

Learning Project Management through Working for Real Clients*

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This paper presents the strategies of the Project Management course for undergraduates followed at the Engineering Faculty of the University of Zaragoza. It is based on the management by each student group of a project for a real client. The course is supported by the services provided to the groups by a Project Management Office set up by the teachers of the course. On analyzing the failed projects carried out during terms 03/04 and 04/05, lack of internal coordination was detected as the most recurrent cause explaining failure to achieve the expected results in certain groups. This research has resulted in the inclusion of a series of changes, aimed at offering the student groups a more professional work environment in which to carry out their projects. The results obtained once the changes were made point to the importance of ensuring internal coordination within student groups in order to prevent project failure, as well as the positive reaction of the students to their new working environment.

Keywords: project management; engineering education; experiential learning; cooperative learning; project management office; newly formed groups

INTRODUCTION

HIGHER EDUCATION in Europe is at present undergoing a profound process of change with regard to both the achieving of professional profiles and competencies and the teaching approaches focusing on the activity of students. Both these aspects will be decisive for the design of future curriculums.

In many cases, this is driving the transformation of teaching methods from traditional approaches based on lectures towards active work methodologies. Approaches such as cooperative learning, problem based learning, and experiential learning [1–3] are essential fields of reference.

In the context of engineering education, there are already a large number of courses designed for developing specific competencies, in addition to all the other theory, through the use of methodologies focusing on work performed by the students [4–7]. There is quite widespread general agreement regarding the competencies that need to be perfected among students, related to aspects such as teamwork, communication, and problem solving.

In the particular case of Project Management teaching, the offer of training products at university level ranges from 30-hour courses to 120 ECTS (European Credit Transfer System) Masters. Most of the approaches to training undergraduates, with regard to content, are oriented towards the Bodies of Knowledge of associations such as Project Management Institute (PMI), International

Project Management Association (IPMA) and Association for Project Management (APM) [8] and, with regard to their methodology, they combine lectures, case studies, role-play, e-learning and, occasionally, the carrying-out of real business projects [9–10]. However, in the professional environment it is apparent that most project personnel (85%) have gained their knowledge through day to day experiential learning [11].

In spite of this, the use of student groups working on real cases and performing a service for a company is not common in engineering faculties. Even in the institutions that deal with Problem-Project Based Learning (PBL) that perform work relating to companies, the stress is on students learning from the development of the proposed project, rather than from its results [12]. In such an approach, the service to a third party offered by the project's result is rendered irrelevant. The goal is that the student will learn and reflect on what has been learned. One example of teaching that is focused on service to a third party is the Aalborg University program, known as Work Based Learning in Continuing Professional Development [13], where work is done with graduates who are already working within companies.

In contrast, in the field of medical education, the notion of performing a service for a patient is well established as one of the learning goals for students. According to Cooke [14], 'all forms of professional share the goal of readying students for accomplished and responsible practice in service to others. Thus, professional in training must master both abundant theory and large bodies of knowledge; the final test of their efforts, however, will not be what they know but what they do.'

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The foreseeable future of Project Management education calls for evolving *'from training and development which produces practitioners who can follow detailed procedures and project management methods towards learning and development which facilitates the development of reflective practitioners who can learn and operate in a project environment'* [15]. Project Management education must be able to teach project managers how to be reflective practitioners in touch with the latest theory and research, and their day to day practice of managing, *'focusing Project Management education at the level of transferring foundation knowledge of the various professional association bodies of knowledge, with delivery in the form of short courses by professional trainers who lack significant, real-time project experience, is a trap that needs to be addressed as we rethink project management'* [16].

Regarding new experiences in Project Management, Cicmil [17], concludes that *'perhaps there are no finite conclusions to be made, just sharing of experience and creating more exciting opportunities for the future cohorts of students [. . .]. In an experience-based course, the benefits are understood as an opportunity for the participating students to learn from experience 'how to observe and understand organizational behavior, communicate effectively, resolve conflict, motivate, assess, give feedback, and lead'*.

In line with all this, we now move on to an approach for Project Management teaching that has been conceived as continuously renewed experiences, where the aim is for the student to be able to perform a service for a real client.

