Learning Management Systems Desiderata for Competitive Universities

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Abstract

English Abstract

The competition in the market of higher education has pushed universities towards the adoption of more sophisticated organizational practices to ensure effectiveness of their activities. The adoption of these practices, however, must not occur at the cost of disfiguring the characterizing features of universities regarding their organizational structure, especially in what concerns their organizational goals. A possible strategy to evolve the organization of universities, in order to achieve the necessary governance that can ensure adequate performance levels for all their activities, can be effected through the expansion of the functionalities of *Learning Management Systems*. These systems are a specific class of systems initially developed to support the storage and distribution of learning material, typically through the Internet, and the management of enrolments and student activities. In this article we have identified some concrete desirable features that can be added to Learning Management Systems in order to improve their utility for the management and control of universities. We have also identified some projects and systems which apparently are moving towards the implementation and provision of these features.

Brazilian Abstract

A competição no Mercado acadêmico universitário tem levado as universidades a adotar práticas organizacionais mais sofisticadas, para garantir a eficácia de suas atividades. A adoção dessas práticas, entretanto, não deve ocorrer à custa da distorção dos atributos que caracterizam a estrutura organizacional das universidades, em especial no que se refere aos seus objetivos. Uma estratégia possível para a evolução da organização das universidades, com o objetivo de conduzir à governança necessária para garantir níveis de desempenho adequados em todas as suas atividades, pode ser construída através da expansão das funcionalidades dos *Sistemas de Gestão do Aprendizado*. Esses sistemas constituem uma classe específica de sistemas, desenvolvidos inicialmente para o apoio ao armazenamento e distribuição de material de ensino, tipicamente através da Internet, e a gestão de matrículas e atividades dos estudantes. No presente artigo identificamos alguns atributos desejáveis, os quais podem ser acrescentados aos Sistemas de Gestão do Aprendizado, com a finalidade de ampliar a sua utilidade na gestão e controle das universidades. Identificamos, também, alguns projetos e sistemas que aparentemente seguem na direção de implantar e proporcionar esses atributos.

Keywords

Learning Management Systems, University Management Systems.

List of topics

Introduction

The utilization of the Internet and distributed content management systems for learning has been widely discussed recently, most remarkably in the context of the development and application of variations of *Learning Management Systems* – LMS – and their distinguished components identified as *Learning Content Management Systems* – LCMS – as can be appreciated e.g. in the articles published in the conference series *Advances in Web Based Learning* (Fong et al., 2002, Zhou et al., 2003, Liu et al., 2004, Lau et al., 2005, Liu et al., 2006).

Very briefly, LMSs are software systems to manage the delivery of learning material to students. Most typically, LMSs are based on the WWW and aim at providing "anytime, anyplace, any pace" distributed management of the delivery and assessment of learning material. LCMSs are a variation of LMSs, in which the focus is on managing learning *content* (the "C" in the acronym). Most recent LCMSs encompass the functionalities provided by LMSs, and add to them resources to store, index and retrieve learning content components, to author and edit those components, and to render the learning content components through multimedia interactive interfaces. Heretofore, we shall employ LCMS to refer to these two sorts of systems indistinguishably.

This class of systems, empowered by the most recent advances and available resources in web-based technologies, distributed and ubiquitous computing, mobile technologies, and corresponding techniques in software engineering, is still very recent. Its application is directly related to *education*, which is

fundamentally a social issue. As a consequence, the effectiveness of these systems requires a significant amount of time and effort to be measured, and at present we still do not have sufficient empirical data to perform a thorough analysis of the consequences of the utilization of these systems.

At present, the field characterized by such systems can be considered still in a prospective phase, in which requirements are gathered and organized, based on models and hypotheses about learning and distance learning processes, and then used to guide the construction of concrete systems. These systems are then put in production, thus creating the opportunity to obtain experimental results that eventually will complete the cycle, providing information to refine the foundational models about learning and therefore the requirements to build better supporting systems for the management of learning content and learning in general.

Some interesting models to guide the construction of LCMSs consider as a primary issue that learning is indeed a social phenomenon, and are founded on the proposition that learning processes should be decentralized and based on the interactions in a social network (Dalsgaard, 2006, Stahl, 2002). We consider these models of particular interest, because of their inherent suggestion that the responsibility upon all aspects of learning should be shared among all participants of the learning processes. This suggestion challenges the more traditional views, in which specialized responsibilities were distributed to different actors in the learning scenario, such as the student, the instructor and the manager of the learning environment. According to the traditional views, for example, instructors should care about the production of high-quality content and the effective distribution of this content, and students should care about the effective absorption of the distributed content. Students and instructors should have clearly distinct and separate roles in the process. The systems based on social networks admit and foster the plurality of roles for all participants in the learning process.

