ASSESSMENT OF KNOWLEDGE ACQUISITION OF "GOOD PRACTICES" IN PROJECT MANAGEMENT AND ITS INFLUENCE IN THE ACHIEVEMENT OF PROJECT SUCCESS

A. Lozano, T. García-Segura, L. Montalbán-Domingo, E. Pellicer

School of Civil Engineering. Universitat Politècnica de València (SPAIN)

Abstract

In addition to the technical knowledge acquired during the academic training, it is equally important to develop skills and attitudes demonstrated in a job, which can be a distinctive factor respect to other human resources of the company. Project management stands out among these distinctive competences, and it is a professional competence of great importance in any activity sector. This competence can be acquired in different University Schools, such as the Civil Engineering School (Universitat Politècnica de València). In this particular School, Project Management is taught as a part of the Business Management subject in the fourth year of Civil Engineering Degree, as well as Project Management subject in the Master of Science in Planning and Management in Civil Engineering. One of the objectives of these subjects is that students acquire the knowledge of "good practices" in project management, which are included in the guide of the Project Management Book of Knowledge (PMBOK). In order to detect the knowledge of the students in these good practices and its influence in the achievement of project success, questionnaires have been elaborated and distributed to the students at the beginning and at the end of the course of these two subjects. In this way, it is possible to compare the prior knowledge of the students and their progress once the management courses have been taken. Likewise, this communication highlights the differences between postgraduate and graduate students, as well as differences related to age, gender, nationality or previous qualifications. Finally, the students' preference for management in construction respect to other branches of civil engineering is also analyzed.

Keywords: knowledge acquisition, project management, distinctive competences project success.

1 INTRODUCTION

Interest in project management has increased considerably in recent years, in the professional and in the university field. Nowadays projects are involved in environments of great uncertainty and complexity, so many of them do not finish successfully.

The development of management skills, traditionally linked to project managers, is currently implemented in educational processes. The management requirements are growing in the educational process and it highlights the growing need to teach the theoretical knowledge of management to the students and its implementation in the practical field, as well as the creation of products and services that provide added value to clients [1].

In response to this situation, professional associations have been incorporating management standards and certification processes through courses and evaluations, and companies have invested in training their resources and implementing management methodologies [2]. One of the associations that developed its own management standards and certification programs was The International Project Management Association (IPMA), which represents members of various national organizations, mainly in Europe, Asia and Africa. In 1996 the Australian Institute for Project Management (AIPM) published its National Competency Standard for Project Management, and in England, the Association for Project Management also created "competency standards" about project control and project management. But undoubtedly, the organization that has a remarkable recognition in the international management field is the Project Management Institute (PMI), entity that offers the Project Management Professional (PMP) certification, which has become a requirement for access to certain project management jobs. The body of knowledge of this entity is integrated into the Project Management Book of Knowledge (PMBOK) [2]. PMI offers several educational programs focused on teaching of advanced project management, quality management, programming, risk management, skills and programming within the complex project environment, preparation to manage a project management office or preparation for the PMI's certifications. Universities also offer management programs, most of them located in the USA, which offer their programs mainly at the master's level

(MBA, MA, MSc, etc.) and some in doctoral programs. Some of these programs are created to cover the areas of the PMBOK guide and to prepare for the PMP certification [2].

An example of a university that offers project management training at graduate level and master's level is the School of Civil Engineering at the Universitat Politècnica de València, in the Master of Science in Planning and Management in Civil Engineering (MAPGIC) and in the Civil Engineering Degree. At both levels, project management knowledge included in the PMBOK is taught.

The Master of Science in Planning and Management in Civil Engineering (MAPGIC henceforth) was born in 2008, promoted by various professors belonging to the Construction Engineering Department and is supported by the School of Civil Engineering [3]. This master offers courses with several objectives, like develop management skills and teamwork. This is the case of Lean Construction course [4] or Project Management course, which is focused, among other issues, on the transmission of PMBOK's knowledge. In the same way, project management and PMBOK's best practices are taught in the fourth year of Civil Engineering Degree, in the Business Management course. Based on these two subjects, the objective of this article is to analyze the students' prior knowledge about the best practices included in the PMBOK, as well as the knowledge acquired after the training received. It also identifies the level of importance assigned by students to each of the practices in obtaining success in construction projects, before and after taking the courses.

2 MATERIALS AND METHODS

In order to analyze the knowledge of project management according to the PMBOK, the authors prepared a questionnaire aimed at the students of the Business Management course and the students of the Project Management course. In the educational process other studies have been carried out in collaboration with the students, such as the one that analyzed the employability of Spanish students compared to the French students of the Civil Engineering Degree [5].

