PROJECT MANAGEMENT LEARNING IN A COLLABORATIVE DISTANT LEARNING CONTEXT

An Actual On-going Experience

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Abstract: The goal of this paper is to show the results of an on-going experience on teaching project management to grade students by following a development scheme of management related competencies on an individual basis. In order to achieve that goal, the students are organized in teams that must solve a problem and manage the development of a feasible solution to satisfy the needs of a client. The innovative component advocated in this paper is the formal introduction of negotiating and virtual team management aspects, as different teams from different universities at different locations and comprising students with different backgrounds must collaborate and compete amongst them. The different learning aspects are identified and the improvement levels are reflected in a rubric that has been designed ad hoc for this experience. Finally, the effort frameworks for the student and instructor have been established according to the requirements of the Bologna paradigms. This experience is developed through a software-based support system allowing blended learning for the theoretical and individual's work aspects, blogs, wikis, etc., as well as project management tools based on WWW that allow the monitoring of not only the expected deliverables and the achievement of the goals but also the progress made on learning as established in the defined rubric.

1 INTRODUCTION

The actual implementation in Spain of the new educational model – established by the Bologna process in the European Higher Education Area (EHEA) – has brought to life a prolific framework of innovative educational initiatives (Ivaniskaya et al., 2002; Schoner et al., 2007).

This paper reports one of those initiatives, an experience based on the usage of Web 2.0 tools, a technology that opens doors to new fields for ample user collaboration (Moursund, 1999), in the project management learning area. The goal of this experience is to develop a Bologna oriented learning framework for effectively teaching the basics of project management to grade students with no prior experience and the added difficulty of doing so under a competitive context, as these students are simultaneously following other courses. In order to achieve that goal, an approach that combines theoretical contents, individual applied tasks, usage of software systems and a strategy of learning by doing it is proposed. More specifically, the interest of this experience is to provide basic project management competences by following a monitoring and evaluation approach.

This course was traditionally designed according to an expository paradigm accompanied with exercises to directly apply a particular technique or use a specific tool. A more applied approach in project management teaching is to assign a project to a team of students in order to eventually evaluate

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those students by means of the quality of the deliverables provided as a result of developing that project. With this approach the quality of the results is measured, but the proper usage and application of the different project management methodologies remain unsupervised, at least formally.

A previous work (Cobo-Benita et al., 2010) already tackled the difficulties of estimating the effort of both students and instructors in a competitive collaborative environment. The present paper focuses, instead, on monitoring the aspects related to the management dimension as well as to improve the traceability of the different team members' performance by means of a forensic analysis of the records stored in the software-based support system. Moreover, the experiences aims to enhance other management competences such as those related to negotiation and communication.

As the project is developed in a context of geographical offshoring –with teams comprising students from different universities at different locations and different backgrounds– a careful selection of the software-based support system is mandatory. This extends the pursued goals with a few ones that must be achieved in order to start this experience on the first semester of the course 2010-2011.

- Formal definition of the requirements that a software tool for collaborative project management in education must fulfil in order to have a positive impact on the competences' acquisition of the students
- Selection of the most suitable Web 2.0 tool for simulating an actual experience of project development in a collaborative environment with distant team members from different universities.
- Definition of a set of objective features for its use in the evaluation of the students developing a project experience in a collaborative context.
- Measurement of the impact on the student's acquisition of competences related to project management.
- Evaluate the goodness of the Web 2.0 software tools in the context of this experience.
- Measurement of the impact of the Web 2.0 collaborative software tools on competences acquisition.

Section 2 presents a brief review on related works. Section 3 describes the methodology used. Section 4 describes the technological aspects involved in the experience. Finally, section 5 shows the conclusions obtained up to now developing this on-going experience.

2 A BRIEF REVIEW ON RELATED WORKS

Problem-Based Learning (PBL), where student's activities are structured around solving open-ended problems, has proved to be an excellent method for developing new forms of competencies (Graff and Kolmos 2003, Kolmos and Kofoed 2002). Project-Based Learning (called here PjBL to distinguish it from the acronym for problem-based learning) follows a similar pedagogic approach than PBL, but its organizing principle is one or more open-ended projects. A PjBL environment enables students to draw upon their prior knowledge and skills, brings a real-world context to the classroom, and reinforces the knowledge acquired by both independent and cooperative group work (Schmidt, 1993).