In the present article we also advocate that a plurality of roles is beneficial to the effectiveness of LCMSs. We focus, however, on the plurality of roles involving instructors and managers of the learning process. We challenge, therefore, the traditional view in which instructors do not have to care directly about management issues and vice-versa, i.e. managers do not have to care directly about the quality of learning, unless some specific proposed procedures can have managerial impact, e.g. incurring in additional costs or creating opportunities for profit for the learning institution in charge of those procedures.

Not so much discussion can be found in the literature on the integration of LCMSs and organizational management systems used by universities. From where we stand, there seems to be a separation between the organizational management of the universities and the management of their core product, namely learning processes. This separation hinders the opportunities to improve the effectiveness of learning as proposed by universities, which can improve the quality of the proposed learning procedures as well as their effectiveness in the utilization of material and human resources such as those represented by instructors and students, as well as administrative and managerial staff.

In the present article, we argue that the designers of LCMSs should aim at this integration, so that organizational issues can be dealt with directly and explicitly by the value producers in universities, namely the producers and distributors of learning material (lecturers, instructors, etc.), as well as influence the decisions of those actors, whilst enabling effective unmediated management of the needs of those actors in the universities, taking into account a broad organizational view of the university, influencing and accepting decisions about issues such as cost and funding distribution, measurability and monitoring of efficiency and effectiveness of learning activities.

The market for learning institutions (such as universities, which are our focus in this work) is becoming more competitive every day. In certain fields, such as engineering and computer science, the decline of demand has driven universities and large corporations to build special research programs to reinvigorate these academic fields and change this trend (Microsoft, 2006). Certainly, having fewer students for a growing number of schools creates a scenario of more aggressive competition. As a consequence, the problem we are tackling in this article is also becoming more pressing each day. It can be the factor that will determine which universities are going to survive and which universities are going to find themselves out of their business in the near future.

In section 2 we discuss a little further our view of the development of the market for universities, which demands a business oriented organizational approach from those institutions, including methods to measure and monitor their efficiency. In section 3 we present some desiderata for LCMSs, to promote their evolution specifically towards enabling that instructors and managers can share their activities, responsibilities and roles through these systems. In section 4 we highlight a few ongoing projects we have found, which we believe have the potential to contribute to our view. Finally, in section 5 we present some preliminary conclusions.

Organizational challenges for competitive universities

Drucker (1988) argues that the evolution of organizations is leading towards *coordination* replacing *management*. As a consequence, the traditional command-and-control organizational structure shall be replaced by information-based organizations, based on the coordination of the activities of highly autonomous entities (Correa da Silva and Agusti-Cullell, 2003).

According to Drucker, universities can be envisaged as prototypical organizations in which coordination is more central than management. Individuals and decentralized work groups have a high degree of autonomy, and the success of such organizations depends on the alignment of the goals and agendas of these individuals and groups with the general goals and agenda of the organization as a whole. As a consequence of the subject matter of these organizations, self-motivation, autonomy and initiative must be fostered and rewarded, and their organizational structure must be adapted to make good use of this necessary condition.

For reasons that are completely different from those that make universities organize themselves the way they do, other organizations have built internal structures that resemble those found in academic institutions. Organizations devoted to a large variety of activities have found in these organizational structure resources to improve their flexibility and agility to adapt to market conditions.

As brilliantly pointed out by Scholtz (2002), however, the competition in the market of higher-level education has requested from the universities the adoption of many conventional procedures to improve their accountability, monitoring and control, so that they can work efficiently and effectively towards established performance goals that can ensure their survivability in the market.

As a consequence, it is likely that conventional organizations and universities meet halfway, regarding organizational structure. Considering this scenario, it can be interesting to start designing the appropriate

tools to support the operations of those universities that are going to survive in a highly competitive environment.

These tools shall provide the means for the professionals directly involved in the end products of universities – namely, instructors and lecturers – to be informed about the goals and agenda of the organization as a whole, so that they can align their activities, goals and agendas with those of the organization. They shall also provide the means for the activities directly related to the end products of the universities – namely, teaching and research – to be recorded and measured, based on publicly available and agreed upon methods, so that those activities can be monitored and concrete goals can be proposed to the organization. This way, the supporting tools shall contribute to the plurality of roles and responsibilities shared by instructors, administrative and managerial staff.

