Towards a Support System for Course Design

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Abstract: Many stakeholders in higher education develop with time. In this paper, we propose a new type of platform, called a Teaching Content Management System (TCMS). Such platforms are intended for instructors to help them produce teaching specifications and quality teaching designs. We first of all present drivers of change that currently affect universities and we discuss some specific aspects of education in higher education. We then derive a set of support requirements for instructors and provide a services design that TCMS should comply with.

1 INTRODUCTION

Learning Content Management Systems (LCMS), also called Learning Management Systems (LMS) have been developed gradually over the past fifteen years across all levels of education (Zou et al., 2012). These Internet-based platforms are mainly designed to foster the creation and sharing of content, and interaction between instructors and students, by using the Web (Bennett et al., 2006). Almost all universities make LCMS available to their students and instructors such platforms as Blackboard (http://www.blackboard.com) or Moodle (http://moodle.org). LCMS platforms provide rich opportunities for teaching students, but few opportunities, if any, to help instructors in specifying and designing their teaching courses.

Therefore, most instructors manage the preparation and design of their courses in a traditional manner and are poorly equipped in information technology in the area of specification and design of their teaching courses (Ottenbreit-Leftwich et al., 2012). The question of developing a support system to help instructors to specify and professionally manage the construction of their teaching courses was raised with a view to supplement LCMS. In Section 2, we first show the development factors and constraints that currently weigh on higher education. In Section 3, we set out the objectives for TCMS in the form of strategic support requirements that the TCMS should satisfy, based on the analysis of the previous section, some specific aspects of higher education and our long years of experience in higher education. In Section 4, we then propose a preliminary design in the form of a system comprising three support axes that are detailed as follows: 1) improving instructor knowledge and professional skills 2) management of a professional knowledge base 3) project realization. In Section 5 we discuss about TCMS as a new concept and also about its practical implementation and usefulness. In Section 6, we offer our conclusions and perspectives for future research.

2 STATE OF ART OF DEVELOPMENT FACTORS WEIGHING ON HIGHER EDUCATION

The profession of instructor has been changed by several development factors in recent years. Six important factors are presented in this section.

An initial factor relates to the continuing progress of ICT that transcends communication, coordination, knowledge management, production of learning tool or objects and the scripting of teaching.

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This first factor has caused the President of Stanford University to state *"Just as technology disrupted and transformed the newspaper and music industries, it is now poised to wreak havoc upon another established industry: higher education"* (Hennessy, 2012).

A second factor relates to how the mission entrusted to higher education has developed. Thus, a vast professionalization movement has lead to the requirement of providing training programs that are closer to the concerns of businesses while seeking to provide training throughout life (Pisa, 2005). This leads to an evolution in the perception of knowledge and to the development of curricula definitions based on skills and business rationale with more useful knowledge that can be immediately applied (D'Andrea and Gosling, 2005).

A third factor relates to the professionalization of instructors and educational systems. It is reflected in the many reforms of university systems and a vast movement for the development of quality assurance (Manjula and Vaideeswaran, 2011). It participates in the consideration of teaching as a project where the product is student learning (Van Rooij, 2010).

A fourth factor relates to the changing profile of students, particularly in respect of their number and behaviour. This "Y" generation is more critical of the relevance of knowledge that the university wishes to teach it, than the previous generation (Roberson, 2011). Thus, we need a teaching design framework that produces more elaborate teaching activities capable of adapting to this new audience.

A fifth factor is the considerable growth and diversification of knowledge taught. This makes knowledge more difficult to acquire and less sustainable. Thus the search of knowledge and it capitalization are becoming fondamental.

A sixth factor relates to advances in the diffusion of research in teaching and learning. Indeed during the last two decades, this research has led to the emergence of new ideas such as active learning, significant learning, and educative assessment. These techniques are better suited to new student profiles and enable the development of learning techniques that are closer to current training needs (Warin et al., 2011a).

This state of art shows that the knowledge and skills that are now required for an instructor are no longer confined exclusively to their subject, but also relate to the use of Information Technology and Communication (ICT), teaching systems, student profile and expectations, the development of knowledge and teaching methods. The major challenge for instructors is no longer access to knowledge but the ability to take ownership of it, to organize relevant educational activities to enhance the learning of their students, and to justify themselves economically within the educational system.