The questionnaire consisted of three parts. The first part is about general information of the students, in terms of age, gender and nationality. The second part contains two questions, one in which the students choose the preferred area of civil engineering and another question that evaluates between 1 and 5 the actual knowledge of the PMBOK's best practices. In the third part students rank the influence of 17 management practices to achieve success in projects, based on a 5-point Likert scale where 1 is completely disagree and 5 completely agree. The reliability of students' responses was analyzed with Cronbach's alpha analysis. The collected data was analyzed with IBM SPSS Statistics software (version 24). First, a statistical characterization of the sample was made and then the statistical significance was analyzed to compare the answers at the beginning and at the end of the courses studied, as well as the differences between the students of the Civil Engineering Degree and the Master's Degree.

3 RESULTS

3.1 Statistical characterization

A total of 132 surveys were successfully answered and considered in the analysis. 71 surveys were answered before taking the courses, 38 were from graduate students and 33 from the master's degree. The other 61 surveys were answered once the students have taken the project management courses, being 34 students from the master' degree and 27 from the Civil Engineering Degree.

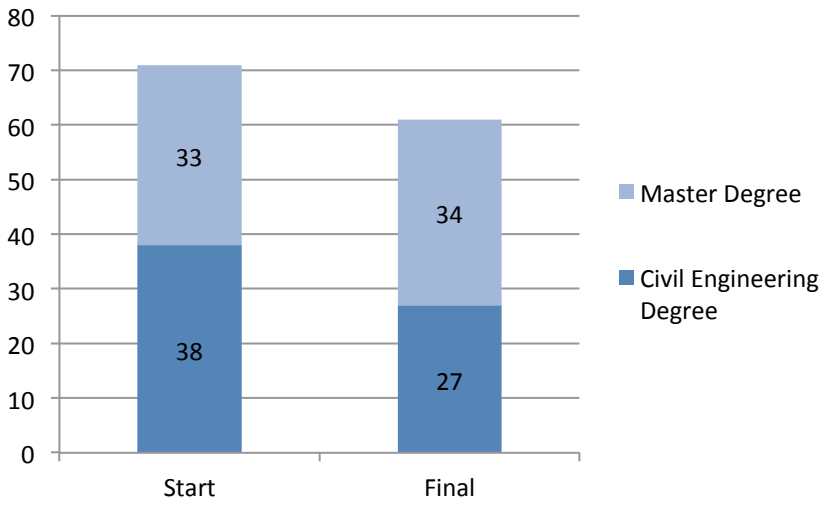

Figure 1. Percentage of students per type of degree at the beginning and the end of the courses

Other characterization data that were collected from the students were age, gender and nationality. The age of the graduate students was mostly between 21 and 22 years old, while the majority of MAPGIC's students are between 21 and 24 years old. Related to gender, 16% were women from the Civil Engineering Degree and 36% were women from the MAPGIC. The students are from various nationalities, mainly from Spain (49.3%), Ecuador (12.7%), France (7.0%) and Peru (5.6%).

In the survey conducted, students were asked to rate their knowledge in the PMBOK from 1 to 5. The results at the beginning and at the end of the courses are shown in Fig. 2 and 3.

