A Web-based Support System for Providing Effective Monitoring, Feedback and Evaluation in Project Management Education

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Abstract: This work introduces a web-based learning environment to facilitate learning in Project Management. The proposed web-based support system integrates methodological procedures and information systems, allowing to promote learning among geographically-dispersed students. Thus, students who are enrolled in different universities at different locations and attend their own project management courses, share a virtual experience in executing and managing projects. Specific support systems were used or developed to automatically collect information about student activities, making it possible to monitor the progress made on learning and assess learning performance as established in the defined rubric.

1 INTRODUCTION

Project Management education was traditionally designed according to an expository paradigm that was accompanied by exercises to directly apply a particular technique or use a specific tool. However, exercises or case studies do not provide sufficient stimuli to foster the level of engagement needed to effectively facilitate learning (Barron, 2005). The teaching and learning of project management has grown in interest and popularity recently ((Berggren and Sderlund, 2008), (Ojiako et al., 2011)) and it is well accepted that new and non-traditional initiatives are required. It is important to ensure that students move into a higher order of thinking and learning with the idea of moving from knowing what to know to knowing how and why to know (Roger, 2008).

In the process of acquiring the competences required to become project management professionals, learners seek to acquire a learning process that provides them with experiences that are similar to what they will encounter in the world beyond the classroom. The ability to work in teams and to communicate effectively is deemed to be an essential skill. This is particularly important when design team members are based in differing locations and meet in a virtual environment (Rooij, 2009).

This paper introduces a new web-based learning environment that is designed specifically to facilitate a structured approach to involve M.Sc. students in project management and B.Sc. students in project engineering learning processes.

Section 2 presents a brief review on related works. Section 3 provides an overview of the learning experience and section 4 is dedicated to describe the web-based support system designed. Finally, the last section discusses some general conclusions and presents future work.

2 BACKGROUND

There is evidence that teaching Project Management must be organized in a more learner-centered approach than classical lectures offer. Several practical approaches to the teaching of project management can be found in the literature.

For instance, (Martin, 2000) presents a software environment for generating customized computer-based simulations that facilitate project management education. (Abernethy et al., 2007) describe a specific experimental approach for information technology students. They argue that project activities must mirror the real world, if information technology students are to learn what needs to be done in industry projects. (Cobo-Benita et al., 2010) proposed a teaching approach that is based on the learning by doing paradigm to enable students to acquire technical knowledge and to develop some human skills, such as

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conflict resolution, complex problem-solving and decision making.

More recently, (Crespo et al., 2011) advocated a combination of theoretical content, individual applied tasks, use of software systems and a strategy of learning by doing in teaching project management. They formally introduce negotiating and virtual team management aspects to different teams from different universities in different locations.

(Mawdesley et al., 2011) focuses on a teaching module that employs simulation games as the primary source of instruction in a self-directed learning exercise. Similar approach has been reported by (Ordieres-Meré et al., 2011) where the gap reductions between academia and the industry were discussed.

According to the previous non exhaustive overview there are so many already proposed framework that it is relevant to make clear why one more framework is required. Authors believe that there is not a convenient framework allowing to foster the project management learning process from an structured point of view, including distant, cooperative learning and based on evidences and paying attention to learner's competence development.

3 COURSE DESCRIPTION

The learning experience presented is based on *playing to manage projects*. The main purpose is to move on from simply learning content by heart to understanding, discussing and sharing in order to learn from experience.

To reinforce concepts and improve learning by traditional methods, the simulated scenario involves the student in the development of a real engineering project. Thus, the instructors team adopts the role of a corporation that has decided to embark on the construction of a new facility in accordance with its feasibility studies.

In this study, the program owner, P2ML INC., wants to invest in the rising up automotive oriented nano-coating market. As a part of its strategic plan, this corporation is considering hiring a company as provider of basic engineering services for its new plant. Main representative for the owner into the project board will be the teachers.

The companies in the program are composed of students from two different universities, Universidad Politcnica de Madrid (UPM) and Universidad de La Rioja (UR). P2ML INC. expects to obtain the technical documentation necessary to authorize and build the facility. This includes both documents and digital content like computer models and systems.

It is expected that students will learn and apply a methodology that enables them to manage projects better. As a way to develop their own strategy, they will learn the project management method (Project in Controlled Environments: PRINCE2 ™). This method is published by The Stationery Office (TSO), is protected by Crown copyright, and is owned by the Cabinet Office of the UK Government Commerce (OGC) (Office Of Government Commerce, 2009). The use of this method, even for academic purposes is not new, as it has been frequently reported ((Hewagamage and Hewagamage, 2011) and (Zhang et al., 2012)).

According to the chosen method a multiphase life-cycle is accomplished, where meaning for all of them is learnt during the first three weeks of the course. The general picture of the project life-cycle can be seen at Figure 1.

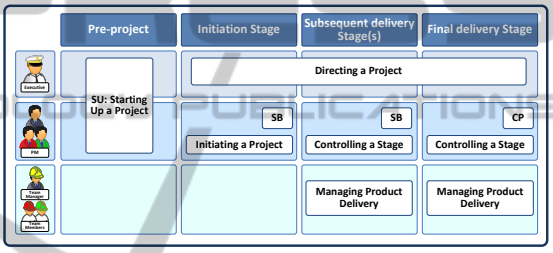

Figure 1: Project life-cycle: phases and processes.

