

# A Comparative Analysis of the Incorporation of Skills at the Master's Degree Level\*

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This work presents a comparison of two universities: one public, and the other private. Two competency-based Master's degree programs will be compared in terms of the strengths and weaknesses identified by their coordinators. The faculty's perceptions of the development/acquisition of said competencies by the students will be presented, as well as their impressions of the entire competency-based teaching/learning process.

**Keywords:** generic competencies; teaching/learning process; methodologies; assessment tools; feedback

## 1. Introduction

Since the introduction of the new plans of study in Spain in 2010, numerous studies have been carried out implementing new active methodologies [1], for example, presents different strategies for the inclusion of new learning methodologies as well as the identified problems and the possible solutions provided by the same research. These strategies have been considered in the present study. On the other hand, in [2] we can find an example of the implementation of generic skills in the teaching learning process and the opinion about such implementation from the point of view of students and teachers in an engineering school in Australia. In this case interviews showed that both groups did not understand the meaning of these generic skills and neither how they were supposed to be developed, but in practice it could be observed clear evidences where those skills were being put into practice. In the same work it was concluded that it would be interesting to enhance this practical part as an example of good practice. In [3] evidences and assessment tools used for the application of PBL methodologies were presented. The problem-based learning is a leading methodology from the point of view of both teachers and students as the best for the development of generic skills. This experience presented was implemented in different students groups within the framework of three different subjects at the Universitat Politècnica de Catalunya--BarcelonaTech in Barcelona, Spain (UPC). In this research the

skills of teamwork and communication (both oral and written) were implemented. Feedback or feed-forward was introduced as a key strategy of assessment for the continuous improvement of students work, increasing the motivation and the satisfaction of these learners and their teachers thanks to good results. It can be said that this is a clear example of good practices in PBL. Another interesting work is [4] which presents a comparison between the point of view of employers and the point of view of academics relating the importance given to generic skills. This comparative highlights the divergence of opinions between both groups. Moreover, it allows academics to see the point of view of employers for their future designs or in order to improve their plans of study, not only in terms of knowledge but also in terms of competencies. Finally, [5] presents an example of a good practice case for assessing students' skills.

In all these cases teaching and learning experiences have been student-centered and changes in the system of assessment types and strategies have been analysed. An example of an outstanding assessment tool it has been, for example, the increasing use of multiple choice questions in technical degrees [6]. In this study it was also highlighted the use of projects as a generic skill assessment tool of which clear evidences were found [7, 8], also considering whether or not feedback was provided in those cases [9, 10]. On the other hand, on the literature, we can find examples of analyses of different programs (under-

graduate degree or Master's), schools and universities [11, 12], as well as individual courses [13], which demonstrate the effectiveness of student-centered and competency-based instruction. One of the points most commonly addressed in these articles is the measurement of competency acquisition. It is evident that when the plans of study were defined, and depending on the qualification, different generic or interdisciplinary competencies were determined that must be acquired by the students [11]. These competencies were considered in the Tunning project [14], which took into account the opinions of employers to determine the competencies that students should acquire according to the professional profile they were to have in the professional world. There are other studies supporting competency-based instruction, such as that conducted by Charles [15], which analyses employability in terms of these competencies. France was compared with England and Sweden, highlighting the need for the professionalization of students and competency-based training in the workplace. Hernández [16] analyses the opinion of faculty members and employers with regard to engineering studies, finding a high degree of agreement in terms of the generic and specific competencies that were most highly valued by both groups. The generic competencies that were stressed were: the use of computer tools, mastery of the student's area or discipline, the ability to quickly acquire new knowledge and the capacity for team work. In the work by Pol [4], differences were found between the opinions of employers and faculty members in terms of both the importance given to the competencies and the extent to which these had been practiced in the academic setting. Generally speaking, they found that faculty members placed greater importance on all the specific competencies (mastery of the subject area), and considered that they were given more attention in the academic setting than the employers did. According to [12], who analysed two groups of students, one which studied while working, and another that studied but did not work, a difference in the perception of the acquisition of generic competencies was evident, resulting from the simultaneous professional experience. The two Master's programs that we will analyse in this document were designed based on this knowledge.