3 PROPOSITION: TCMS AS NEW TYPE OF SUPPORT SYSTEM

Thus, the question of developing a support system to help instructors to specify and professionally manage the construction of their teaching courses was raised. The top diagram in Figure 1 shows that TCMS will help instructors by impacting on their teaching knowledge, subject knowledge, etc., as well as on their work methods and organization. Its goal will be to foster the creation or development of teaching, improve instructor skills and integrate developments that weigh on higher education. The entire Figure 1 shows the differences in requirements, constraints and objectives between TCMS and LCMS. The purpose of TCMS is teaching specification and design, whereas the purpose of LCMS is the implementation and monitoring of teaching with students.

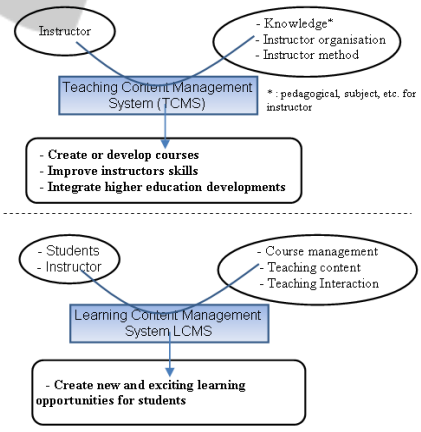

Figure 1: TCMS versus LCMS.

From an operational strategy perspective, current technology makes it possible to foresee an Internet based client / server tool, accessible anywhere, anytime, on various media from a PC to a smartphone. In fact, TCMS could use current technology platforms such as Moodle and even be directly integrated into them.

From a strategy point of view of functional requirements: the support to be provided must take into account the specific manner that Higher

Education instructors operate, who, for the most have never learned to teach (Bergin et al., 2001), must devote an important part of their activities to research, upon which their recognition and promotion are based (Harzing, 2010), and finally, for which the systematic creation principles or methods of current learning systems, such as the highly structured ADDIE (Molenda, 2003) or MISA (Paquette, 2010), do not correspond to their work traditions. Having to learn to use any computer-software teaching tool is one of the major hindrances to their use (Rößling et al., 2008). Thus, TCMS should incorporate its own learning system and be used at different levels of expertise adapted to the skills of the instructor who uses it.

4 THREEFOLD DESIGN OF TCMS

In order to assist instructor in these new challenges, we suggest that TCMS be built around three support axes: 1) Improving the instructor knowledge and professions skills 2) Management of a professional knowledge base and 3) Project realization. These three axes are detailed here after. This threefold design enables ownership to be taken in an iterative and incremental manner. The instructor is free to use one or more axes. Inside the first axis, ownership can be taken through several levels provided by a framework based on five sub-axes. Thus the instructor is free to build their engineering at their own pace. In doing so, our platform can include both the first time instructor, or the inexperienced instructor, and the experienced instructor.

4.1 Support for Improving Instructor Knowledge and Professional Skills

Providing support to instructors by making updated knowledge and skills related to their instructor profession available to them. This axis will not simply be a mere repository of knowledge, but will also offer activities to learn and master these skills and knowledge. We propose that this axis be structured and developed through a framework that consists of five quality sub-axes: (1) Teaching technique, (2) Subjects (knowledge to be taught), (3) Scripting (4) Technology and (5) Research and innovation. Using a framework to frame the content of this axis has two advantages: it will organize the implementation of the future system, but it will also, by being designed with relatively independent sub-axes, offer multiple entries to future teaching users that will facilitate the full adhesion of instructors to the system, through the possibility of gradual ownership.

Teaching Technique. This sub-axis relates to teaching basics. Its goal is to help instructors in identifying and taking ownership of basic teaching techniques. This sub-axis of the future platform will be responsible for managing teaching basics and basic teaching techniques, such as: knowing how to classify knowledge to be taught, knowing how to define educational objectives, knowing student learning conditions and strategies, etc. This part will be based on the classical works of Bloom, Krathwohl, Mager, Glaser, Gagne, Jonassen, etc., for which we do not provide an exhaustive list of references in this article due to lack of space. An interested reader can refer to Talon et al. (2012) for more information. The knowledge required for the "Teaching Technique" sub-axis is more of the academic knowledge type and will require limited effort by the instructor to master.

