



An empirical study of POM teaching in Spanish universities (II)

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Faculty profile, teaching and assessment methods

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Abstract *Production/operations management (POM) is today a key element for the competitiveness of companies, and the demand by Spanish companies for university graduates qualified in this area is significant. Therefore, in this discipline, the correct education and training of future business managers is an evident need to be addressed; however, little is known about the current situation of POM teaching in Spanish universities. Hence, to obtain reliable and useful data, a comprehensive empirical study of the total population of university teachers of this discipline in Spain has been undertaken. The present paper concentrates first on the analysis of the characteristics of the POM faculty in Spanish universities, then considers the teaching and assessment methods and the didactic material employed in the teaching of this discipline. In both cases, a critical analysis has been made of the various problems observed, and alternative solutions have been proposed. The analysis of the content of POM programs is the subject of another article published in this journal.*

Introduction

In the article devoted to Part I of this empirical study (Machuca and Alfalla, 2003) we stressed that although production and operations management (POM) training is a critical element for companies in achieving higher business competitiveness, it appears that many universities do not seem to be really aware of the importance of the field. Many important aspects that influence the quality of POM teaching remain practically unknown, such as the number of credits awarded and the content of POM courses, the number and characteristics of POM faculty and the teaching and assessment methods used. In our opinion, only when the higher education institutions in leading



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countries confront these questions with in-depth studies will we begin to build up a true picture of POM teaching. Only then will we have the means to compare courses and improve quality. In light of this situation, we considered it vitally important to seek answers to these fundamental questions in order to determine the position of POM teaching in our country. We also hope that with this study we may be providing a model which can be used for other similar studies in EU countries. Never before had all these aspects of POM teaching been researched together as a coherent whole. It was our considered view that research of such scope and depth was absolutely essential in order to give valid guidelines for improving the teaching of our discipline.

As the content of POM courses in Spain was discussed in another issue of this journal (Machuca and Alfalla, 2003), in this related article we are concentrating on the census and characteristics of POM faculty, and on the teaching and assessment methods employed in POM courses taught at Spanish universities. Moreover, since the features of the empirical research were fully described in the first article, we shall limit ourselves herein to a short summary of the methodology used.

Our study concentrates on the first and second levels (or cycles, as they are known in Spain) of university education for the four degree qualifications: "Licenciatura" in Business Administration (LBA, four or five years), "Diplomatura" in Business Administration (DBA, three years), Higher Industrial Engineering (HIE, five or six years) and Technical Industrial Engineering (TIE, three years), since these are the academic degrees in which most of the courses involving POM are included (in this paper, the terms "academic degree", "degree" and "university degree" will be used indistinctly to refer both to the qualification awarded and to the university-level course of studies and teaching leading to this qualification).

A survey was conducted of the total population of POM faculty for the 1997-1998 academic year. The total number was identified as 241 teachers (138 in Business Administration (BA) degrees and 103 in Industrial Engineering (IE)) employed by 46 universities. Due to the relatively small size of the population, it was not considered appropriate nor necessary to resort to sampling techniques, as a result of which the questionnaire was mailed to all the teachers identified. A final response rate of 70.5 percent was achieved (103 teachers or instructors of BA degrees and 67 of IE in 43 Spanish universities). This high response rate allows us to draw significant conclusions that can safely be extrapolated to the population as a whole with a minimal margin of error, and be taken to show the real position of POM teaching in Spanish universities generally.

An analysis of the responses showed that a total of 281 POM courses taught as part of 92 university degrees (35 LBA, 22 DBA, 22 HIE and 13 TIE) were recorded for all the degree courses indicated by respondents in 1997-1998. However, the same course is sometimes taught by more than one teacher; if this

overlap is allowed for, the effective total is reduced to 190 different POM courses. Nevertheless, this repetition has only been eliminated for analysing course characteristics. The 190 POM courses analysed are allocated a mean duration 61.1 hours; a low standard deviation around this mean was found, with 68 percent of all courses being allocated between 45 and 60 hours of teaching (Machuca and Alfalla, 2003).

POM faculty

The first point we emphasize with respect to POM faculty is that very few of the published studies analyzed have dealt with this subject, and in the cases that they did, they did not include all aspects as far as the position in the USA is concerned (Ducharme and Lewis, 1987; Raiszadeh and Ettkin, 1989; AACSB, 1987, 1998). This lack of studies of POM faculty in Spanish universities, together with the absence of associations or specific meetings and gatherings for faculty members for the discipline there, has meant that the situation and characteristics of said faculty have remained largely unknown, even among the group members themselves. Given this, we set ourselves the following objectives:

- To conduct a census of POM faculty in Spanish universities and to determine whether there are sufficient numbers of teachers compared with other disciplines.
- To determine the principal characteristics of the POM faculty: professional category, academic degree, number of years of POM teaching experience, etc.

In the following sub-sections, we comment briefly on the main results of our study.

Census of POM faculty

The census of the Spanish POM faculty was conducted by telephone together with a prior survey of those POM faculty already known to us. After seven months of meticulous work, we arrived at a total of 241 names of POM teachers active in the 1997-1998 academic year, a figure we believe to be very close to the true total at that time.