The innovative contribution made by the present article is thus the comparison between two Master's programs at two different universities, one private, Abat Oliva University (UAO) and another public (UPC), in terms of the perception of students, faculty members and those responsible for the program design (masters programs can be found

at the following link: <https://goo.gl/VyuEFh>). Said comparison will analyse the teaching/learning methodologies, methods and tools for assessment and acquisition of generic competencies that are intended to be developed by means of different activities or that are perceived to be developed by the parties.

## 2. Methodology

In order to compare how the new methodologies and tools of assessment have been implemented, a survey was taken of both the students and the faculty at the two universities (UPC and UAO) being studied. The two qualifications subject to the comparison were the Master's degree in International Logistics at UAO, where 17 out of a total of 19 students responded, and the MUESAI degree (University Master's degree in Automatic Systems and Industrial Electronics) at ETSEIAT/UPC, in which 27 out of a total of 29 students responded.

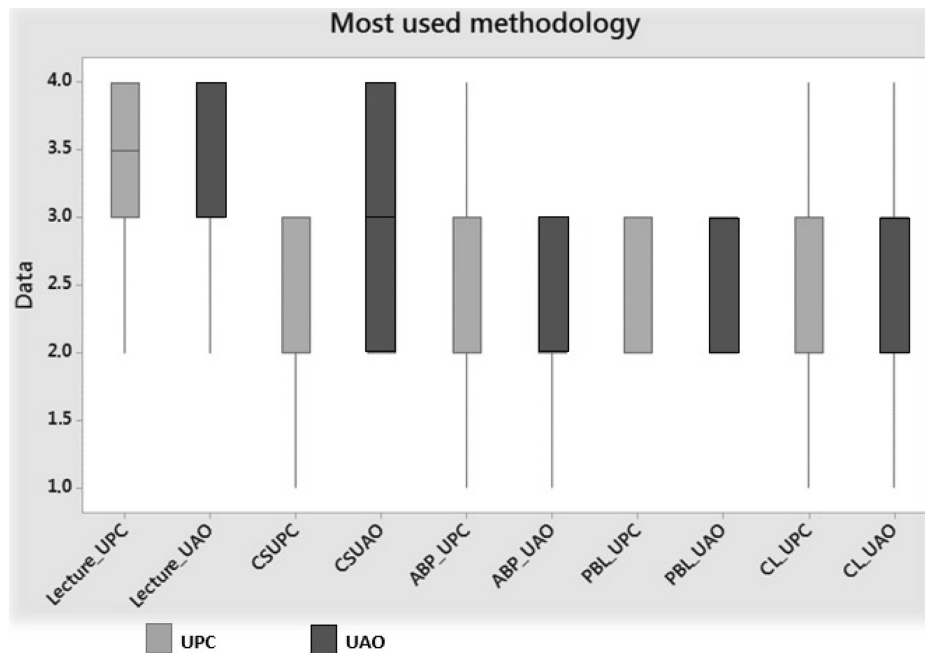
The results obtained on the surveys were processed using the statistics program IBM SPSS v19 Solutions for Education<sup>®</sup>, in order to carry out the quantitative analysis and determine the descriptive frequencies of the different variables. Contingency tables were created to analyse variable cross, the degree of significance and Chi-square, in order to verify the correlations between the variables analysed. A degree of significance of less than 0.05 resulted in the rejection of the null hypothesis, demonstrating that the correlations were not random.

The primary people responsible for the Master's degrees and those responsible for the design of these new qualifications were also interviewed to determine the extent to which the introduction of the competencies and the new teaching/learning methodologies were taken into account in the design. These individuals also offered us their personal thoughts on the strengths and weaknesses of a competency-based system.

Finally, professors were surveyed about the introduction of competencies in the courses, the methodologies used in the learning process and the evaluation design.

