An improved way for evaluating competences

A different approach to project management learning.

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Abstract—This paper presents a formal initiative for monitoring the competence acquisition by a team of students with different backgrounds facing the experience of being working by projects and in a project. These students are inexperienced in the project management field and they play this game on a time-shared manner along with other activities. The goal of this experience is to make some improvements in determining the competence levels acquired by means of how the work is being done. The use of this information, which is out of the scope of this particular work, could make possible to bring additional information to the students involved in terms of their individual competencies and the identification of new opportunities of personal improvement.

Keywords—component; Project based learning (PjBL); interdisciplinary learning; computer based approach; competence development in project management.

I. INTRODUCTION

Teaching project management to engineering students is, most commonly, a challenging matter. This is mainly due to the well-established approach to problem-solving that the student already has developed after years of training on detailed technical problems—very well defined and with only one right solution. Leading with this theoretical approach to problem-solving by asking the students to meet a client's requirements develops a new approach to problem solving due to the highly undefined nature of the client's requirements. An added difficulty is the length of the course, just 6 ECTS; a short time considering the lack of experience of the students.

This is not a new problem at all, as different formal approaches have been proposed to cope with it. Problem Based Learning (PBL) has proved to be an excellent method for developing new forms of competencies [1][2]. Research has shown that students retain minimal information in the traditional didactic teaching environment and frequently experience difficulty in transferring the acquired knowledge to new experiences [3].

A Project-Based Learning (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 [4]. A search in the literature shows that the

researchers have even found interesting the analyses for estimating the effort of both students and instructors in a competitive collaborative environment based into the PjBL strategy [5]. Moreover, specific software tools have been proposed for formalizing the cooperation between teams not located at the same place [6].

The organization of the paper is as follows. In section II the competence model used is presented. In section III the software tool used and supporting the metric system is introduced. Next step is presented in section IV, where information is provided on how and when the observed competences are measured. Only one competence will be detailed, for the sake of brevity, as an example of the proposed system.

II. THE COMPETENCE MODEL

Some aspects need to be clarified in order to get a good understanding of the research performed. Firstly, 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 terms competency and competence are becoming increasingly used by project managers in conversations around selection or development of project managers. Although the twin ideas of competency and competence frameworks first emerged around 25 years ago, their adoption within the project management profession for various purposes continues. In [7] an interesting difference is established between competency and competence and its relationship with the outcomes of the project, which is very worthy in our work.

Input – Competencies	Output - Competences	Outcome - Successful project delivery
Typically relate to a wide range of situations	Typically based on a work task and relate to a particular role or job	Performance
Knowledge Skills e.g. decision making ability Personality	e.g. execution of risk management e.g. maintaining stakeholder commitment	Delivered project objectives On course to achieve benefits Stakeholders satisfied
Assessed using PMA5	Assessed using PMA5	Assessed using Scored CV

Figure 1. Relationship between competency, competence and project outcome (source [7]).

So competencies could be considered as the underpinning knowledge, attitudes, skills and behavior that an individual needs to acquire to deliver superior performance. These may be thought of simply as inputs. Competences, on the other hand, describe what people need to be able to demonstrate to perform the job to a required or specified standard. These are more akin to outputs. In the case of this paper the interest is to be able to measure competences, as they can be collected from evidences recorded with the project management information system (PMIS). The reference framework used as a reference for competences was the IPMA Competence Baseline [8]. The IPMA Competence Baseline is the common framework document that all IPMA Member Associations and Certification Bodies abide by to ensure that consistent and harmonised standards are applied. As such, the majority of its content focuses on the description of the competence elements. To meet the needs of those interested in the practical application of the ICB, the certification process is described for each level, together with a taxonomy and a self-assessment sheet. Professional project management is broken down into 46 competence elements that cover the following:

- **technical competences** for project management (20 elements);
- **behavioural competences** of project personnel (15 elements); and
- **contextual competences** of projects, programmes and portfolios (11 elements).

The length of the course itself is very limited, just 4.8 ECTS (european credit transfer system), which imposes restrictions [5][9], on the dedication of both instructors and students. All these characteristics produces a quite challenging experience from different points of view and only a few of competences are being assessed, but, in any case, the model for competences of project managers is being considered as adequate.

