technologies, 1996, http://www.hi.is/~joner/eaps/wh_stuff.htm

[3] U. D. Ehlers, The Need for Quality – Key Process or Add-on?, [Conference proceedings] *eLearning Conference – Towards a Learning Society*, Brussels: European Commission, 2005, pp. 158-161, http://www.elearningconference.org/

[4] D. L. Kirkpatrick, *Evaluating Training Programs: The Four Levels*, Berret-Koehler Publishers, 1996

[5] D. Morrison, *E-learning Strategies – How to get implementation and delivery right first time*, John Wiley & Sons, 2003

[6] J. J. Phillips, Measuring ROI: The Fifth Level of Evaluation, *Technical & Skills Training*, April 1996, pp. 10-13

[7] I. Pozo, *Aprendices y maestros: la nueva cultura del aprendizaje*, Madrid: Alianza, 1996

[8] G. Conole, M. Dyke, M. Oliver, & J. Seale, Mapping pedagogy and tools for effective learning design, *Computers & Education*, Vol. 43, 2004, pp. 17-33

[9] K. A. Pituch, & Y.-K. Lee, The influence of system characteristics on e-learning use, *Computers & Education*, Vol. 47, 2006, pp. 222-244

[10] E. W. T. Ngai, J. K. L. Poon, & Y. H. C. Chan, Empirical examination of the adoption of WebCT using TAM, *Computers & Education*, In Press

[11] C.-S. Ong, J.-Y. Lai, & Y.-S. Wang, Factors affecting engineers' acceptance of asynchronous e-learning systems in high-tech companies, *Information & Management*, Vol. 41, 2004, pp. 795-804