From the three sets of data entered, it was analysed whether the students really perceived that the competencies established were actually developed from the beginning, and whether they noticed that the teaching/learning methodologies and tools of assessment have been updated. It was also assessed whether what the students perceived coincided with what they believed to be most useful.

Finally, it was possible to analyse whether the strategy used in the two Master's programs at the



\*List of methodologies used for the study: Lecture, Case study (CS), Problem-based learning (ABP), Project-based learning (PBL) and Cooperative learning (CL)

Fig. 1. Most frequently used teaching methodologies 1 = UPC, 2 = UAO.

public and private universities was the same or exhibited any differences.

### 3. Results

First, the study survey results are presented, followed by the interviews of those responsible for the programs and the questions answered by the faculty.

#### 3.1 Student perception results

In the first place, the results of the student survey at the public and private university indicate that the most commonly used methodologies at both universities are master classes. However, at the public university, the second most common methodology was project-based learning (PBL), while at the private university it was case studies (Fig. 1).

When the students were asked to identify the teaching methodologies that they believed to be the most useful, at the public university (UPC), they indicated laboratory experiments and both project- and problem-based learning. Similarly, at the private university they also indicated PBL and mentioned case studies as one of the most useful, perhaps as this is one of the methodologies most commonly used by the faculty. In this case, we can see that although both Master's programs are technical, UAO is traditionally a more literary university and case studies is a much more commonly used methodology at this type of university.

With regard to assessment, the most commonly

used strategy at both the public and private universities is multiple choice tests. However, as shown in Fig. 2, at the public university, written assignments/projects and laboratory reports stood out as the next most commonly used, while at the private university they were written assignments/projects and short answer tests.

When asked about the methodologies or tools of assessment they felt were the most useful, students at both universities agreed that written assignments or projects were the most useful instruments (although it should be pointed out that these projects do not measure the learning process, rather the final result). At the private university, multiple choice tests and oral presentations were also identified as useful, as shown in Fig. 3.

Table 1 shows the results when the students were asked to name the methodologies or assessment strategies that allowed them to develop the generic competencies established for their degree programs. In this case, the seven competencies (mastery of the discipline, capacity for team work, analysis and synthesis, initiative, social and ethical commitment, oral and written communication and ICTs) that must be developed in both programs were chosen. As we can see, in both the public and private universities, oral presentations and lab notebooks were mentioned, in that order.

The analysis of the contingency tables of the most commonly used teaching methodologies, the most frequently used tools of assessment and the different

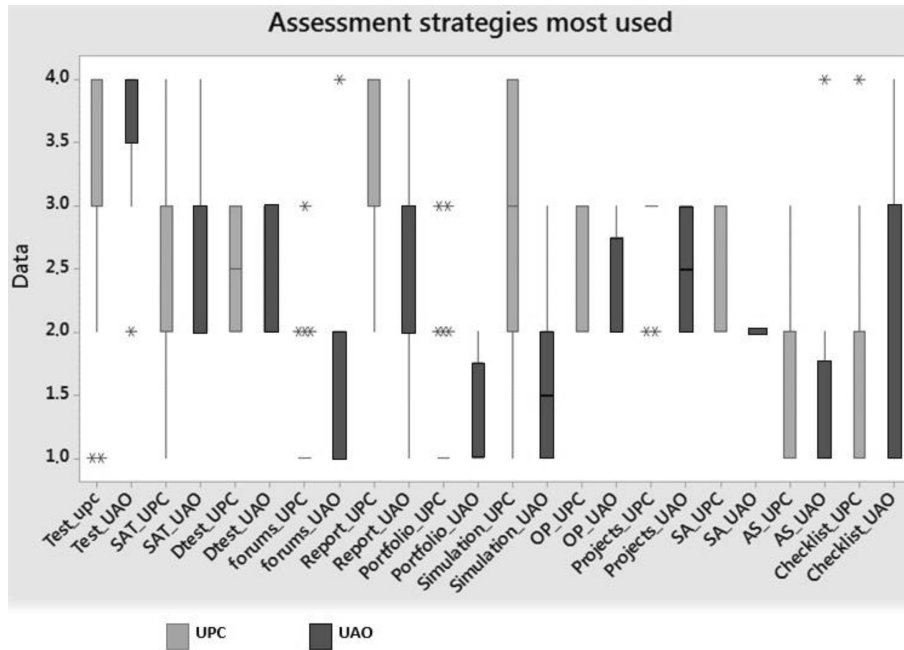


Fig. 2. The most commonly used strategy (SAT: Short Answer test; Dtest = Development Test; OP = Oral presentation; SA = Self-Assessment; AS = Attitude Scales; UPC = Universitat Politècnica de Catalunya; UAO = Universidad Abat Oliva).