It must be said that, before this census, neither the numbers nor the identities of the full set of POM teachers in our country were known to anyone. Moreover, without this data, it would have been virtually impossible to organize and hold the First World Conference of Production and Operations Management, which took place in Seville in August 2000, and brought together for the first time 138 POM faculty members of Spanish universities, representing 57.3 percent of the census total. As a result, networking among the Spanish academics and between these and POM academics from 33 other countries became a realistic possibility for the first time. This fact alone shows

the value of undertaking similar studies in other countries and publishing the results (this Spanish census, now up-dated, can be consulted on our Web page (<http://gideao.us.es>). It is regrettable that, apart from certain exceptions, the number of teachers whose data are widely known in the various other European countries is minimal, in comparison with the probable true numbers (as an example, in the EuROMA membership list of 2001/2002 only 29 Spanish teachers' names appear, despite there being more than 200 names listed at the undergraduate level alone; other countries are even worse, with just six French, six German, seven Portuguese teachers, etc.)

Although the census produced a much greater number of POM teachers than we expected to find, we also thought it would be instructive to compare this with the totals known for other management disciplines. We note that according to the estimates of the Spanish Association of University Faculty of Accounting (ASEPUC), there were more than 900 teachers of this discipline by the end of 1999. In the field of marketing, the total number of university teachers was about 460 in the 1998/1999 academic year. In view of these comparative figures, and as our study has shown, we can say that the present total number of POM teachers in Spanish universities is clearly insufficient for such an important and fundamental management function as production/operations. Furthermore, taking into account that the great majority of these estimated totals for Accounting and Marketing faculties are teachers on BA degrees, and that only 138 of the POM faculty identified in our census claimed to be working on BA degrees, then the numerical difference is even more evident. When we consider also that the size of faculty contingent tends to be a reflection of the number of POM courses that are incorporated into current academic degrees, as well as of the number of corresponding credits assigned to these courses (which were analyzed in our first article on this study (Machuca and Alfalla, 2003), we have to say that our discipline continues to occupy a secondary position with respect to others with which it should be of equal importance, given the relevance of POM to all companies today. A contributing factor to this unsatisfactory situation is that in Spain POM is not officially classified as a specific "area of knowledge". The official "areas of knowledge" are limited to those defined under Spanish legislation as integral to the development of the various academic disciplines and which are included as obligatory subjects in all the corresponding university degrees through one or more required core courses. POM topics are normally integrated into the area of knowledge designated "business organization" (and in principle any lecturer in any aspect of business organization can be responsible for teaching POM). This situation is different from that of, for example, Marketing, which is recognized as a specific area of knowledge in itself. In the case of the BA degrees, POM is not even included in the disciplines that constitute the required core contents, in contrast to the situation of Marketing, Accounting and Finance. This means that, whereas these latter disciplines figure as obligatory in all the BA degrees,

each center has discretion over whether or not to introduce POM into its degrees. The effect of this is to dilute the role of POM in Spanish BA degrees. Its true importance is not reflected and the development of the discipline is severely hindered. Nevertheless, in spite of these difficulties, it is encouraging that over the last decade there has been a considerable increase in the number of POM faculty, particularly in BA degrees; we hope that, if this trend is maintained, the discrepancies identified in this study should reduce in the future.

If the census data are analyzed to separate faculty in function of whether they are attached to centers teaching BA or IE degrees, it can be observed that, although the BA degrees employ more POM faculty than IE degrees in absolute terms (138 compared with 103, respectively), these also show fewer POM instructors per center (averages of 2.4 compared with 3.0). If we add to this finding the observation that the student/teacher ratio on IE courses is much more favorable than on BA courses, the manifest disadvantage suffered by these latter degrees is clear to see. These data should serve as a point of reference, so that responsible authorities take the necessary measures to correct this situation, which has clear negative consequences both for the professional development of many POM teachers, and for the development of the discipline itself in the many university centers teaching BA academic degrees. In our judgment, this desirable advance would be accelerated if POM were to be adopted nationally as a core course in the curricula of the university degrees analyzed.

Faculty profile

In this part of our study, our aim is to outline a profile of the total population of teachers of this discipline, through the analysis of the following academic background factors:

- number of years of POM teaching experience;
- professional category;
- holder or not of a doctorate;
- whether doctorate was gained for POM-related work; and
- teaching on courses of other management disciplines.

Comprehensive data were collected but we shall limit this report to the more notable conclusions.

The average length of service of POM faculty in this discipline is some six years. Although teachers can be found with 30 years of experience, 78.8 percent of the total have been teaching POM for nine years or less. It must be remembered that it is only in this last decade that a substantial number of such instructors were incorporated in Spanish universities, particularly in BA studies. Analyzing these by type of academic degree, it can be observed that the average number of years experience of faculty on BA is rather less than of

those on IE degrees (five years compared with eight years). Therefore, overall, one can identify a certain “youthful” profile of POM teachers, particularly pronounced on BA degrees. The greater length of faculty experience in IE is doubtless due both to the longer period of time such courses have been established and the greater “sensitivity” traditionally demonstrated toward POM.

In relation to the professional category, it is observed that, overall, only somewhat more than half of POM faculty (55.3 percent) have tenure. This situation is considerably worse in centers teaching BA than IE; in the former, tenured teachers barely account for 50 percent of the total, whereas in the latter, they account for 62 percent. These data are consistent with those presented previously, since progress toward tenure is closely related, among other factors, to the number of years of service teaching and to the time available for professional development, which is inversely proportional to the teaching load carried by the teacher; this load is greater on BA degrees which have higher student numbers and higher student/teacher ratios. Considering the total Spanish population of university teachers, in the academic year 1997/1998 those with tenure comprised 55.4 percent. In Marketing, the proportion was 34.4 percent and in Finance and Accounting 47.2 percent. Therefore in POM we are a better position than these other two disciplines.