Research has been focused too on the context that facilitates and supports the motivation and implementation of PjBL (Lam et al., 2010), as well as in the use of the PjBL approach on scientific teaching (Cavanaugh and Dawson, 2010). Rashid et al. (2009) proposed a project management approach used in a multilevel scheme by promoting an integrated framework for diffusion on distant learning. The framework is based on an integrated systems-engineering approach in the light of the diffusion of innovation theory utilizing techniques of project management and Blooms-taxonomy.

PjBL is an interesting alternative as well in capstone courses where the innovation comes from the interdisciplinary nature related both to the instructor and to the students (Rhee et al 2010).

Moehr et al. (2004) provided different solutions in the context of distant learning strategies, including valuable discussions. General references on the usage of Web 2.0 software tool for PjBL can be found in Graaff et al. (2003). Mehvar (2010) studied the procedure related to synchronous distant learning. Technological approaches have explored as well the agent-based field for improving the current distant teaching approaches (Bouhadata and Laskri, 2008).

In the light of the aforementioned contributions, the present paper advocates the combination of several of the results presented in those works. The most significant differences with them are:

a) PjBL focused on an actual multi-factor problem involving many different dimensions. The students do not work in a lab-controlled environment but in one where the results by themselves are unknown and, moreover, they will depend on the decisions made by the development team and their creativity.
b) The focus of the experience is put on the

project management dimension, which is the discipline to learn, and not on the problem to solve, which is considered as a mere instrument. The software system serves as a support tool in order to formalize these aspects.

c) The collaboration amongst different teams reinforces the acquisition of competences such as those related to negotiation, e.g.. The formalization of these aspects is performed by means of a detailed rubric.

d) The learning process aims at enhance the acquisition of competences that have been identified as relevant by the practitioners of the field, as has been remarked by the International Project Management Association (IPMA) (Caupin et al., 2006).

3 METHODOLOGY

The approach followed in the courses of the different universities involved (Technical University of Madrid –UPM–, University of León –ULE– and University of La Rioja –UR–) is structurally similar. The course begins by asking the students to propose the definition and configuration of a solution to the problem to solve. It must be ensured that the situation proposed allows multiple solutions, the need of multicriteria decision making processes, enough milestones to consider, and that it involves different technologies and disciplines, etc. In brief, that it complies with the criteria of the CIFTER model (GAPPS, 2006) to evaluate the complexity of a project.

The teams from UPM comprise students with selected different profiles –backgrounds in mechanical engineering, industrial engineering, electrical engineering, materials engineering, etc. – as those teams have the responsibility of defining the global solution. The teams from the other universities work as contractors developing specific tasks of the project. Thus, these are formed with students that share a common background and that work as a team of specialist to solve specific problems.

The project manager (PM) has the responsibility of organizing the work and leading the team. It is chosen after estimating the leadership features of the candidates by means of the Blake and Mutton test, the negotiating skills by using the NEGO test and the negotiating style by using the DECTI test. The results of their personal tests are provided to the students so that they can choose their best PM at the kick off meeting according to their initial skills.

Once the PM is chosen, the PM must define the work breakdown structure (WBS) and negotiate with the other teams –the contractors– their participation according to the scope that it is being defined. This negotiation is developed in a competitive mode with the rest of the teams. The success in forming the consortium, its suitability according to the WBS, the price of the contracts and the benefits expected are evaluated at this stage. The negotiation is developed within the software-based support system in order to eventually analyze the critical factors of the negotiation.

The PM assigns the different tasks to the rest of the members. The performance of the team is monitored on a weekly basis by means of the software-based support system. The minutes of the meetings and the evaluation of the team members made by the PM are supervised as well.

The instructors pay attention to the whole set of teams involved in the experience. This is done by impersonating the role of three different virtual consultants. The first role is the client's consultant whose main interests are the quality of the final product. There is a second role for a technological consultant that helps the team by providing them specific help related to technological aspects that might be too complex for the students. The third role is a management consultant that helps the teams with those aspects related to the use of the software-based support system. This allows to eventually performing a comparative analysis on performance and learning.