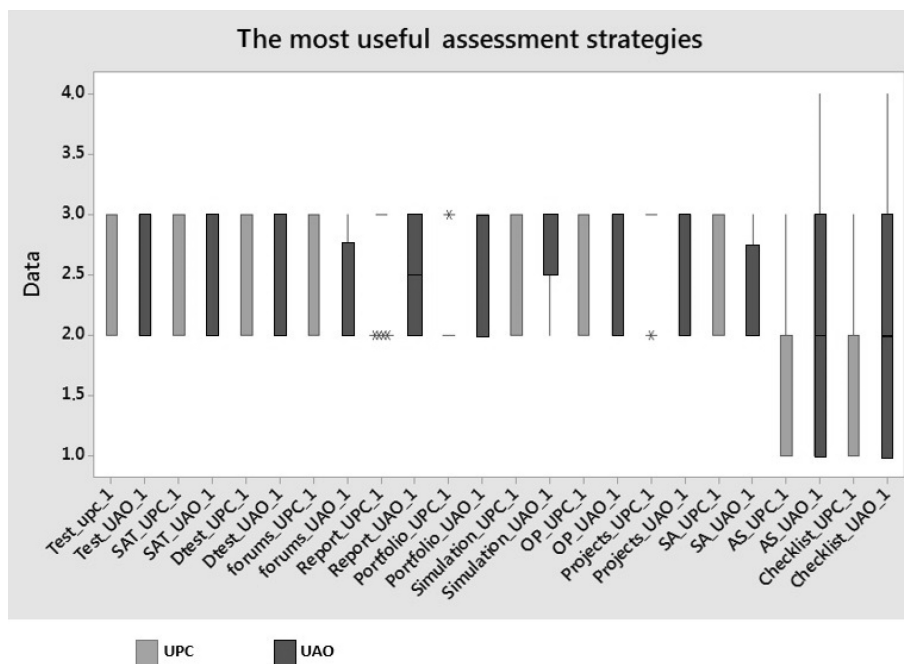


Fig. 3. The most useful assessment strategies. (SAT: Short Answer test; Dtest = Development Test; OP = Oral presentation; SA = Self-Assessment; AS = Attitude Scales).

generic competencies studied (seen in the first column of Table 1) shows that a significant correlation was found between the competency of initiative and the assessment strategies most commonly used throughout the Master's program, i.e., written assignments and projects. This means that the use

of projects is a very commonly used evaluation strategy in the Master's programs, and it shows that it is useful to promote the competency of initiative. This supports its importance and the advisability of its selection as an instrument of evaluation in these Master's programs.

**Table 1.** Relationship between generic competencies and strategies or tools of assessment

Competence	University	
	Public	Private
Mastery of your area/discipline	Projects	Lab notebook/Projects
Capacity for team work	Projects	Projects
Capacity to analyse, synthesize and draw general conclusions	Projects	Projects
Initiative	Projects	Projects
Ethical and social commitment	Projects	Projects
Oral and written communication	Oral presentations	Oral presentations
Capacity to use computer tools	Lab notebook/Projects	Projects

A significant correlation was also found between the problem-based teaching/learning methodology and the competency “capacity to use computer tools”, which reveals that the students consider that problem solving as an instrument of assessment is useful for learning how to use computer tools, since in many cases calculation or simulation programs are used.

### 3.2 Interviews with those responsible for the Master’s programs

Furthermore, conversations were held based on a script previously sent to those responsible for the Master’s programs, and who in this case participated in or provided leadership for their development. These interviews were recorded and analysed.