The proportion of POM teaching staff who hold doctorates is 52.1 percent, although the situation varies notably according to academic degree. On BA courses, faculty with a doctorate make up 45.4 percent of the total while in IE the number rises to 61 percent. For Spanish universities as a whole, the percentage with doctorates is 43 percent, but we have not found comparable statistics for other business studies disciplines. Be that as it may, although in our opinion we are still far from an optimum situation, these aggregate figures may be taken as an indicator that a significant potential for research is being generated in our discipline; from these results it can be seen that in Spain there is already a certain “critical mass” of doctorate-level faculty dedicated to POM in relative terms. The hope must be that the recent rapid increase in the number of instructors in the discipline will soon lead to a similar rapid increase in those gaining doctorates in the field.

We decided to analyse whether or not those who currently hold doctorates wrote their doctoral theses on POM issues, as this would be an indicator of how well consolidated the discipline currently is. The results show that more than 61 percent of these faculty members had written their theses on topics within the POM field. A breakdown by type of academic degree reveals that only 56.5 percent of the total number of instructors teaching on BA degree courses with doctorates wrote their theses on POM topics and, as such, directed their research toward the subject from the beginning. The situation is rather different with regard to IE degrees; approximately 67 percent of this faculty holding a doctorate had already demonstrated their POM research ability by

completing their doctoral theses in said field. This could be the result of IE degrees being established earlier than BA degrees, with POM being more consolidated into their curricula, and to the higher degree of specialization demonstrated by IE instructors; at the same time, the more recent appearance of POM in BA curricula may have led to the discovery that more teaching staff have doctorates in different, but connected, areas. The aspects most dealt-with in doctoral theses were: AMT (19.2 percent), an analysis of specific production sectors (11 percent), operations strategy (9.6 percent), process management (8.2 percent), scheduling (6.8 percent), quality management and control (6.8 percent), JIT (5.5 percent) and simulation (5.5 percent).

This section is concluded with the comment that POM faculty on BA degrees would appear to have a greater potential for teaching with a cross-functional approach, which is a very important need for POM, as many authors have pointed out (some of these authors can be found cited in Machuca *et al.*, 2000). More of these instructors either are currently teaching or have in the past taught other management disciplines, in comparison with POM teaching staff on IE degrees (84.5 percent compared with 63.6 percent), in addition to having themselves received a more multi-disciplinary training in their own university studies. This is a very important aspect that was raised by the American Assembly of Collegiate Schools of Business in 1995, when it concluded that one of the problems affecting the teaching profession was the lack of interdisciplinary capabilities in faculty.

POM teaching at Spanish universities

With respect to the teaching of POM courses, the following objectives were set for our research:

- To determine what teaching methods are employed in POM courses and for what reasons each of these methods was or was not adopted by the faculty member surveyed.
- To study the assessment methods that are used in POM courses, together with the weighting of each type of evaluation in the student's final grade or mark.
- To determine which didactic materials are used by the students, together with the relative extent to which each type of material is used.
- To find out what teaching tools are relied on by teachers for presenting their courses, together with the relative degree to which they are utilized.

In the following sub-sections, the results obtained and conclusions reached in relation to each of these questions are presented. Each of these factors was analyzed, first, in aggregate for the set of POM courses as a whole, and second, in function of the main characteristics of the courses (academic degree, required or elective status, number of credits ...) and of the teacher (professional category, holder or not of doctorate or teaching on courses of other

management disciplines . . .). However, the only characteristic that has shown a noticeable statistical influence on the factors mentioned is the academic degree. For this reason, in this article we will comment only on the results related to this particular variable. Our objectives are not only to develop a detailed descriptive analysis of these aspects of POM teaching as practiced in Spanish universities, but also to go deeper into the possible causes that might explain our findings on whether or not various different methods and means studied are being employed. In addition, we have tried to establish analogies and differences in respect of the results obtained in other studies of this topic in other countries, although the possibilities for such comparisons are rather limited by the scarcity and partial scope of such other studies.

Concentrating on those studies of the teaching and assessment methods used at university level, our comprehensive bibliographical search has revealed only three studies, conducted by Carraway and Freeland (1989), Raiszadeh and Ettkin (1989) and Goffin (1998). Two of these relate to the situation existing more than ten years ago, but do not appear to have been up-dated. The first analyzes the POM courses offered by 20 leading graduate business schools, determining, among other questions, the teaching methods, the didactic material and the assessment methods utilized. The study by Goffin (1998) presents similar objectives in respect of ten leading European business schools. Hence, since these studies are concerned with POM at MBA level, their conclusions are not directly comparable with those of our study, relevant to the two first-degree levels of university education. In respect of the study of Raiszadeh and Ettkin (1989), this analyzes, but not in depth, the methods employed by 431 POM teachers in US universities (a response of 42 percent of the population surveyed). We shall comment on the main results obtained from these studies in the relevant sections of this article; we will also refer to more specific studies that illustrate situations of interest at certain universities and centers but without providing a general view of the discipline.