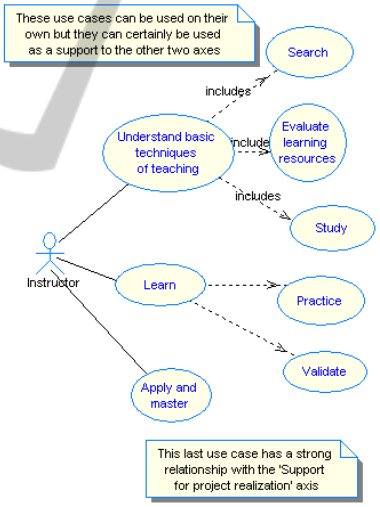

Figure 2: High-level use case of the “Support for improving instructor knowledge and professional skills” axis.

This "Teaching technique" sub-axis will also offer, 1) learning activities to learn the basic teaching techniques, 2) software for validating teaching knowledge, and 3) course definition tools. All or part of the results produced, such as the teaching objectives, can be automatically exported, depending on the opportunity, to the LCMS part of the platform to be brought to the knowledge of students. Figure 2 illustrates the main use cases for this "Teaching Technique" sub-axis. These use cases

are written in the well-known UML language (http://www.uml.org/).

Subjects. This sub-axis relates to the content to be taught: computer science, mathematics, languages, etc. It aims to make resources validated by the best experts in the field available to instructors. Semi-automatic quality assessment tools of *a priori* resources can be integrated into this sub-axis. Indeed, an unidentified or authorless resource can be detected a priori as being of lesser quality. Similarly, in order to be classified as quality, these resources should not be mere knowledge repositories, but must be "comprehensive" in the sense that they must be accompanied by a teaching framework that facilitates their ownership or adaptation by the instructor: context, wording, specific correction elements, precise evaluation criteria, feedback, etc. Professional monitoring, based on peer review and feedback, can be put in place to assess the quality and relevance of resources.

Scripting. This sub-axis relates to more developed and more practical knowledge in relation to teaching. It aims to enable instructors to identify and take ownership of complex teaching strategies, such as, for example, serious games techniques or project-based learning. The volume and complexity of additional knowledge that instructors have to master is not the same as those of the "Teaching.

Technology. This sub-axis relates to the technology for helping instructors in relation to teaching methods. These are generic tools, whereas the technology tools related to the subject taught will be associated with the "Subjects" sub-axis. For example, visualization software to run a sorting algorithm will be integrated into the “Subjects” sub-axis. The purpose of this "Technology" sub-axis is to facilitate the use of ICT by instructors to manage their teaching activities. For example, in the near future, instructors that have mastered the Moodle or Blackboard type e-learning platform will have a distinct advantage. All the more as there are recent techniques that facilitate their configuration (Drira et al., 2011).

Research and Innovation. This sub-axis relates to knowledge, processes and tools that facilitate the production of knowledge and innovation practices. It aims to help instructors in mastering the techniques of knowledge acquisition or creation, be they teaching or subject knowledge as advocated by Labour and Kolski (2010). It is important that an instructor masters access to bibliography databases and to simple techniques, that are not well know by many instructors, in relation to quality indices such the impact factor, the h-index and the g-index (Harzing, 2010), etc.

4.2 Support for the Management of a Professional Knowledge

Whether to support the creation or development of their teaching or to achieve research results, instructors need to improve and manage their professional knowledge. The purpose of this axis is to provide a content management system that enables them to store, classify and enrich their professional knowledge.

In this content management system we need to distinguish free knowledge from other knowledge. Free knowledge can be freely modified and distributed without charge by the instructor. Free knowledge, even if there are different modalities of implementation (http://creativecommons.org) is the only knowledge that the teacher can reuse, improve, adapt and distribute for free during his teachings. The concept of free knowledge is important because it allows the teacher to remain master of his own issues: reducing the time spent in preparation, high quality educational resources provided, accuracy of knowledge disseminated and adaptation to the student audience.

Traditional knowledge can be managed effectively in the TCMS with bibliographic management tools such as for example, Mendeley software (http://Mendeley.com), possibly with additional functions and search rankings. Free knowledge included in the TCMS will be managed using a tool that combines the functions of a traditional CMS for its ability to store and organize knowledge, with those of a versioning tool. Evolutions must be stored including dates and major changes but also the identification of their contributors. Free knowledge does not mean anonymous knowledge. In addition, in connection with the third axis, *Support for project realization*, the tool will provide support for the capitalization of knowledge, acquired during the implementation of these third axis projects.