THE PROJECT MANAGEMENT COURSE AT THE UNIVERSITY OF ZARAGOZA

Teaching approach adopted

According to Davidovitch [18] *'in order to prepare the students for a real project environment there is a need to practice in the 'real-world' of project management'*. In this case, the group of teachers responsible for the Project Management course at the University of Zaragoza have made their own the notion that the best way of learning Project Management is by managing an actual project for a client.

This is the main novelty of the approach reflected in this work: that behind every project developed by the students there is a client who is to benefit from a service. What this implies for the student is that they must: find a client, identify their needs, presenting different alternatives to solve the problem arising in each case, write a final report including the solution, which will be useful as a guide for carrying out the project, and also defend before a panel—including the client themselves—the adequacy of the solution proposed. All of this should be done while keeping permanently in contact with the main stakeholders of the project.

For an approach of this nature, where students face their first professional task, it is not only necessary to communicate knowledge and know-how to the students, but also to set up an environment that will make the experience possible.

The course is set within a fictitious consulting company where students work in groups, under the mentoring of their teachers. The teachers offer students the usual services of a Project Management Office (mentoring, time control, progress reports, psychological support and training (lectures, conferences, and seminars). Furthermore, in every new course the Project Management Office is renewed using the experiences gathered from the projects of the previous courses.

The purpose of this structure is to provide services, on the one hand to the students being trained in Project Management, and on the other to the clients, who should be satisfied with the work performed.

Features of the course

The Project Management course is taught within the framework of the Industrial Engineering degree of the University of Zaragoza, having a total of 6 acknowledged credits, between 130 and 150 registered students and a total of 6 teachers.

Since the year 2001, the training scheme part of this course has been based on the performance, in groups of 5/6 students, of a project for a real client that the students must find for themselves. Such clients are usually SMEs, NGOs, the small-town councils, etc. The usual scope of these works involves preparing a Project Management Plan, which is handed to the client for them to implement if they consider it beneficial. In some cases, however, the students become involved in reaching the goals set by their project. Typical examples of the commissions undertaken are extensions and relocations of companies, organizing a variety of events (sport, social, cultural, artistic . . .), preparing proposals for financing the activities of NGOs, etc.

Learning objectives

Currently, in Spain there are no established requirements for learning objectives to be met at the college, faculty or department levels [19]. The situation differs radically from that of engineering education in the US, where through the crediting criteria for the various programs proposed by ABET (American Board for Engineering and Technology), a series of objectives to be met for each degree are established [20], as well as indications aimed at reaching them [21].

After several years of teaching in this course, it has been observed that the registered students, in spite of being in their senior year, have never done any of the following:

- Worked in a group, except for small laboratory assignments;
- Participated in a project;

- Given an oral presentation to an audience;
- Written a technical report;
- Faced the need to solve a real problem presented by a client.

The present goal of the course is for it to be a first immersion in reality, where a group of students manages a project to satisfy the needs of a real client, and where all the groups learn from the experience.

The detail of the knowledge and skills that students must acquire in order to guarantee their fulfilling the points mentioned before is as follows:

- **Project Management Knowledge.** At the end of the course, students will be able to:
 - Explain in their own words the fundamental terms and definitions of Project Management, dealt with in the Body of Knowledge of professional associations such as the IPMA;
 - Correctly apply such terms, whether to the project they are working on or to simple cases and examples proposed by the teachers.
- **Competencies.** At the end of the course, the students, by means of the project they are working on, shall prove that they have developed skills relating to the following.
 - Teamwork, by contributing to a steady work rate for the group, attending meetings, providing information, and performing the tasks assigned to them.
 - Commitment to satisfying the client, by acknowledging the need to add value with the solution decided on in each case.
 - Project definition, proving the ability to express clearly both the purpose and the scope of the project proposed to the client.
 - Time management, including hour estimates of the work to be done in order to improve coordination within the group.
 - Communication, involving an oral presentation before a panel including teachers and the client to justify the adequacy of the proposed solution.
 - Writing of a technical report, a group paper

reflecting the solution proposed to the client and useful for its implementation.

Learning assessment

In order to verify whether the students have reached the objectives of the course, they must complete the following.

On the one hand, a written exam to be taken individually, to assess the theoretical knowledge acquired, by means of a questionnaire in test format (multiple choice) similar to that of the professional certification tests of the IPMA, but of comparatively reduced length.