Teaching methods used in POM

As a key element in the call for new approaches that are more consonant with the reality of POM teaching needs (Machuca *et al.*, 2000; Hayes, 2000), we must also renew the teaching methods employed and adapt them to the new necessities of the discipline, taking advantage of the possibilities for improvement offered by technological advances.

In the study by Raiszadeh and Ettkin (1989, p. 38), it was observed that, in US universities, traditional teaching based mainly on the lecture method and, to a less extent, on the case study method, was clearly predominant, with very little use being made of the computer in the classroom. In the studies by Carraway and Freeland (1989, pp. 77-9) and by Goffin (1998, pp. 440-43) evidence was found of more use of methods that bring the real world into the classroom environment, such as case studies, factory visits or business games

and simulations. This would seem logical since, as already mentioned, both these studies focus on MBA programs, which can usually count on more resources and fewer students per class than the BA and IE first-degree courses we have surveyed. The remainder of the published studies found dealing with this aspect of POM teaching are concerned with analysis of specific experiences of the application of various different teaching methods in various universities (among these, see for example de Meyer, 1996; Machuca, 1998; Kumar and El Sawy, 1996; Lovejoy, 1998; Morris, 1996; Moskowitz and Ward, 1998; Simons, 1996; Spearman and Wallace, 1998; Spearman and Hopp, 1996; Schwarz, 1998).

In our study, the various different methods employed in the teaching of POM courses at Spanish universities have been analyzed under the following seven categories: lectures, case studies, company visits, guest lectures by practitioners, business games, multimedia technologies and exercises performed using computer software. The analysis of 261 courses (20 responses were not valid) shows the clear predominance of the most traditional and best-known methods, IE the lecture and the case study. In contrast, the incidence of methods using the new technologies is very scarce (Figure 1). The full class lecture clearly continues to be the method most frequently employed by the POM faculty in Spain, followed by the case method (although as we shall see later, with only moderate emphasis). In respect of the rest, more modern methods are used more frequently on IE than on BA degrees: exercises performed using computer software are used on 68 percent of IE courses, as against on 50 percent of BA courses, visits to companies on 60 percent, as against on 27 percent, invited practitioners on 55 percent, as against 21 percent; and software for problem-solving on 68 percent, as against 50 percent. The underlying causes of these differences can be found in the smaller number of students in IE classes, and the better ratio of IE teachers to students, which imply a substantially reduced number of IE students per group and

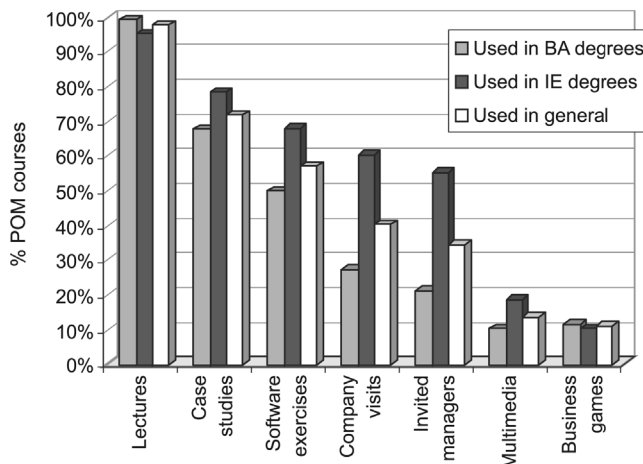


Figure 1.
Teaching methods used in POM courses surveyed

more time available to the IE teacher; the establishment of this important finding should help toward resolving these differences. One last aspect to emphasize is that there are few courses (10.7 percent) in which just one single teaching method is adopted.

In this survey of the different teaching methods used, we have not limited the analysis to whether they are used or not but have also found important to enquire about the intensity or frequency with which each method is used; results of this are given in Table I. Here it can be seen that the pattern of use already identified is reinforced, because not only is the lecture the method used in most courses, and by most teachers, but it is also the method most frequently reported by teachers as “frequently used”. Although the intrinsic virtues of the lecture method are defended by many, we are with others who believe that it is necessary to use other methods that more clearly bring the student closer to the complex business reality of POM, and that the master lecture presents limitations in this respect (e.g. Hayes, 1998; Houshyar, 1990; Laforge and McNichols, 1989; Oakland *et al.*, 1986). Nevertheless, as we shall see in the following section, in the current context in Spain (scarcity of resources in most of our centers and departments, classes frequently with a large number of students) it is going to be very difficult to change this situation. Of the other methods considered, only the case study and exercises performed using computer software present significant percentages of reporting in the “moderately used” category. All the rest are used relatively infrequently. It is important to note the scarce use made of simulation, of business games and of multimedia techniques, despite respondents apparently being clearly aware of their advantages, which have been stressed by many authors (Hayes, 1998; AACSB, 1997; Forrester, 1989; Machuca, 2000; Machuca *et al.*, 1998, 2000; González *et al.*, 2000). In spite of this, the potential benefits of these are still not materializing, due to the very limited use of these new methods.