It should be pointed out that significant effort was dedicated to drafting them, in order to introduce both technical and interdisciplinary competencies in the programs. This involved a large part of the faculty and required significant preparation on the part of the institutions.

When asked about the instruments of evaluation, at the private university, we were told that these consisted primarily of “business games and other team work tasks that require a presentation and a defense, as well as multiple choice tests after every session, of course”. While at the public university there were still exams in the different subjects, an important part of the work also consisted of projects and labs. In particular, an effort is made to put all of the theoretical content into practice.

At both institutions, they mentioned to us that a repository of good practices has been set up to ensure on-going improvement, and the professors have examples of strategies to apply in their courses.

With regard to final Master’s degree projects, in both cases, the competencies are evaluated in a generic manner (both specific and generic competencies), and it is difficult to discriminate among them in this form of evaluation.

When asked about the weaknesses of their program and the evaluation of competencies, they confessed “It can sometimes be a complicated process, since it is not easy to cover all the compe-

tencies of the program and it is not possible to evaluate some and not evaluate others. It is therefore not so easy to design this evaluation”

“There are competencies that are difficult to evaluate individually, for example, if the student fails an exam that is in English . . . if in that course, competency in a foreign language is evaluated, it is difficult to discern to what extent the lack of comprehension of the language is the sole motive, or if it is a lack of technical knowledge that is the problem”.

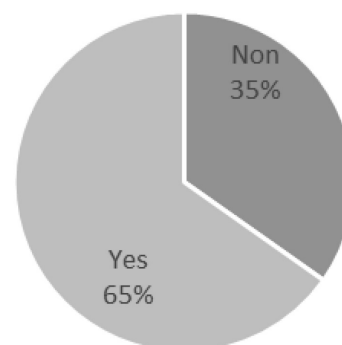
And they obviously stress that:

“. . . Students are required to not only understand the concepts at a theoretical level, they must also put them into practice and know how to communicate them. . .”

“One positive aspect is that it is obviously a sign of quality to evaluate specifically that which the student is said to be going to develop. . .”

Finally, respondents were asked if they were tracking students to know the employability in the sector once the master was finished. At the UAO its coordinator confirmed that every year they ask this question to students and each year students’ employability in the field is increasing. The 65% of respondents’ students from the last class (2014–2015), for example, answered that after the master they had achieved a position in the sector, as shown in Fig. 4.

When the UPC head was asked the same question he informed about a study carried out by the university every year by the students who were



**Fig. 4.** Students’ responses on the employability in the sector after the master at the UAO.

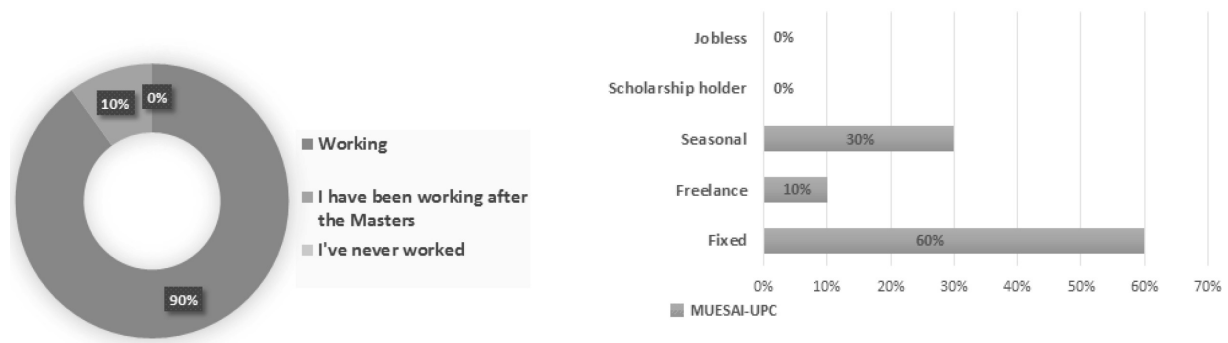


Fig. 5. (a) Employability study for the master at the UPC; (b) Types of contracts.

finishing their studies. As we can see in Fig. 5, the level of employment of the degree is 90%, with a 60% of students with a fixed contract, as shown in Fig. 5b. Moreover, from the same survey administrated, there were 13 students from 30 who were already working in the area before starting the master and their goal was to renew knowledge and to have future internal job promotions in their companies. From these 30 students in total, 11 started internships in the sector during the last master semester. So it can be said that 80% of these students are currently working in the field.