On the other hand, for the practical aspect (real-life project), each group must write a report for the client, and offer an oral presentation before a panel formed by teachers and the client, in the presence of the rest of their classmates. In this presentation the group must defend its project and prove the validity of the solution given. The teacher panel will evaluate the project by inter-judge consensus, as well as the acquisition of competencies reflected in the subject's objectives.

COURSE DEVELOPMENT

The Project Management course lasts for 16 weeks. Within that period the various teaching activities take place (conferences, workshops, and seminars), as well as the development of the practical assignment itself. The content of the latter is subdivided into two parts to be delivered ('Statement of Work' and a preliminary version of the Project Management Plan) and concludes with the handing in of the Project Management Plan and an Oral Presentation given before the client and a panel of three teachers of the subject. On delivery of both parts, each group must present and justify the work performed for the client.

The various deliveries of the project divide the course into three stages with different objectives, which gives each of the activities developed during the course a different orientation, with the goal of supporting the successful development of the practical tasks (see Fig. 1).

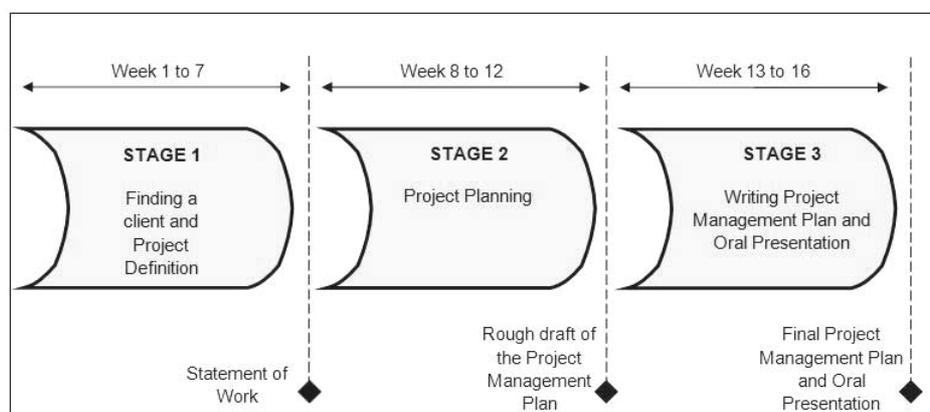


Fig. 1. Development of the Project Management course.

Stage I. Finding a client and project definition

The course begins with the search for a client and formation of groups. To date, students have grouped freely in units of 5/6. Teachers impose no restrictions on the choice of partners, only reminding students of the importance of all members having compatible schedules in order to make teamwork possible. Most students tend to form into groups with those with whom they are already acquainted through other subjects making up their degree; the process is usually rapid and after the first lecture a large majority of groups are already set up.

Once the groups have been formed, the next step is to find a client. To aid in this, the teachers distribute a leaflet with the information and objectives of the subject, as well as advice regarding the type of work to be carried out. This leaflet is useful as support when it comes to contacting companies and organizations.

To find a client, the students either rely on their own contacts within local companies and organizations or contact potential clients directly on the basis of the information provided by the teachers, derived from the experiences of previous terms.

During the two weeks allotted for finding a client, there are two programmed seminars in which each group presents the potential clients that they have contacted and the kind of work they are proposing to them. The teachers offer suggestions regarding which kind of proposals may fit best and which aspects they should clarify before making a decision. However, at the end of the process, groups are free to choose the project they want to carry out, and their mentors will do their best to support them whatever the option chosen.

LECTURES

During the first weeks of the course and for an average 2 hours, a series of conferences are given, aimed at supporting students in carrying out their projects. These cover the fundamental topics of Project Management collected in the bodies of knowledge of professional Project Management associations such as the IPMA [22]. Namely, the program offered is made up of the following subjects:

- Introduction to Project Management
- Project Life Cycle
- Project Definition
- Project Planning
- Time Management
- Cost Management
- Risk Management
- Procurement Management
- Project Quality
- Project Closing-out.

The content of these subjects aims at covering the needs of the students involved in managing their projects. These lectures are concentrated within the first weeks of the course in order to enable the

students to begin work on their projects as soon as possible.