Given their increasing development, it would also seem important to familiarize students with the use of the software employed at various levels in POM. Some POM manuals include software packages as complementary material to the text; as an alternative to such programs, spreadsheets are frequently adapted. Some studies describe specific experiences of applications specially designed for the teaching of POM topics (e.g. Batley, 1991; Chong and Kukalis, 1989; De Lurgio and Zhao, 1989; Smith, 1990; Southern, 1986); other authors go beyond this and propose the utilization in teaching contexts of the same POM software actually used in companies, with the aim of imparting realistic training based on the activities undertaken in the production function in actual companies (e.g. Laforge and McNichols, 1989; Laforge and Busing, 1998). Some authors writing in our discipline (e.g. Saluti and Brown, 1987; Satir and Goyal, 1987) consider this matter sufficiently important to suggest the creation of specific courses, which should be introduced into the curricula of courses. However, in spite of the advances observed in recent years, it must

Frequency of use	Lecture		Case study		Software exercises		Visits to companies		Managers invited		Multimedia		Business games	
	BA (%)	IE (%)	BA (%)	IE (%)	BA (%)	IE (%)	BA (%)	IE (%)	BA (%)	IE (%)	BA (%)	IE (%)	BA (%)	IE (%)
Not used at all	0.6	4.7	32.3	21.7	50.0	32.1	72.6	39.6	78.7	44.8	89.7	81.1	88.4	89.6
Infrequently used	4.3	5.7	20.7	40.6	15.2	19.8	20.7	43.4	15.9	44.8	7.7	7.5	5.5	2.8
Moderately used	25.6	26.4	38.4	26.4	22.6	32.1	4.3	15.1	5.4	4.8	1.9	5.7	5.5	1.9
Frequently used	69.5	63.2	8.6	11.3	12.2	16.0	2.4	1.9	0.0	5.6	0.7	5.7	0.6	5.7

Table I.
Frequency or extent of use of different teaching methods

also be said that in general the software available for teaching purposes has not yet reached the level of suitability necessary; moreover, the extent of use of such software in Spanish universities is much less than could be considered desirable.

In the light of these results, it can be stated that POM teaching in Spain is still clearly dominated by the most traditional methods, while the introduction of those methods that could bring the real world of business more directly into the classroom can only be described at best as timid. The most striking single factor affecting the reality of business management today in all functions is the ubiquity of the computer: sadly, in POM teaching, the computer is only used with any significant frequency with problem-solving software, for which limited application it is used in about half of the courses analyzed.

It would therefore seem that the move from dependence on the traditional master lecture toward its combination with more innovative and effective methods is not taking place as we would like to see; the situation in which we find ourselves in teaching methodology is analogous to that of US universities more than a decade ago (Raiszadeh and Etkin, 1989). In respect of the studies by Goffin (1998) and Carraway and Freeland (1989) on MBA programs, the situation differs from that found in our universities; from these studies one can see that MBA students are able to get closer to the real world through the more frequent use of visits to companies, invitations to practising managers and games and simulations.

Faced with the situation we have described, and given that we believe that, just because most teachers are using certain methods, these are not necessarily the methods they should be using, we considered it fundamental to determine the causes leading teachers to opt for the more traditional methods, and not employ more innovative methods more frequently. In our opinion, such modern methods would train students in an educational framework increasingly better adapted to bringing the student into closer contact with the world of business, and would in the training process apply those new technologies increasingly used in business. A lot of results were gathered but for reasons of space, we shall only comment on those considered the most relevant:

- *Large number of students in classes (especially on BA degrees).* In very many cases, this situation leads the teacher to use lectures as the only possible method.
- *Lack of resources.* This is particularly for multimedia technologies and business games (classrooms properly equipped with hardware are simply not available in many centers).
- *Lack of suitable software.* Software developed by companies is expensive, with sophisticated hardware requirements, and is excessively complex. At the other extreme, the available educational software is generally too simple and with a “not-very-friendly” user environment.

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- *Great expansion of course content.* Our discipline has undergone a considerable increase in the number of topics of interest. This situation, together with the insufficient number of hours available has again led faculty generally to tend toward lectures as the basic teaching method.

Assessment methods in POM courses

As already stated, we only found two empirical studies on the situation of teaching in this discipline that report research into the assessment methods applied in POM courses. Referring to the obligatory courses, Carraway and Freeland (1989, p. 77) state that the final grade of the student is obtained from:

- examinations (type of examination not stated), the results of which carry an average weighting of 50 percent;
- written-up case studies (25 percent weighting); and
- classroom participation (25 percent weighting).

The authors provide no information on the results of the elective courses, in their analysis. For his part, Goffin (1998, p. 443) concludes that all the European business schools studied use a combination of at least two different types of assessment. In terms of the marks allocated, examinations (the majority based on short case problems) are the most important methods. They are used at every school and, on average, 58 percent of the total POM grades are derived from examination results (with a range from 30 percent to 80 percent). Written assignments (case assessments, short projects . . .) also account for a significant proportion of total grades on most courses. In contrast, class participation is assessed at only three schools with the range of marks assessed from this varying from 10 percent to 70 percent of the final grade. Therefore, in both these studies, the examination appears as the fundamental means of evaluating the knowledge acquired by the student, although written assignments also carry a significant weighting. Nevertheless, neither study deals with the situation on undergraduate courses, therefore we cannot draw close parallels between business schools and the results found from the study of POM taught in Spanish universities.

In our study, the assessment methods used were analyzed for a total of 267 courses (14 responses were not valid). Teachers were asked to indicate the weight in percentage terms allocated to a series of different assessment methods, in arriving at the overall grade awarded to students. These different methods indicated in the questionnaire are:

- test-type theoretical examination;
- theoretical examination with questions to be developed;
- practical examination (problems and exercises);
- class participation; and
- projects or studies carried out by student.