LCMS desiderata for competitive universities

Generally speaking, the existing LCMS account for the following set of requirements:

- Management of enrolments; general management of users and their roles; general management of courses and their corresponding material.
- Management of academic calendar.
- Management of delivery of course material to enrolled students.
- Management of delivery of assignments and projects from the students to the instructors.
- Management of marking and grading.
- Management of discussion lists.

These systems must be scalable and accept a large number of users, since their typical use scenario involves many users for each possible role admitted by a system (student, instructor, administrator, each of these potentially organized in a hierarchy of groups and communities). As can be verified by the documentation of many existing projects and systems, modern software engineering techniques have been employed to develop these systems, of which we highlight software modularity and scalability via the model of plug-ins.

The resulting systems are typically rather sophisticated, offering to the users a myriad of functionalities, often accessible via a single, multipurpose interface. Some examples of systems that abide by this description are Moodle (http://moodle.org), ATutor (http://www.atutor.ca), Dokeos (http://www.dokeos.com) and Claroline (http://www.claroline.net). All these systems are open source and freely available through the Internet. Many other commercial systems exist, and some of which are reputedly of high quality and adopted by several universities. The evaluation of the commercial systems, however, is more difficult to perform than the evaluation of the open source systems, since most of them require their acquisition in advance or at least the formal request of a copy for evaluation to access their full functionality.

These systems are good supporting tools to manage the end product of academic institutions. However, they do not provide the users with functionalities to support the general organizational management of the academic institutions, including for example financial management and logistics. They also fall short of providing tools for the administrative and managerial staff to monitor the activities of instructors and students, which could enable tools for an integrated analysis of these actors in the instructional environment, comprising their academic as well as administrative performance.

Typically, the management of academic institutions makes use of a separate set of supporting tools, which are not integrated with the LCMS. Generally speaking, these tools are customizations of existing products for Enterprise Resource Planning (ERP). Many of the major vendors of ERP systems offer customized versions of their systems specifically for universities. These systems account for the following set of requirements:

- Monitoring and control of costs and activities.
- Definition, monitoring and control of workflow.
- Financial analysis and control.
- Planning, monitoring and control of commercial transactions (e.g. acquisition of goods).
- Monitoring and control of human resources (including payroll and related issues, as well as payment of fees by students).
- Customer relationship management.
- Data warehousing and OLAP resources.

We propose that the LCMS should be extended to provide for a better integration with the functionalities that are requested by the organizations and which are typically provided by ERP systems. They do not necessarily need to offer these functionalities, since in many cases the universities already have ERP systems in use, but they should be designed to ensure that information flows effortlessly between them and the ERP systems.

Moreover, the designers of LCMS should avoid the "Swiss army knife" syndrome, i.e. they should resist the temptation of putting all available functionalities of their systems in a single interface, which can be confusing and misleading to the users.

Our desiderata for LCMS, considering the points discussed above, suggest that they should comprise the following features:

- *Adaptable interfaces* – a LCMS should offer modular and customizable interfaces to the users, instead of a single all purposes interface, thus extending the modularity of its software architecture to the level of user interfaces. With that, the productivity of the learning processes that occur through the LCMS can be improved, since each individual user can be offered the precise set of functionalities that is useful to her/him, avoiding the distraction of unnecessary or uncalled for operations.

Adaptable interfaces can improve the effectiveness of LCMS, not only considering the quality of the learning processes conveyed by these systems, but also the productivity of these processes. The construction of interfaces for LCMS should abide by the tenets of *Interaction Design*, as proposed in e.g. (Winograd, 1997, Preece et al., 2002). More specifically, it should be such that the use of the LCMS would be guided by design. In more technical words, it should maximize the *affordance* of the LCMS (Norman, 2002).

- *Compliance with existing standards for learning material* – there are many standards for the presentation and archiving of learning material – IMS, SCORM, AICC and IEEE/LTSC, among

others – as well as many frequently used data formats that have been used for the same purpose – for example, Microsoft Word or PowerPoint file formats. The usefulness of a LCMS is greatly improved if it can store, render and edit material prepared using any of these standards and formats, or at least automatically redirect a file to an appropriate specialized application capable of editing and rendering the corresponding material with utmost quality – for example, if it can automatically trigger Microsoft PowerPoint to render and/or edit a file stored in PowerPoint format.

Compliance with existing standards for learning material evidently improves the usefulness of a LCMS by ensuring its interoperability with other systems. It is also a useful tool to preserve the knowledge assets of an academic institution, embodied in its archived learning material.