STATEMENT OF WORK

Once the groups have been set up, and a mentor assigned to each of them, students begin work on defining their project. For this they write up the Statement of Work (SOW) document, where the aspects stated are: justification, goal, objectives, stakeholders, deliverables, risks, hypotheses and restrictions. The process of defining a project with a high degree of novelty poses a difficult problem for any professional [23]. In the case of our students the relative degree of novelty is very high, and therefore it is perceived as a very complicated task; in order to offer them support, a Statement of Work workshop is set up where each group discusses with the teachers and the rest of the class the preliminary version of the definition they are preparing for their project.

At the end of this process, during the seventh week of the course, all groups must hand in their project description paper, which must have been previously agreed with and approved by their client.

Delivery of this paper is no object to the inclusion of updates and changes that may arise later throughout the course.

Stage II. Project planning

Once the definition of the project has been agreed with the client, the group moves on to the development of the Project Management Plan. Independently of the nature of their project, they prepare a proposal of the plan that the client should follow in order to reach the goals pursued. This includes: statement of work (Updated), Work Breakdown Structure (WBS), project planning, risk analysis, procurement management and project cost estimation. At this stage the first personal differences between the members may arise, derived from the very dynamics of teamwork. To deal with such problems, two seminars are offered. In the first of these, 'Causes of Failure in Projects', the teachers present the experience gathered throughout the years regarding the most significant problems perceived in student groups taking the same subject, as well as the sort of attitude and behavior that will help prevent such problems. The performance of this seminar relies on students from previous years relating their own experiences during the course. The second seminar, 'Conflict Management', is offered by a teacher from the Psychology and Sociology Department, and by means of a series of role-plays students represent the most common conflict situations that may arise in teamwork, and strategies to deal with them are proposed.

Also, students are trained in the use of the MS Project software tool, which they will use to plan their projects.

This second stage concludes with the delivery of a preliminary version of the Project Management

Plan that students must give to the client at the end of the course. This will be the basic framework of the later Final Report, and is evaluated and corrected by each mentor, who will point out to the students which aspects of the project should be modified before its final delivery.

As for the Statement of Work, and with the same objective, there is a Project Planning workshop in which each group presents the rest of the class with the state of their project at the time, followed by a debate between teachers and students.

Stage III. Writing project management plan and oral presentation

The last weeks of the course are spent writing the Project Management Plan and preparing the oral presentation of the project.

Coordinating the contributions of 5/6 different people within a report is a difficult task, especially if done for the first time, when its tone should be that of a professional presentation given for a client, and with a term interrupted by Christmas holidays.

To offer the groups support, the teachers offer a seminar on written and oral communication including video examples of oral presentations, both good and bad, given by groups from previous terms.

THE PROJECT MANAGEMENT OFFICE OF THE COURSE

For a student group with no previous experience, carrying out a real project for a client involves an interesting challenge.

In order to aid the proper development of all the subject's projects, the teacher group becomes a Project Management Office, hereafter PMO, whose function it is to contribute to the success of each of the projects to be carried out.

The services offered by the PMO are: mentoring of the groups, upkeep of support systems and integration of the lessons learned.

Mentoring

At the beginning of the course, a mentor is assigned for each group to guide it throughout its project. Mentoring within each group will include tutoring and self-evaluation sessions.

Tutoring consists of weekly 30-minute meetings that the group members hold with their mentor. During these the student group and the mentor discuss the work carried out to date, the next steps to be taken, and any doubts the group may have. The students themselves are responsible for the decisions made regarding the project, the role of the mentor being merely to offer advice. In order to reflect with the group upon aspects of its functioning regarding the work, self-evaluation sessions were begun in term 03/04 for all groups. Since then these meetings have taken a different

direction, and at present a questionnaire of five questions is filled in anonymously by the students for the mentor and the rest of their classmates. In the questionnaire they are asked to evaluate whether in their group: members are working as a team, timetable incompatibility has been solved, each member of the group has a specific function, there is a fair distribution of tasks and all members have a clear perception of the work to be done. By using this questionnaire, in the last course, problems were detected in 5 of the 18 groups surveyed. In the meetings called as a result, all of those groups admitted to their mentor that they had problems hindering their proper functioning, and the students themselves asked for help in solving their differences.

Support systems

The course is arranged so that students must manage two projects: One, that to be carried out by their client and which it is their task to define, plan, budget, and document. The other is the internal management of the group itself in order to achieve the goal of meeting the requisites established for the course. It is in the second of these projects where it becomes most necessary to rely on certain elements for improving internal coordination and teamwork in the groups. Thus, in term 05/06 a collaborative environment, a time-control system and an 'organization manual' were included in the course to support the internal management of the groups.