As shown in Figure 2, the situation is very similar for both academic degrees, although class participation and test-type theoretical examination are more used in IE degrees. In aggregate terms, the method most frequently used, albeit with differences, is the practical examination, used in almost 95 percent of courses; this is probably due to the eminently tactical/operational approach presented by our discipline at Spanish universities. Next most used is the theoretical examination with questions to be developed (70 percent) and the undertaking of projects by students (65 percent). The methods least used are student participation in class (46 percent) and test-type theoretical examinations (36 percent). It is also observed that teachers normally employ between two and four different methods to evaluate the progress of students in POM courses, with an average of three methods; very few report that they base all of the final grade on one single test (only 2.6 percent).

With respect to the weighting given to each assessment method (Table II), we observe a very similar situation in the two main types of academic degree. The practical examination has a high specific weight in the final grade (representing on average somewhat more than 46 percent of the final grade)

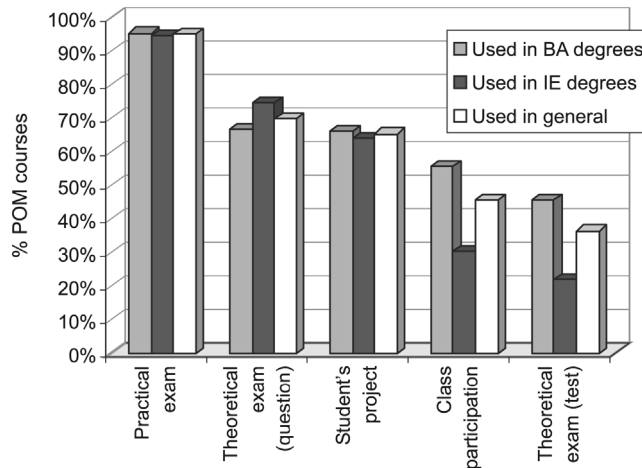


Figure 2.
Assessment methods used in POM courses

Assessment methods	BA degrees			IE degrees		
	Average (%)	SD	Maximum (%)	Average (%)	SD	Maximum (%)
Practical examination	43.4	19.8	100	50.0	24.6	100
Theoretical examination with questions	22.5	21.0	75	24.0	17.9	65
Student's projects	13.5	15.6	90	14.2	15.8	100
Test-type theoretical examination	14.7	20.8	100	6.0	14.6	100
Class participation	5.6	6.0	25	5.7	12.9	60

Table II.
Weighting given to the different methods of evaluation in the final grade

followed by the theoretical examination (23.1 percent of the final grade). In IE degrees, the student's project is the third most important element, but in the BA degrees the test-type theoretical examination has more weight than the project. For both academic degrees, class participation carries the least weighting in the final mark. It is also worth noting that sometimes the test-type examination, the practical examination, and the student's project (in IE degrees) are each used as the only method of evaluation, albeit in only a few courses.

Didactic material used in the teaching of POM

Students need to use a variety of didactic material in their work on POM courses, such as:

- class notes taken by the student;
- textbooks;
- notes on theory issued by the teacher or department;
- problems and cases for study, issued by the teacher or department;
- journal articles;
- papers of various types (from lectures, conference papers, working papers, etc.);
- software produced by the department; and
- externally-produced software.

The material available for use by the student will have a notable influence on the content and quality of instruction received, and the choice of material will depend to a large extent on the teacher's preferences, as well as on the characteristics of the courses themselves.

As with the methods of assessment, there are very few empirical studies of the POM situation that have enquired into the didactic material used by students of this discipline. Only in the cited studies of Carraway and Freeland (1989, pp. 77-82) and of Goffin (1998, p. 440) can any references be found. The first of these states only that, although 75 percent of the required POM courses analyzed use one or more of the available textbooks, few use the same one; on the elective courses, there appears to be more diversity, depending on the particular specialty of the course. The second study only indicates that six of the ten business schools studied recommended particular textbooks, while the other four have decided against recommending a textbook and instead use material extracted from several books or journal articles. Consequently the results obtained do not provide a clear picture of the didactic material used by students in their POM training nor do the results allow any useful comparison with the Spanish situation.

The results of our research (Figure 3) reveal that class notes taken by the student, textbooks, and problems and case studies issued by the teacher/department are used in almost all courses, with minimal differences

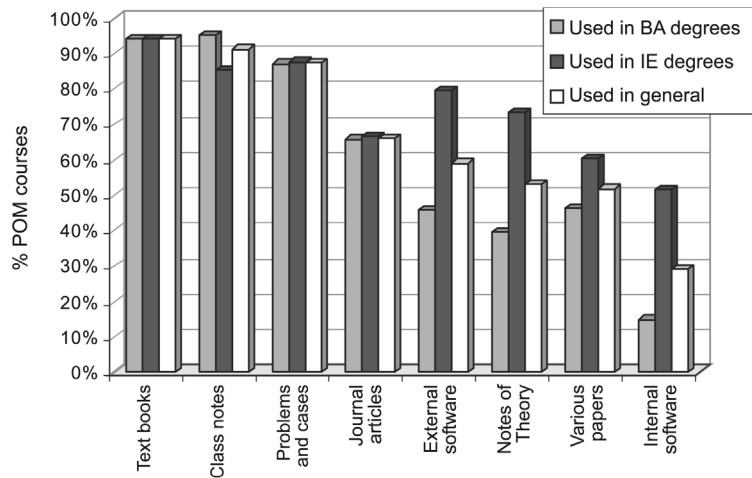


Figure 3.
Didactic material used on
POM courses

between the two types of degree. However, differences are found in respect of most of the complementary material (which is used but to a less extent): notes on theory, papers and software. In our opinion, these differences could be due in part to the stronger tactical/operational focus observed in the POM courses in IE degrees (Machuca and Alfalla, 2003). However, we believe that these differences are mainly due to the smaller size of student groups and the lower student:teacher ratios found in IE degrees.

