INTRODUCING PROJECT MANAGEMENT PROCESSES AND SKILLS ON A PBL SUBJECT

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Abstract. This paper describes how to introduce different project management processes and skills on a PBL subject where the students lead their own learning process even defining the statement of work for the project after negotiating it with the faculty.
The subject 'Workshop on Water and Environmental Engineering', taught to students on the third semester of their Master studies, focusses on the Risk Management Knowledge Area [1] so students need to perform a risk analysis of an engineering system which is generally described only at a high level at the beginning of the semester. One of the key points is to engage the students in decisions related to setting the scope of the project.
While working on the project, students are able to develop existing skills including people management, communication with stakeholders and project team, managing conflict among others and acquire new skills as they lead and learn (risk management, scheduling, negotiating, critical thinking or team building).

1 INTRODUCTION

The School of Civil Engineering of Ciudad Real (Spain) was born in 1998 with Project Based Learning as a key element in the learning process. Therefore, most students have dealt with several PBL subjects prior to taking the subject this paper refers to. But students are used to

having no say in problem formulation although they are able to lead problem solving and become more active on their learning process as they progress in their studies and gain experience on PBL subjects.

So, they are ready to face a new challenge: formulating their learning goals.

There are several types of project work depending on the degree of teacher-centred planning [2]. The best Project Based Learning should encourage students to explore project management skills leading much of their own learning experience and, so, try to avoid teachers making most of the decisions [3, 4]. This is the aim of the PBL subject described herein

2 METHODOLOGY

In the subject 'Workshop on Water and Environmental Engineering', taught to students on the third semester of their Master studies, a maturity situation in infrastructure management is considered. Therefore, conservation, maintenance, restoration or dismantling are key points to be considered by civil engineers. Risk evaluation, especially those associated with climate change, is a very useful tool that allows prioritizing investments among the different alternatives proposed to reduce the risk levels of the infrastructure under study.

The subject focusses on the Risk Management Knowledge Area [1] so students need to perform a risk analysis of a civil engineering system which is generally described at a high level at the beginning of the semester: breakwaters or sanitation systems in coastal areas are a couple of examples.

The methodology is summarized in Figure 1 and the different stages are described below.
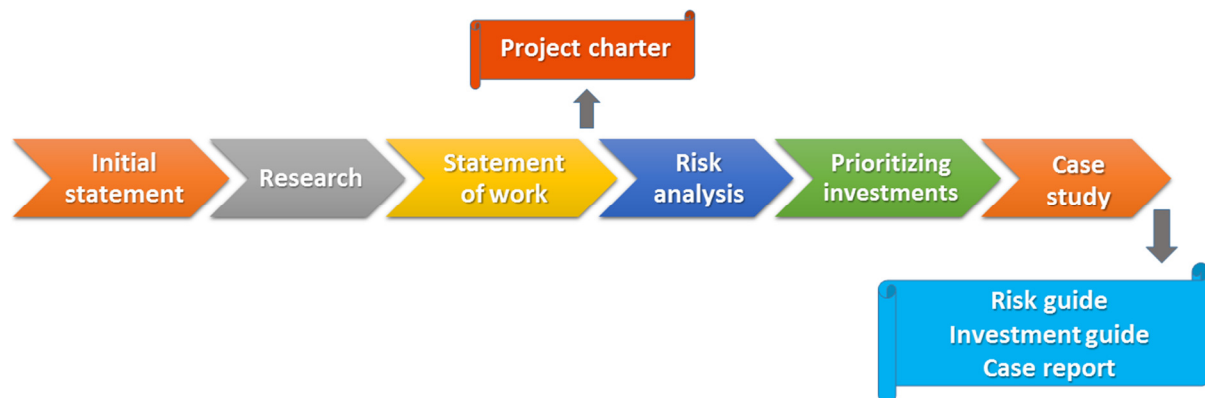

Figure 1: Description of the methodology

2.1 Initial statement

A general description of the system under study is given to the students. They also receive some general guidelines on what is expected from them regarding key words such as risk analysis or prioritizing investments and related deliverables. Mini lectures on Project Management processes and, especially, Risk Management are included.

To set the final scope of the project (subject), they need to inquire into the basis of the system under study and they should make sure to start creating a collaborative team environment while doing so.

2.2 Research

First, students need to identify what they know and what they need to know as well as how they can get to know it so they are required to do some research.

They need to understand how the system works, identify risks and potential responses as well as stakeholders and be aware of the constraints related to human resources, information, tools and time available for achieving all their goals. And they also need to select the site for the case study.

2.3 Statement of work

Their first task in this stage is to write a proposal to bring forward which should include the statement of work after inquiring into the basis of the system under study, data and tools available and risks identification. The second task is negotiating the proposal which they must adequately justify. Diplomacy, persuasion and negotiation with faculty are used to define the ultimate scope of the problem. Thereby, students are fully responsible for designing and managing much of their own learning.

The final task in this stage is submitting the first deliverable: the project charter which should include a list of stakeholders, high level risks, deliverables, roles including the project manager and any premises related to what must or must not be covered in the deliverables among others.

2.4 Risk analysis

The risk management processes included in the subject are: identifying risks, performing qualitative risk analysis, performing quantitative risk analysis and planning risk response.

Most of the risks have been identified during the research stage but new ones may arise at any time. They are all included on a risk register.

The qualitative analysis is applied to all of them combining the results from the probability and impact matrix into severity calculation and concluding which of them are prioritized risks and, therefore, must undertake a quantitative risk analysis.

Montecarlo simulation technique is used for the quantitative risk analysis. Understanding how the system works is a key factor for this process. The results of this step are risks levels.

Finally, planning risk response includes the definition of different alternatives trying to reduce risk level and the evaluation of their costs.

A methodological guide for risk analysis of the system under study summarizes all these procedures and becomes the second deliverable of the project.

2.5 Prioritizing investments

The starting base for this stage is the set of alternatives from the risk response plan and their main features: cost and risk level reduction achieved when implementing it.

Several scenarios are considered dealing with the available budget.

A methodological guide for prioritizing investments of the system under study is the third deliverable.

2.6 Case study

The final deliverable at the end of the semester is a report on a case study where the

methodology for both risk analysis and investment prioritization is applied. The students visit the project site to gather information and interview with stakeholders.

3   RESULTS

The evaluation is based on several areas such as personal development and attitude, report writing and oral presentations.

Key competencies for our students among the ones described in [5] are:

- critical thinking: as they work throughout the project
- research and analytical skills: when they look for and select information dealing with the problem being described
- conflict resolution: conflict is always present associated with team work
- professional responsibility: as they fulfill their roles in the project
- leadership: especially for the project manager
- ability to learn teamwork: creating a collaborative team environment
- planning and scheduling: while preparing the statement of work and during the project
- written communication: different types of professional writing which include a project charter, a report on the case study and the guides
- verbal communication: they present their work to the client
- environmental awareness: environmental risks are included.

4   CONCLUSIONS

Delegating responsibility to the students on formulating their learning goals helps them exercise their independence. They gain confidence in their own learning abilities, improve critical thinking skills and written and oral communication skills including professional report writing and technical presentations. They also acquire competencies such as decision-making, time management, research, analysis and synthesis of information.

While dealing with problems within one discipline (Risk Management on Water and Environmental Engineering), they must display the ability to show understanding and respect for one another, communication and listening skills, conflict resolution and reflect on their own development while creating a collaborative team environment.

At the beginning of the semester, students feel overwhelmed by the amount of undefined tasks lying before them but, ultimately, they are amazed at having been able to successfully reach their learning goals.

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