A collaborative environment has been set up as support for the long-distance work of the students, as a work area where the group stores and updates documentation for the project, and that can be accessed by Internet, providing a communication system not only within the group, but also with their mentor. This collaborative environment is configured within the e-learning platform WebCT [24]. Other information is also deposited there, such as slides for the course, material from conferences and seminars, the course guide, time sheet and minutes of meetings. At each meeting with the mentor, and in general at all meetings held within the group, a minute of the meeting is taken, minuting the agreements reached therein regarding the tasks to be carried out next, and who will be responsible for doing so.

Every week the groups must fill in a time sheet where each member states the hours he or she is devoting to development of the work according to a series of predetermined categories, just as a professional working for a consulting company would do. This time control system makes the group aware of the time devoted to the project, and is useful for detecting possible imbalances in the workload of the members. With the information collected in the time sheets, and coinciding with the self-evaluation sessions, each group is given a follow-up report provided by the PMO, where the group can check what work has been carried out, the number of hours devoted to date,

and how the workload has been distributed between the members. This information is useful for making estimates of pending work on the basis of the hours devoted so far, as well as for redistributing the workload among the members of the group.

Finally, the students can rely on an 'organization manual' where, apart from the rules applicable for their papers and presentations, there is advice and recommendations offered by the mentors so as to improve the functioning of the group. Among these, students are advised to appoint a group coordinator (in charge of internal organization) and a secretary (in charge of updating the time sheet and minutes of the meetings and storing them in the collaborative environment), tasks requiring part of the time devoted to the project.

Integration of the lessons learned

At the end of each edition of the course the mentor group meets to analyze its results (papers and presentations, theory exam, opinion of the clients, evaluation of the course by the students, and incidents). Thus, the course and its teachers behave as a learning organization integrating the knowledge collected in each of its revisions for use in future editions.

Course revision is based on asking the following questions at the end of a course.

- What has gone well/badly? Why?
- What should be done to avoid certain failings?
- What have we learned from this course that we didn't know last year?
- What changes are we going to make in the course next year?

In agreement with Kolb [3], the approach has been completed with the introduction in each course of a series of measures affecting both the training program and the way in which mentoring or support systems are handled. In Table 1, the changes introduced in the course in the last few years are reflected.

The various modifications included in the course are the result of the teaching research accompanying it in recent years. According to Prince [25],

'doing research on teaching and integrating successful innovations into classroom practice clearly have the potential to improve teaching and learning'.

Next, the teaching research carried out to deal with the problems detected during the 03/05 period is presented, along with assessment of the results obtained. If our goal is to have students complete work for their clients successfully, we must discover the factors affecting group performance, developing the knowledge to help new groups in managing a new experience positively, so that they will feel satisfied with the various experiences involved in the course.

TEACHING RESEARCH CARRIED OUT

Methodology. Action research

The research carried out is a typical example of action research, where at the same time that the course was acted upon and modified, an understanding was sought of the factors affecting the results of the work done by the groups.

From term 03/04 to term 05/06, what has been studied is a total of 66 projects carried out for 66 real clients, in which the participants have been the 66 clients, 399 students, and a group of 6 mentors who each year have helped see through between 22 and 25 projects, lasting between 3 and 5 months.

The lessons learned on how to manage projects of this kind have derived from the analysis of the experiences of those 66 cases.

Failure analysis. Terms 03/04 and 04/05

The main motivation of this research was to try to understand why certain projects were not achieving the desired results.

As pointed out by Westerveld and Cooke-Davies [26, 27] the causes of failure in projects are peculiar to each case and depend on the established failure criteria. For the present situation, following Pinto [28], the established criteria have been that there is failure whenever any of the following features occur:

- The group of mentors is not satisfied with the results achieved. We have considered that a

Table 1. Evolution of the Project Management course. Features integrated.

	Training/Evaluation	Mentoring	Support systems	Organizational learning
Term 03/04		Self-evaluation sessions		Failure analysis
Term 04/05	'Causes of Failure' and 'Conflict Management' seminars			
Term 05/06			Collaborative environment Time sheet Roles of coordinator and secretary in groups Follow-up reports	

group has failed when its project report attains a mark below 6.0 on a scale of 0 to 10.