If we analyze by type of degree the extent to which each type of material is used, we obtain the results given in Table III. Three basic types form the core of the materials currently in use: class notes; textbooks; and problems and practical cases issued by the teacher or the department. All of these are used very extensively, each reaching a frequency of use of around 65 percent, as a minimum (based on the sum of the categories of frequent and moderate use).

As stated, textbooks clearly form a basic element in the instruction received by Spanish students in this discipline. This coincides with the findings by Carraway and Freeland (1989) and by Goffin (1998) at the MBA level. This is not surprising given the increased quality and quantity of available POM textbooks, which have improved dramatically over the past decade. An analysis was also made, as part of this study, of the specific textbooks used in POM courses at Spanish universities. The survey revealed a total of 30 titles in use. Table IV shows the percentages of respondents using and not using each of the ten most frequently used manuals. In general, it can be said that textbooks in Spanish are used much more frequently than those in English, which is natural considering that working with foreign-language textbooks represents extra effort in addition to that imposed by the complexity of the discipline itself. We can therefore summarize the situation by stating, first, that there exists a well-defined nucleus of textbooks used on POM courses in Spanish universities, comprising predominantly those written in or translated

Frequency of use	Textbooks		Class notes		Problems and cases		Journal articles		External software		Notes on theory		Various papers		Internal software	
	BA (%)	IE (%)	BA (%)	IE (%)	BA (%)	IE (%)	BA (%)	IE (%)	BA (%)	IE (%)	BA (%)	IE (%)	BA (%)	IE (%)	BA (%)	IE (%)
Not used at all	5.7	5.7	4.9	14.7	12.8	12.3	34.2	33.3	54.0	20.4	60.5	26.4	53.7	39.4	85.2	48.5
Infrequently used	14.6	30.2	17.7	14.7	9.1	16.0	37.9	38.1	19.9	22.3	17.3	10.4	34.0	36.5	7.4	17.5
Moderately used	42.7	50.9	26.2	36.8	40.2	30.2	21.7	24.8	16.8	39.8	9.3	36.8	6.8	21.2	6.8	26.2
Frequently used	36.9	13.2	51.2	34.3	37.8	41.5	6.2	3.8	9.3	17.5	13.0	26.4	5.6	2.9	0.6	7.8

Table III.
Extent to which
each type of didactic
material is used

into Spanish; second, it is important to note the presence of six books written by Spanish authors among the ten most commonly used textbooks, which indicates the existence of a growing nucleus of teachers and researchers firmly dedicated to advancing the POM discipline in our country and other Spanish-speaking countries. From the analysis of the usage of the cited manuals in function of their use as either basic or complementary bibliography, it can be seen that certain titles are clearly established at the forefront of POM teaching, while certain others are well-established as complementary textbooks.

Types of support tool used in POM teaching

Whatever teaching method is used, the teacher must rely for help on certain tools or equipment for suitably transmitting to the student the wide range of POM concepts, methods, techniques and other material being taught. The most commonly used media are:

- blackboard;
- overhead transparencies;
- mounted slides;
- video; and
- computer presentations (plus their associated projection or viewing equipment, screens, loudspeakers, etc.).

The usage of these tools for POM teaching has not been considered before in the few other empirical studies consulted, therefore no comparison is possible with the findings of our study in this respect. However, some specific examples have been described of the employment of various support tools in the classroom, particularly the use of videos, with the aim of illustrating aspects of the reality of our discipline to students (Sohal and Oakland, 1990; Schvaneveldt, 1996).

From our study, we found that POM teachers in Spanish universities mostly rely on the more traditional support tools in their classes. Figure 4 shows that the blackboard and transparencies clearly occupy the first two positions in our

Table IV.
Frequency of use of the ten textbooks most used in POM courses at Spanish universities

POM textbooks	% used	% basic	% complementary
Machuca et al. (1995a)	72	69	31
Machuca et al. (1995b)	62	74	26
Chase and Aquilano (1994)	49	36	64
Schroeder (1993)	47	44	56
Fernández (1993)	35	55	45
Fernández and Vázquez (1994)	33	47	53
Díaz (1993)	28	30	70
Adam and Ebert (1991)	26	14	86
Heizer and Render (1991)	24	20	80
Companys (1989)	23	33	67