- *Unmediated integration with ERP systems* – in order to promote the integration of the activities of students, instructors and the administrative and managerial staff, it is necessary that the information systems employed by each of these users can exchange information and services. From the perspective of the LCMS, this amounts to the necessity of publication of the metadata employed in the LCMS, as well as the services provided by this system and possibly the services and data required by the system to perform its operations. Ideally, this information about the LCMS should be published accompanied by the desired semantics for each piece of information. This feature can be obtained by the use of technologies such as those promoted by the Semantic Web and the Semantic Web Services research initiatives, embodied in the form of *ontologies* for the codification and exchange of metadata (Alarcon and Fuller, 2002, Abarca et al., 2006).

A trend for the development of LCMS

Some of the features proposed in the desiderata of the previous section can already be found in some systems and projects of LCMS. These features, however, are not always clearly identified, and are not always articulated and organized the way we proposed in the present article, for the explicit purpose of enabling the information flow and the coordinated and cooperative work among students, instructors and the administrative and managerial staff at universities through the extended functionalities of LCMS.

We have found two specific projects of LCMS which comprise many of the features proposed in the desiderata above, which we now highlight as indications that some designers and developers of LCMS are already following the trend of integrating the actors in the learning scenario referred to in the present article. These two projects can be accessed and used freely from the *CodePlex* open source repository (http://www.codeplex.com). The projects are called *SharePoint Learning Kit* and *SharePoint Web Parts for Moodle*. Both projects have been developed by an open community, following the standard practices of open source software development.

- The *SharePoint Learning Kit* is a full fledged LCMS based on Microsoft SharePoint technology. It contemplates each of the points referred to in the desiderata:
  - Its interface is based on web parts. Different web parts are presented to different actors in the learning scenario. Customized web parts can also be added to the system, thus enabling the adaptability of the system interface and providing means to improve its affordance.
  - It is fully compliant and integrated – through SharePoint – with all Microsoft Office formats and applications. It is also fully compliant with SCORM, which is among the most popular standards for the codification and archiving of learning material. The high quality of the rendering of SCORM packages provided by this system deserves mention.
  - SharePoint web parts and SharePoint web portals function as mediators for the integration of diverse information systems. Through the SharePoint technology, this system can be easily integrated with any other system whose interface can also be adapted to the form of web parts, and vice-versa.
- The *SharePoint Web Parts for Moodle* is a collection of Microsoft SharePoint 2003 web parts, which selectively publish specific functionalities provided by the Moodle LCMS. Although this project does not fully address all points in the desiderata, it works as an interface for Moodle, that improves its features related to each of the points in the desiderata:
  - The all-in-one original interface of Moodle is replaced by the web parts. The web parts are customizable, and different subsets of the available web parts can be presented to different groups of users. The improved adaptability and the affordance of this interface, when compared with the original Moodle interface, are greatly improved.
  - Moodle already is a fine system, regarding compliance with existing standards and formats of learning materials. This system inherits these features of Moodle.
  - SharePoint web parts and SharePoint web portals function as mediators for the integration of diverse information systems. Through the SharePoint technology, the functionalities of Moodle are made available to any other system whose interface can also be adapted to the form of web parts, and vice-versa.

Conclusion

The competition in the market of higher education has pushed the universities towards the adoption of more sophisticated organizational practices to ensure the effectiveness of their activities.

The adoption of these practices, however, must not occur at the cost of detaching universities from their organizational goals – universities must continue to be institutions devoted to higher level research and education, and by no excuse these goals should be allowed to be distorted to accommodate deviant strategies for sake of improving organizational competitiveness.

One possible strategy to evolve the organization of universities along pathways that remain faithful to their goals and in such way as to achieve the necessary governance that can ensure adequate performance levels for all their activities can be through the expansion of the functionalities of LCMSs. In this article we have identified some concrete desirable features that can be added to LCMSs in order to improve their utility for the management and control of universities.

We argue that this strategy can be good for universities, because they provide them with tools to improve their productivity and efficiency without losing the focus on their primary goals. They also bring the concerns about productivity and efficiency to all levels and functions in the organization, thus creating opportunities for higher levels of alignment of goals throughout all components of educational institutions. This way, universities can effectively materialize the model of coordination-based organizational structures proposed by Drucker, which hopefully shall contribute to their competitiveness.

Our propositions, however, still demand further empirical validation.

We have identified some projects and systems which apparently are going towards presenting these features. Among the desirable features observed in these projects is the adaptability of the corresponding systems that are being developed in each of them. Our future work shall focus on the effective adaptation of these systems to serve specific purposes, namely to provide for the fluid information exchange between LCMS and ERP "views" of integrated management systems, in order to empirically validate the positions we have presented here.

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