Finally, once the job is done, a presentation is made to show the results to the client. This presentation is focused on remarking the most relevant aspects of the experience from the point of view of the client –the main strengths in business terms– and the most important conclusions obtained by the team related to the development of the experience itself.

The evaluation process aims at considering many different dimensions. It makes use of a rubric oriented to measure the improvement in both the transversal and specific competences. As far as the transversal competences are concerned two different kinds of competences are considered: those related to leadership or the capacity of adaptation to new scenarios –systemic competences–, and those related to the capacity of analysis and synthesis, oral and written communication, information management skills, problem resolution, etc. –instrumental competences–. Amongst the specific competences, those related to the capacity of organizing, planning and controlling the project are considered.

To determine the performance on each of the individuals' competences different indicators and

achievement levels have been established for every role: defective, acceptable, expected, optimum. The evidences related to these performances are collected by different means (WBS, minutes of the meeting, etc.). These are evaluated by using the software-based support system.

Let's consider, for illustrative purposes, the competence related to the capacity of organizing the project. For this competence the indicators 'definition of the scope of the project' and 'definition of the resources needed' are used. The first indicator is measured on the team members by using the software-based support system and investigating how the individual's contributions are incorporated to the system. In the case of the project managers it is measured by evaluating the quality of the WBS developed, its coherence with the time management plan and the level of agreement that they have strived to achieve. The evaluation of the rest of indicators and competences in the model proposed is made in a similar manner as the one detailed.

4 IMPLEMENTATION

The first step regarding the implementation had to consider the selection of the best software tool to provide the student a common place for interaction, communication and collaboration.

The following parameters have been taken into account in order to choose the most adequate software environment. They are, in descending order of relevancy:

1. ePMO (Enterprise Program Management Office)
2. Collaborative multiuser Web 2.0 environment
3. Open-source
4. Number of collaborative tools provided (Blogs, wikis, forums, automatic e-mail reports, document repository and forms to name a few)
5. Real-time supervision of the work developed by the students and forensic analysis
6. Performance logs
7. Security management, roles and permissions
8. Usage flexibility
9. Multiple business capability in the same application
10. Management of multiple projects
11. Intensive use capability, with about 200 hundred students on the experience
12. Documentation management
13. User and administrator documentation provided
14. Workflow
15. Simple resource assignation
16. Broad range of reports for the project supervision
17. Ease of communication channels between virtual businesses

According to the parameters listed above, the selected software environment was Project.net (http://www.project.net). This software facilitates the students the 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 might be located at distant locations.

4.1 Work Environment

The proposed work environment is the adaptation of the already presented course methodology but improved by the use of the selected software.

The role-play consists on the virtual creation of two consultancy companies and a variable number of technical companies, depending on the number of students involved in the experience. There are as well a number of businesses for the communication amongst the students and the instructors.

Every company must generate its own project and must define the tasks to work on, as well as assign resources, define task durations, so that the total length should be equal to the time available for each student.

The collaborative tools provided by Project.net will be used as follows:

- Wiki: Knowledge database.
- Blog: The team members have a blog to record activities perform or completed tasks.
- Documents: Repository of documents with a versatile document management system.
- Discussion groups: they allow the team members to consolidate ideas, points of view, and thoughts as well as to share their questions with other team members.
- Automatic e-mail notification for a quick transmission of the information to the whole team.

The PM can order a global view for the project (Figure 1), allowing him the information on the status of the project regarding resource load, scheduled tasks, meetings and so on. This view helps the PM as it allows focusing in specific problems, as required.

Each student should report, using the software-based support system, the time dedicated to each task, giving as a result the total number of hours the student dedicated to this experience. This provides a log of the progress made and the time consumption for every task.

As expected, a number of classical tools for planning and monitoring the project are available in order to support the PM actions (Figure 2).

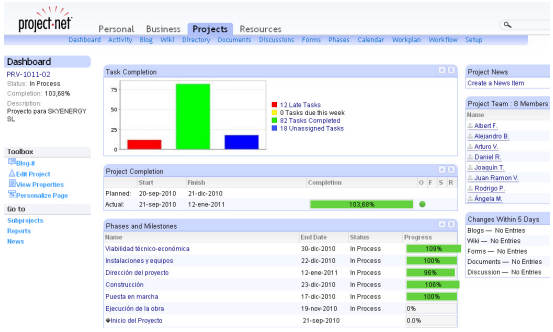

Figure 1: Global view for one running project.