3.3 Results of the professors' survey

Finally, the survey given to professors was analysed, with a small sample and a low level of participation. This representation of 25% shows that most of the professors have been teaching classes for more than 10 years, and thus have a long history in the teaching process. 75% state that they insert the generic competencies in their courses and consider that the incorporation of the European educational

space in 2010 has been key for some, representing a change in the way they teach.

In general, they believe that their students reach a satisfactory level in the competencies considered, and that perhaps they are very critical, as they think that they do so with certain notable difficulties. Following the analysis, the authors believe that the number of competencies introduced in the period of time allotted for the Master's program is very ambitious, and therefore it is very difficult to develop all the competencies that are proposed. The 27 competencies (both specific and generic) identified for a single year of the Master's program, as in one of the cases, are a clear example of this.

They also believe that the best way to develop the competencies is through the different learning methodologies used in the classroom (PBL, CL, master classes, laboratory exercises and case studies) (74%) and business internship assignments/projects (53%), which agrees with the students' beliefs.

With regard to tools of assessment, the professors primarily stress projects, case studies and written

Table 2. Relationship between generic competencies and strategies or instruments of assessment

	Most frequently used teaching methodologies		The most useful teaching methodologies		The most commonly used Assessment strategy		The most commonly useful Assessment strategy to develop generic skill
	UPC	UAO	UPC	UAO	UPC	UAO	
Student	Master classes		Laboratory exercises, PBL and case studies		Multiple choice tests		Projects
Teacher	PBL, CL, master classes, laboratory exercises and case studies		-		Projects, case studies and written assignments, with oral presentations in second place		-
Responsible for the Master's programs	Master classes and projects or case studies		-		UPC Exams, projects and labs	UAO Business games or case studies and Multiple choice tests	-

assignments, with oral presentations in second place. This matches what the students have identified as the most useful.

However, they do not mention multiple choice tests, which the students say are the most commonly used in both programs.

### 3.4 Summary results

In the following Table 2 we can observe a comparison between students, teachers and master responsible opinions on which learning methodologies and assessment strategies are the most used. In the case of students it can also be seen which ones they think are the most frequently useful. As shown in Table 2, in many cases teachers highlight the same methodologies and strategies of the learning process that students considered most useful. It is also important to emphasize that the coordinators for the masters corroborate the same methodologies and strategies.

## 4. Conclusions

As we have presented, there is a great deal of coherence in the results obtained from the three analyses of the coordinator, professor and student perception. We can see an obvious relationship between the methodology used at the two universities, the perception of the students about which are most useful, and the most useful and most commonly used methods of evaluation.

We have also seen that the professors agree with the students when defining the most useful teaching/learning methodologies for developing both the generic and specific competencies, stressing written assignments/projects, as well as oral presentations (developing oral expression), as instruments of assessment.

They highlight group work and oral and written expression (in different languages) as the most important generic competencies.

The program coordinators coincide with the students, expressing that the design of the Master's program based on competencies allows them to participate in the teaching/learning process. They also state that all theory is put into practice with practical exercises, which prepare students for the professional world. The coordinators also agree with the students in terms of the reflection on the difficulty of measuring all the generic and specific competencies equally during the time allotted for the Master's program.

Therefore, having compared the two Master's degree programs, we can conclude that the design strategy has been similar at both the public and private universities. The students clearly perceive a change and a Master's program that has been designed based on competencies, and in which

these are evaluated. Nonetheless, as has been seen, it is difficult to measure each of them separately.

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