Recently, some authors [10] reviewed the contribution of the project manager's competence and leadership style to project success and concluded that the literature has largely ignored the impact of the project manager, and their leadership style and competence, on project success. They found that in the general management literature, it is widely recognized that the functional manager's leadership style contributes to the success of the organization or organizational unit they manage; the project manager's leadership style is generally ignored when identifying project success factors.

III. THE SELECTED SOFTWARE TOOL

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.

Figure 2. Different projects launched by one team inside one business.

Some requirements have been identified as relevant for this experience:

1. Collaborative multiuser Web 2.0 environment.
2. Open-source.
3. Number of collaborative tools provided (Blogs, wikis, forums, news, automatic e-mail reports, unified project calendar, document repository and forms to name a few).
4. Real-time supervision of the work developed by the students (activity tracking) and forensic analysis.
5. Performance logs.
6. Security management, roles and permissions.
7. Multiple business capability in the same application.
8. Management of multiple projects and sub-projects.
9. Documentation management.
10. Task assignment.
11. Real-time supervision of the resource consumption.
12. Broad range of reports for the project supervision.
13. Import and export from and to other applications like Openproj or MS Project.

The tool allows presenting a global view about the project, providing to the Project Manager (PM) the main issues requiring actions.

Figure 3. Global view for one running project.

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.

Figure 4. Detail user’s view for timesheet control page.

IV. MAIN FACTS IN THE EXPERIENCE

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.

As expected, a number of classical tools for planning and monitoring the project are available in order to support the PM actions. According to the IPMA competences for project management, the technical competence 1.10 Scope and Deliverables is presented by a Work Breakdown structure (WBS) and its dictionary uploaded as documents to the file directory area.

Figure 5. Structure of files including WBS, dictionary and other files.

PM is responsible for defining project phases as work packages. For each WP a list of deliverables is identified and declared. Per deliverable, a list of tasks is identified, and per task resources are identified and assigned. All these steps need to be maintained but the system makes possible to monitor its traceability and to assess this PM competence.

Figure 6. Phase definition with deliverables declared

With all this information included, it is possible to make the project plan picture with tasks, relationship and percentage of improvement.

Figure 7. Planning and Monitoring view for the project.

From the project plan, the PM is able to review task’s details as well as the log of the progress made and the time consumption for every task.

Figure 8. Detail view for one task.

In addition, the system allows determining the amount of different resources involved into the task. This is a way to identify the underlying model between multidisciplinary or truly interdisciplinary team implemented [11].

Obviously all these activities help teachers to evaluate the performance for all the students into the IPMA competences 1.11 Time & project phases and 1.12 Resources.

Again, it is possible to have forensic analysis of decisions adopted

Figure 9. Historic view of changes introduced into a single task.

Finally it is possible to have a detailed view over different parameters along its developing period:

TABLE I. LIST OF PARAMETERS MONITORED

Competence	Parameters	Period
1.06 Project organization	Number of WP, Tasks and deliverables	2 times
	Number of work hours initially scheduled and finally claimed	2 times
1.05 Quality	% of deliverables linked to documents and % of deliverables formally approved	6 times
	Averaged quality for deliverables	3 times
1.15 Changes	Amount of PM corrective actions implemented along the project	1 times

In order to monitor the IPMA competence 1.17 Information and Documentation, a control document system was established, allowing to have detailed information about it.

Figure 10. Historic view of changes introduced

CONCLUSION

The presented work allows monitoring the practical experience of project management in such a way that an assessment of several competences of the professional IPMA model can be performed. The model allows to implement a much more formal approach to project management techniques, especially for inexperienced students and this is a very valuable and helpful way for learning about this field.

In the future new competences will be assessed, including teamwork, communication and leadership. Additionally, significant tools looking for a more aggregated monitoring of some parameters will be produced. The final interest is to produce integrated views for project development into the Project.net environment in such a way that evidences can be provided as feedback to the students, as a key tool for improvement of their skills.

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