- The client has stated his disagreement with the results.
- The very course of action followed has prevented the achievement of a satisfactory result.

On the other hand, the criteria for the success of a project has been established at a mark above 8.0, and a positive assessment of the work performed by the group on the part of the client.

The purpose has been to discuss in the mentor group why it may have been that a certain project had not been carried out properly. In each case, the mentor of the group in question prepared a report which he or she distributed among and discussed with the rest of the mentor group.

The causes detected so far can be summarized as:

- *The scope of the project has not been covered:* the students, for whatever the reason, have not handed in their work when expected, this having rendered inadequate the work presented to the client.
- *Insufficient work:* the members of the group have not worked hard enough on their project.
- *Difficulty of the assignment:* overwhelming difficulties were found in the project and/or its environment. For example, political aspects.
- *Group members don't understand what is expected from them.*
- *Lack of client interest in the results of the work:* the customer's interest in the work is important to drive the group's motivation.
- *Poor coordination:* among the group members to perform the project tasks.
- *Low group profile:* the mentors have been unable to exploit the students' potential for good work, or the students themselves have not shown enough interest.
- *No value added:* the work presented offers no value added to the customer/client.
- *Heterogeneous group:* the group was formed by 'leftover' students who had not been able to make a group on their own before the deadline.
- *Personal problems in a group:* at least one of the members was not willing to collaborate on the project.

- *Scheduling problems:* group members didn't share the same schedule and therefore they couldn't find a suitable time for group meetings.
- *Poor communication with the client/stakeholders:* the group had not established sound communication channels with the projects agents (customer, administration, stakeholders).

There may have been some imprecision in the terminology and concepts used in these analyses, since it is often difficult to know whether the causes of failure pointed out are themselves the effect of other unknown primary causes.

During this period (courses 03/04 and 04/05), out of the 41 projects, 5 failed to achieve the expected results and were classified as groups that failed.

The group of mentors analyzed those cases (see Table 2). The following conclusions were drawn from that analysis [9].

- The main cause of failure detected in the group was faulty coordination within it. This cause was present in 3 out of 5 of the cases analyzed. Additionally, 2 of the mentioned 3 groups had had problems due to differences in their schedules and their not being able to find a suitable time for group meetings.
- Otherwise, when looking out for aspects that may have had an influence on success/failure it was found that the groups that had a coordinator within them attained a higher proportion of successes than those where that figure was lacking, namely 75% compared to 59%. Likewise, the proportion of failure was smaller by 10% as compared with 18%.

In our projects internal coordination may be impeded by incompatible timetables and differences in the subjects taken by group members, all resulting in difficulty in finding times to meet. The relevant information is not shared by all, and there is rework that could have been avoided. Assignations may not be clear regarding what is to be done, and pooling information for the final written report and the oral presentation require frequent feedback.

Table 2. Causes of failure detected in terms 03/04 and 04/05

Causes of failure	Course					Frequency
	03/04			04/05		
	G1	G2	G3	G4	G5	
Poor coordination	×	×			×	3
The scope of the project has not been covered			×	×		2
Low group profile	×	×				2
Heterogeneous group			×		×	2
Personal problems in a group			×		×	2
Scheduling problems	×	×				2
Difficulty in the topic of the assignment			×			1
Lack of a client interested in the results of the work	×					1
No value added					×	1
Poor communication with the stakeholders				×		1

Table 4. Students' perception of the tools used

Evaluation of:	Highly positive Positive	Highly negative Negative
Time sheet	69.5%	30.5%
Collaborative environment	87.0%	13.0%
The role of coordinator	87.0%	13.0%
The role of secretary	100%	0%

compared with the 03/04–04/05 period; faulty coordination is no longer perceived as the main cause of failure.

One of the fears of the mentors was that these measures would be initially rejected by some of the students, because they might not perceive any immediate usefulness for their project. Therefore, students were asked for their opinion (highly positive, positive, negative, highly negative) on the measures introduced (Table 4).

As can be appreciated, students have reacted positively to the tools used, and have likewise stated that such tools have helped them improve coordination throughout the project. In this case it has been possible to work on coordination deficiencies, by offering a professional context for efficient work through the collaborative environment, as well as an improved structure for the internal organization of the group, by establishing the roles of coordinator and secretary.