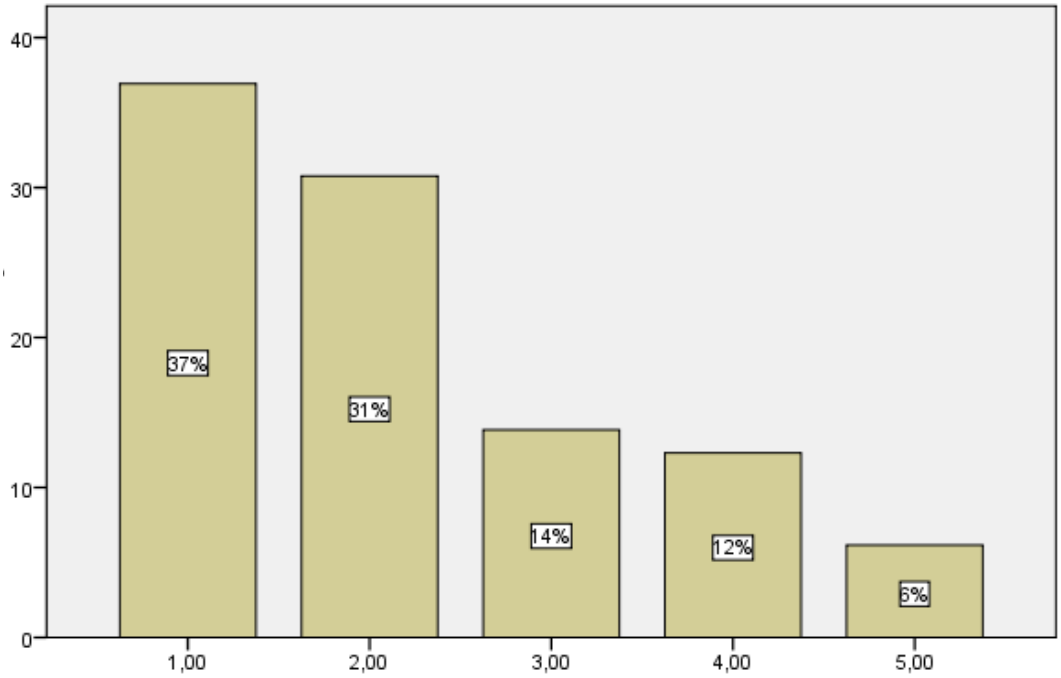

Figure 2. PMBOK's knowledge at the beginning

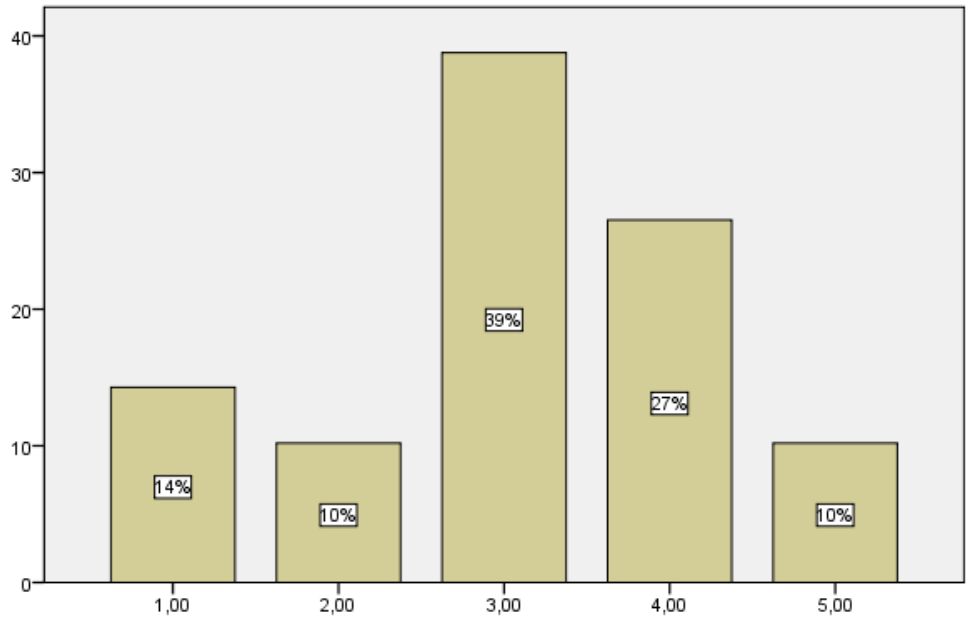

Figure 3. PMBOK's knowledge at the end

These results show that at the beginning of the courses most of the students (71%) ranked between 1 and 2 their knowledge of the best practices included in the PMBOK. On the other hand, at the end of the courses the students mainly ranked between 3 and 4 their knowledge acquired of the best practices of the PMBOK (66%), so their knowledge have increased respect to the beginning of the courses.

In order to analyze the reliability of the scale of measurement, the value of Cronbach's alpha was calculated, obtaining a value of 0.928 in the sample analyzed at the beginning of the courses and 0.836 in the sample at the end of the teaching period. These values are considered acceptable because of the value of Cronbach's alpha> 0.70 represents a good internal consistency or reliability of a sample [6].

Results (mean and standard deviation) that show the influence of the variables measured (VI to V17) in obtaining the success of the projects are shown in Tables 1 and 2. At the beginning of the courses, the average values are between 3.44 and 4.32, while the standard deviation varies from 0.841 to 1.118. It can be observed that the best practices that have the most influence in projects' success according to the students are the leadership skills, motivation, and conflict resolution, effective communication within the organization, programming task and estimate the cost of the project. On the other hand, the practices that are considered to have the least influence on projects' success are manage agents' needs and expectations and obtain information on the level of satisfaction of the project result.