4.3 Support for Project Realization

This is the provision of support for the good management of instructor activities during the preparation and implementation of their teaching courses. We recommend a project management approach, in the sense of industrial project management (PMBOK, 2008). In this context, the TCMS will encourage and support the instructor, via

the available tools, to rigorously set their teaching specification: topics, prerequisites, content, teaching objectives, start and end dates, specific material conditions, etc. It will also enable the incorporation of specific context: implementation of teaching objectives, estimated time set aside for preparation, the instructor's level of command of the subject being taught, the instructor's personal goals in respect of the teaching, etc.

A major objective of the specification of this project mode is to get the instructors to capitalize the fruit of their teaching over course to be taken from one year to another and to be enriched, etc., but it should also support instructors in bringing together several teaching courses, whether they come from them or from a colleague.

5 DISCUSSION

In this section we discuss if TCMS is a new concept and also we discuss its practical implementation and usefulness.

Related Works. The first question concerns existing previous works. Is this concept of TCMS new? Are there existing tools to support it? In our literature search we found similarities with the proposed concept in the Drona work of Anjali (2011). However, no theoretical support is given. There is also little detail. Some other works such as (Polson et al., 2005) introduce a TCMS but reading the relevant articles shows that they actually speak of an LCMS not of a TCMS. Several works such as (Juang et al., 2008), which are interested in improving teaching skills and teaching practices, are more interested by the relationship between teacher and his institution. Again these works cover a very small part of axis 3 of the TCMS. They do not offer a global solution to the teacher. We could not cite all the research related to our proposal, particularly the works carried out by the English-speaking institutions (English, American, Australian and Canadian) in the movement "scholarship of teaching and learning" (SoTL, http). However, to the best of our knowledge, the concept of TCMS proposed in this article is new, or at least very little developed so far in the literature.

Design Choice. The second question in this discussion is the design of our tool. What type (s) of tool (s) to develop? Apart from the fact that it will be Web-based, several options are available to us. We chose to develop it by integrating it in a CMS. For our first tests, we chose the popular Moodle platform. Figure 3 shows a possible integration that takes advantage of the malleability of Moodle in which three spaces were created for the three axes described in this article. This type of development that will reuse part of the back-office, such as user management, should also promote the adoption of our tool by teachers who are already using this type of LCMS (of course, assessment will carried out to prove this) and facilitate the provision to students of lessons designed by teachers.

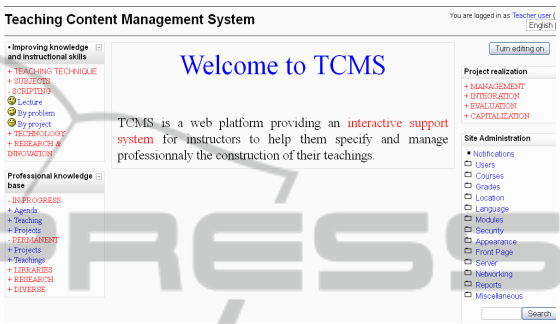

Figure 3: Mock-up of the TCMS home page.

Utility Considerations. The third question concerns the usefulness of such a platform. Would these tools be useful? Our specifications were used in few courses. Some of the tools used were MS-Project and the Moodle platform. A part of implementation has however been done manually. As result of this first experimentation, teachers concerned won an Award for Educational Innovation in a contest that involved seven French universities (Warin et al., 2011b). These teachers did not follow all the suggestions of our specification, but those that were contributed to the winning.

6 CONCLUSIONS

This article looked at instructor-centered teaching engineering in academia. We highlighted six major development factors that require the rethinking of instructor work methods. We proposed a supplement to LCMS introduced in universities by adding a new type of feature: Teaching Content Management System (TCMS). The goal of a TCMS is to support instructors in the specification and design of their teaching so that they reach a high level of professionalism. We have emphasized that TCMS should be designed to enable iterative and incremental ownership. We therefore proposed a general design of the services that TCMS should offer. The first prototype of a TCMS is under

development. It aims to make the system more holistic than the short presentation in three axes suggests. Next works will focus to prove that its use provides assistance to engage the instructor in reflexive inquiry of its practices and facilitates opportunities to work with other colleagues. Indeed, a collective effort should be based on individual strong skills: to be a strong individual support to the instructor it's exactly the purpose of a TCMS.

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