STUDENTS' OPINIONS ON THE COURSE

At the end of the course, students were asked to individually evaluate the project work through an anonymous questionnaire consisting of four sections rated on a scale from 0 to 10 (10 being

the best): project work, lectures, seminars and overall experience. Also, there was a final open question section where students could give their comments.

Table 5 shows the results of the first four sections for the courses. 129 students answered this questionnaire during term 03/04, 116 during 04/05 and 154 during 05/06. In 03/04, no rating for seminars is shown because they were introduced in term 04/05.

Interest in the project work has been high, becoming somewhat higher in successive years. About 90% of students stated that the project experience had been positive or highly positive. Also, seminars have been rated considerably higher than lectures.

Table 6 shows the number of times the most common ideas have appeared in response to the open questions. 'What aspects of this course did you find most interesting?' and 'What do you feel most satisfied about?'

'Working in a group' has been considered to be a positive outcome, and has been quoted as the most favorable aspect of the course, together with 'having taken part in a real-life project'.

On the other hand, in recent years students have pointed out the following aspects as the less interesting or satisfactory (see Table 7):

- Having to do a theory exam apart from the project.
- The great amount of time devoted to the course, although the average total hours devoted is 180, which does not exceed the 6 ECTS credits assigned to it.
- Students would like to have more orientation from the mentor, since they consider that he should be more involved in the decisions made by the group.

Table 5. Course feedback by students

Project Work	03/04 term		04/05 term		05/06 term	
	Average	Standard dev.	Average	Standard dev.	Average	Standard dev.
Interest in the work	7.8	1.4	8	1.5	8.1	1.7
Experience of working in a group	7.8	1.8	8.1	1.5	8.0	1.6
Experience of presenting the work in public	7.7	1.9	7.4	2	7.9	1.9
Relations with the stakeholders	7.4	1.8	7.4	2	7.6	2.0
Lectures						
Interest in the lectures	5.8	1.9	6	1.9	5.7	1.7
Seminars						
Causes of project failure			7.1	1.7	6.8	1.8
Conflict management			7.5	1.7	7.5	2.1
MS—Project			7.4	1.3	7.3	1.6
How to deliver a good presentation			7.3	1.5	6.5	1.8
Global evaluation of the experience	No. of answers	% of answers	No. of answers	% of answers	No. of answers	% of answers
Highly negative	1	0.8	0	0	2	1.4
Negative	5	3.8	3	2.6	2	1.4
Not relevant	6	4.6	6	5.2	13	9
Positive	92	70.8	82	70.7	103	71.5
Highly positive	25	19.2	23	19.8	24	16.7

Table 6. Answers to open final evaluation questions (most interesting aspects)

Question	Answers grouped by similarity	Times quoted		
		03/04 term	04/05 term	05/06 term
Most interesting aspects	• Working in a group	34	60	67
	• To act on a real-life project	59	43	50
	• Presenting in public	22	17	34

Table 7. Answers to open final evaluation questions (least interesting aspects)

Question	Answers grouped by similarity	Times quoted		
		03/04 term	04/05 term	05/06 term
Least interesting aspects	• Having to do an exam	22	10	25
	• Lack of orientation on the part of the tutor	21	10	19
	• Too much work	15	9	14
	• Having to find projects	4	9	21

- Students would prefer that the teachers provided the projects to be developed, rather than having to find them for themselves.

CONCLUSION

The teaching approach of a Project Management course based on groups managing projects for a real client has yielded satisfactory results.

This approach not only provides a learning framework most valued by the students, but also the possibility of interacting upon the features of the course has made it possible to study how the changes made affect the functioning and results of the project groups.

Thus, we are in a situation where we can develop

the know-how aimed at avoiding the occurrence of the causes of failure of projects, and therefore pursue the satisfaction of all parties involved (students, clients, and teachers).

In previous terms the mentor group was not involved in the organization of the work groups. However, the first available data suggest that aid in establishing an organization within each group, and the availability of support procedures for the work of groups should reduce the probability of failure due to faulty coordination.

On the other hand, it should be mentioned that the analysis of the failures that occurred points to causes similar to those stated in the available bibliography for sectors such as civil engineering, but in our case the problems related with the client and the very purpose of the topic of the project are added.

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