Although the two main roles, teacher and student, are still recognizable, they have evolved. Teachers still have the traditional roles of evaluator and knowledge provider, but now must also assume the following roles:

- **Owner.** To identify his or her interests and to negotiate various aspects to ensure that her interests are carried out.
- **Auditor.** To be responsible for the independent assessment of specific aspects of the evaluation indicators and also for any corrective action, if necessary.

For the students learning process, it is necessary to make clear the difference between the different roles of persons who work together on the same project, but with very different responsibilities. In order to do this, and because students from different locations and different backgrounds are involved, they are exposed to different participation experiences by playing three different roles:

- **PM.** Project Manager, with management responsibilities. Each project is managed by a team of seven or eight PM.

- **TMg.** Team manager. A PM temporarily assigned to manage Project Engineers (TM), to produce what it was described into the Work Package document (Managing Products processes).
- **TM.** Team member, with engineering tasks development responsibilities. Each project is composed of seven or eight TM.

In order to promote cross learning process each learner is requested to invest forty working-hours as PM and thirty working-hours as TM.

4 SYSTEM ARCHITECTURE

To facilitate the development of the learning experience, a set of information systems are used. The designed support system is a web solution based on the following software tools (Figure 2):

- An Enterprise Program Management Office (ePMO) that provides the necessary project management tools, as well as some collaborative tools such as blogs, forums, news, automatic e-mail reports, document repository, etc.
  The selected ePMO software was Project.net (http://www.project.net), which is a well known Project and Portfolio Management (PPM) software. This software facilitates the students use of the different roles that coexist in the management of a project, enabling the team members to communicate and work together even though they may be located at distant locations.
- A 360-degree feedback web that contains the designed surveys for collecting numerical assessments about each of the project members regarding their behavioural skills, as well as their teamworking orientation. This makes possible for learners not only become focused on the technical aspects of the assigned work, but also pay attention to other social skills which are keystone for professional PM.
  The designed forms were generated by means of Limesurvey® (http://www.limesurvey.org), an open source, PHP-based web application that allows to develop and publish online multi-question multi-lingual surveys. Moreover, jQuery applications were developed to communicate the survey engine with the ePMO software in order to customize the surveys at runtime by authenticating the user, automatically providing individual information once the user has been authenticated (projects, role, actual phase,...), etc.
- An integration tool (P2ML) specifically developed to monitor the operation of the simulation for each participant, to provide forensic traceability to the assessments, to provide feedback about the learning progress of each participant, and to integrate the data collected from the previous tools to obtain a performance assessment of each participant.
- A global forum to deal with methodological issues. Learners used to ask colleagues and sometimes the same question find different answers. In order to make it possible to increase the *social knowledge* this maintained resource was provided.
- A course management system (CMS), used to deliver pieces of knowledge, like lessons, tests, etc., as well as to discuss theoretical issues.
  Moodle™(https://moodle.org/) was chosen because it is a free web application which provides many tools to create effective online learning sites.

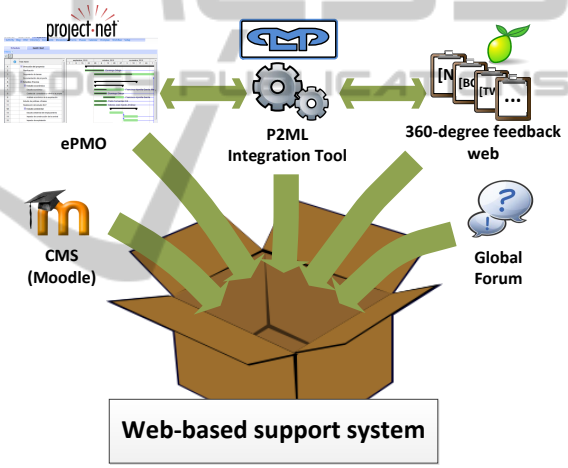

Figure 2: Collection of web tools used and created for the designed support system.

4.1 The P2ML Tool

In order to support teachers in their supervision and evaluation activities, a new software tool was developed by means of CakePHP (http://cakephp.org). It was designed to communicate with the ePMO software –as well as the 360-degree feedback web– in order to collect real-time information about project and team members progress, to monitor the operation of the simulation for each participant, to provide forensic traceability to the assessments, to provide feedback about the learning progress of each participant automatically, and to integrate the data collected from the previous tools to obtain a performance assessment of each participant.

This application allows instructors to make periodic reports to better identify mistakes or inappropri-

ate behaviors. In this way, the teachers can more objectively and efficiently monitor and evaluate students continuously throughout the whole course. Furthermore, to make the most of the information gathered, the system was built to provide feedback to students automatically. It checks different analytical errors, such as links between deliverables and tasks, the relationship between tasks in the project work plan and many other problems. Thus, when a measurable mistake is identified, an e-mail is sent to all students (PM or TM) and instructors who are involved.

The presented virtual learning environment stores a huge number of variables, allowing to perform analysis that would be helpful to instructors in the design of adequate activities or identify better learning paths.

5 CONCLUSIONS

This paper has presented a virtual environment that permits learners and teachers to play around it, making possible to learn Project Management techniques. This learning environment not only include technological solutions like application servers to manage learners or gather relevant information, but also includes operating procedures that highlight methodological aspects like phases, relationships between tasks and work packages, etc.

The web-based support system is useful to promoting the Project Management learning process among geographically-dispersed students. Also, as it captures individual actions, makes it possible to verify inconsistencies in actions and can send alert messages, a type of feedback, to help learners to improve their performance, in addition to the regular assessment activities carried out by teachers.

Authors planned to use artificial intelligence techniques embedded in the support system to shed light on several matters related to learning processes, such as the differences in the learning paths that students follow.

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