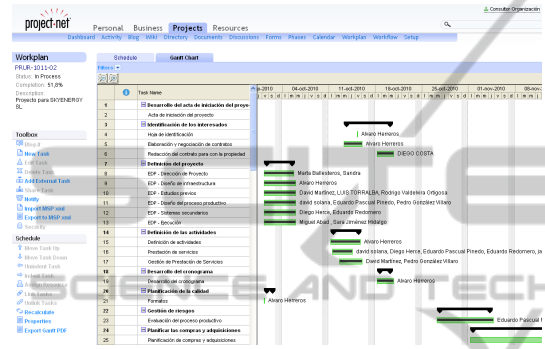

Figure 2: Planning and monitoring view for the project.

4.2 Supervision and Evaluation of the Acquired Competences

Having real-time information about the project's status available to the instructor provides opportunities for optimal supervision. This can help the instructor correct deviations from solutions likely to lead to the success of the project.

The evaluation is being performed in a continuous manner along the whole course. It is also possible to allow the students to evaluate their colleagues. There is the possibility for the system to make a report in a periodical basis for posterior analysis.

Eventually, at the end of the experience a final evaluation is made considering the activity reports recorded, like a post-mortem analysis.

All these tools make possible to evaluate, according to the established rubrics, the individual performance, the quality of the project management and the products carried out. With the activity tracking of the projects and the rest of the tools provided by Project.net it is possible to perform a forensic analysis of the work made by the students so as to obtain data which can be useful in order to perform an objective evaluation of the performance of the team and the team members, particularly on the matter of project management competences acquisition.

5 RESULTS

5.1 Work Methodologies on the Project Management Area

Even though the web tool allows different approaches and structures, specific added value is provided by identifying roles, procedures, bid management, progress monitoring and many other methodological issues. The selected procedures foster the evaluation of indicators as required for adopted rubrics.

5.2 Collaborative Learning

The students acquire the competences not only through the traditional channels but also by the interaction amongst them while using the collaborative tools that Project.net provides. Indeed, there are aspects of the organizational culture that endows the students with a formal work methodology that makes them accustomed to think about what must be done and what effort must be made in order to achieve a specific goal. Moreover, as the deliverables obtained by some members might be inputs in the processes assigned to others, the dependency and connectivity of the task is usually very significant. The software-based support system itself promotes the traceability by allowing multiple versions and complete data.

5.3 Project's Products

The students acquire the concept for the outcomes of the project in an integrative way, as deliverables for work-packages integrated into project phases and they realize in a clearer way the relationship between the products expected by the client, the WBS and the tasks. This concept of project management is a valuable lesson-learned during the course.

6 CONCLUSIONS

The combination of a particular methodology and a specific software tool (Project.net) has proved useful on the following topics:

- There is a boost in collaborative terms on the group dynamics that allows the team member to put into practice specific competences on the project management field.
- The students are required to adopt an active role, as it is them who must solve the problems

that continuously might appear along the project development.

- The student is allowed to develop project management strategies similar to those in a professional environment, and the rest of the team members are able to evaluate the management by means of a continuous supervision. Specific competences for project managers are centric as the IPMA model was selected for designing the methodology.
- The student can work at any distant place and keep contact with the rest of their team members.
- Specific management for virtual teams are used both, for negotiation phase as well as for tracking the evolution of the agreed subproject, including mandatory remarks, etc.

The correct use of the collaborative tools is essential for the success of the experience. The web tool is no longer an e-learning platform but a natural medium with which it is possible to learn, communicate, gain knowledge and share the acquired knowledge in an effective manner.

In spite of the short length of this course (4.8 European Credit Transfer System or ECTS), its closeness to professional practice allows to improve the competence of the students as well as their empowerment as they produce, usually for the first time, an answer to a complex engineering problem.

This teaching model is in harmony with the strategies defined in the Bologna process to develop the EHEA because it is based on achieving specific knowledge according to the degrees involved, and developing the skills required for performance of professional duties and respond to the work challenges of a globalised society.

In the end, it was possible to develop this experience thanks to the selected software-based support system and its functionality, including the traceability for all the decisions, actions, documents and discussions.

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