Table 1. *Statistical description of each variable at the beginning of the courses*

Code	Variable	Mean	Standar Deviation
V1	Balance the conflicting restrictions	3.72	.959
V2	Estimate the cost of the project	4.01	.978
V3	Programming tasks	4.07	.961
V4	Risk management	3.83	1.042
V5	Quality management	3.69	1.064
V6	Identify the product requirements	3.56	1.118
V7	Manage agents' needs and expectations	3.46	.998
V8	Effective communication within the organization	4.32	.841

V9	Leadership skills, motivation, conflict resolution	4.23	.913
V10	Technical and management knowledge	3.97	.878
V11	Commitment of the organization to the objectives of the project	3.83	.926
V12	Manage diversity	3.48	1.067
V13	Efficiency in the use and allocation of resources	3.96	1.048
V14	Manage a satisfactory closure	3.55	1.025
V15	The project has solved the initial problem / need	3.93	1.087
V16	The organization has acquired experience and knowledge once the project has finished	3.68	1.131
V17	Obtain information on the level of satisfaction of the project result	3.44	.996

At the end of the courses students returned to assess from 1 to 5 the influence on the projects' success of each variable, obtaining the results of mean and standard deviation that are shown in Table 2. In this case the average oscillates between 3.66 and 4.43, values slightly higher than the values at the beginning of the courses, and the standard deviation varies from 0.663 to 0.888, values lower than the initial sample with a maximum variation of 35%, which shows that at the end of the teaching period there is less uncertainty about the most important variables in project management, so the courses have managed to consolidate the concepts. In this case, effective communication within the organization, programming tasks, leadership skills, motivation and conflict resolution and estimate the cost of the project, are also the practices that have the most influence on the projects' success, apart from the efficiency in the use and allocation of resources, which is included in this table. The practices that are the least valued are identify the product requirements and manage diversity.

Table 2. *Statistical description of each variable at the end of the courses*

Code	Variable	Mean	Standar Deviation
V1	Balance the conflicting restrictions	4.03	.663
V2	Estimate the cost of the project	4.16	.860
V3	Programming tasks	4.31	.765
V4	Risk management	4.02	.695
V5	Quality management	3.89	.819
V6	Identify the product requirements	3.66	.772
V7	Manage agents' needs and expectations	3.67	.747
V8	Effective communication within the organization	4.43	.718
V9	Leadership skills, motivation, conflict resolution	4.25	.869
V10	Technical and management knowledge	4.08	.862
V11	Commitment of the organization to the objectives of the project	3.95	.762
V12	Manage diversity	3.66	.772
V13	Efficiency in the use and allocation of resources	4.28	.686
V14	Manage a satisfactory closure	3.95	.740
V15	The project has solved the initial problem / need	3.89	.858
V16	The organization has acquired experience and knowledge once the project has finished	3.90	.790
V17	Obtain information on the level of satisfaction of the project result	3.90	.768

3.2 Statistical significance

The relationship of the samples at the beginning and at the end of the courses was analyzed. For this purpose, the non-parametric Wilcoxon test for related samples was performed. According to the data obtained, significant differences were observed in the responses of variables 1 (Balance the conflicting restrictions), 14 (Manage a satisfactory closure) and 17 (Obtain information on the level of satisfaction of the project result).

Table 3. *Relative importance of the variables with significant differences at the beginning and at the end of the courses*

	Difference v1	Difference v14	Difference v17
Z	-2.360	-2.190	-2.286
Asymp. Sig (2 tailed)	0.018	0.029	0.022

Likewise, the non-parametric Mann-Whitney U test was carried out at the end of the courses in order to compare the importance of the variables according to whether students belong to the Civil Engineering degree or to the Master's degree. It was observed that there are only significant differences in the influence of variable 10 on the projects' success, corresponding to technical and management knowledge.

Table 4. *Relative importance of the variables with significant differences between students from civil engineering degree and students from master's degree at the end of the courses*

	V10
U de Mann-Whitney	316,000
Z	-2,215
Asymp. Sig (2 tailed)	,027

4 CONCLUSIONS

This article analyzes the acquisition of knowledge of the best management practices included in the PMBOK and its influence on the projects' success. To achieve this goal, students from the master' degree and students from the Civil Engineering degree completed a questionnaire before and after taking the project management courses, from September to December 2017. The results of the statistical analysis showed that during this period, students increased their knowledge about the best practices included in the PMBOK. Likewise, the variables that have the most influence on the projects' success at the beginning and at the end of the courses are leadership skills, motivation, and conflict resolution, effective communication within the organization, programming task and estimate the cost of the project. Efficiency in the use and allocation of resources is also important at the end of the courses. It highlights the fact that the standard deviations of the variables have significantly reduced once the courses have finished (35%), which means that there is less uncertainty in the most important variables, so project management courses have managed to consolidate concepts. Finally, an analysis was carried out to compare the results obtained at the beginning and at the end of the courses, and the results obtained at the end were also compared according to whether students belong to the Civil Engineering degree or to the master's degree. In both cases no significant differences were obtained.

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