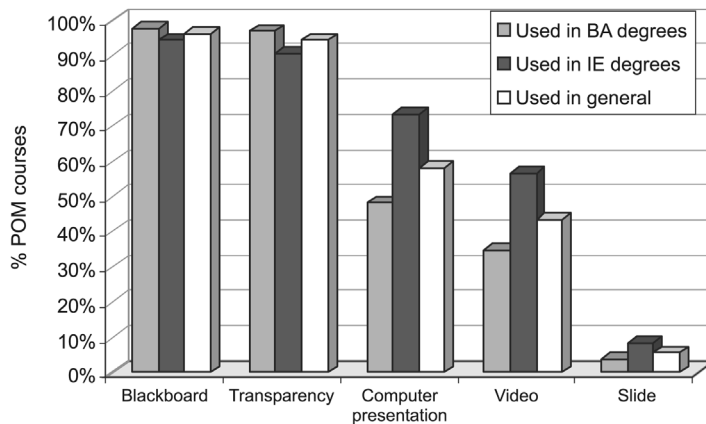


Figure 4. Usage of different types of support tool in POM courses

usage ranking, followed by computer presentations. In general, teachers of IE degrees tend to utilize the less traditional tools more frequently than those teaching on BA degrees. Here again we conclude that the relative larger groups and high student-teacher ratios on BA courses result in BA teachers having less time and opportunity to apply themselves to improving their teaching methodology.

If we consider the extent to which each type is used, to disaggregate the percentage of courses on which they are employed by academic degree (Table V), we observe that the situation is even worse than appears from Figure 4, since the most traditional support tools are not only the types used on most courses but that the extent of their usage is mostly reported as of frequent or moderate use, while the opposite occurs with the more advanced tools.

The great majority of POM teachers in Spanish universities are continuing with a generally traditional approach to the teaching of our discipline, predominantly employing the master lecture and case studies, usually supported by the use of the blackboard and transparencies. In our opinion, this situation could be due to factors similar to those referred to in respect of the usage of different teaching methods, particularly to the lack of sufficient time and resources, which also condition how teachers present their classes.

POM training in Spain: a geographic perspective

We considered it would also be interesting to analyze the POM faculty and teaching in function of geographic distribution, particularly to determine the differences in training in our discipline that exist between autonomous regions (our country is relatively decentralized and is divided into 17 autonomous regions, each with its own regional government and parliament). In our opinion, such an analysis should identify those areas with greater potential for training the future POM managers and staff needed by Spanish industry and commerce.

Table V.
Extent of usage of
types of support tool
in POM courses

Frequency of use	Blackboard		Transparency		Computer presentation		Video		Slides	
	BA (%)	IE (%)	BA (%)	IE (%)	BA (%)	IE (%)	BA (%)	IE (%)	BA (%)	IE (%)
Not used at all	2.4	5.7	3.0	9.5	51.8	26.7	65.2	43.4	96.3	91.4
Infrequently used	13.4	16.0	11.6	17.1	30.5	41.0	28.0	47.2	3.7	3.8
Moderately used	31.2	35.8	29.9	32.4	14.6	20.0	4.9	6.6	0.0	2.9
Frequently used	53.0	42.5	55.5	41.0	3.1	12.3	1.9	2.8	0.0	1.9

With respect to the geographical distribution of POM teachers, we have found an evident disequilibrium among the autonomous regions of Spain: just five regions out of 17 account for 60.2 percent of the total (regions shaded in Figure 5). As could be foreseen, these regions also account for the highest percentages of POM courses, which strengthens their position as important geographic nuclei for the development of the discipline.

To complete this information, we have carried out an analysis by universities (Table VI). This produces an analogous picture, with a small group of ten universities accounting for 50 percent of the total population of POM teachers; another 11 universities account for a further 25 percent, with the rest of the total of 43 universities located by the census accounting for the remaining 25 percent. On analyzing the number of POM courses by university, it is found that there are very few with more than four different POM courses. Considering the coincidence between this latter group and the group formed by those with more than five POM teachers, we obtain a list of ten specific universities, which, in function of these two parameters, could represent today a potentially important focus for the development of the discipline. Logically,

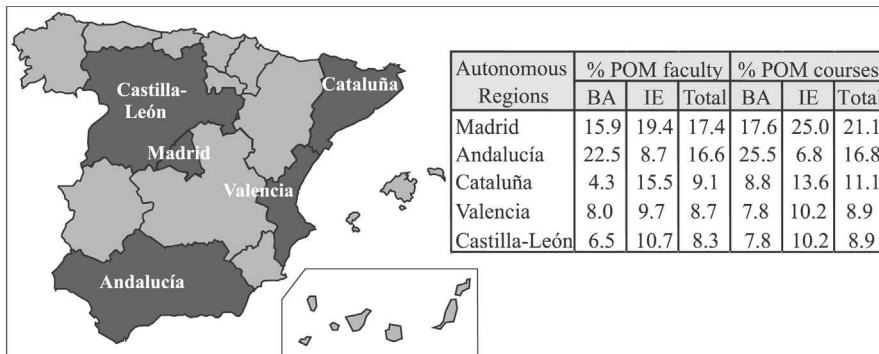


Figure 5. Autonomous regions of Spain with the highest percentages of POM faculty and courses, in 1997-1998

BA degrees		IE degrees	
No. of courses (new curricula)	University	No. of teachers	University
9			Polytechnic of Madrid
8			University Carlos III
7			Polytechnic of Valencia
6	University of Sevilla	12	Polytechnic of Cataluña
5	University Carlos III	5	
5	University Complutense	7	University of Pais Vasco
4	University of Las Palmas GC	9	
	University of Oviedo	10	

Table VI. Spanish universities with greater numbers of POM faculty, by type of degree course, in 1997-1998

this status will also depend on other related factors, such as the number of teachers with doctorates, the dedication of POM faculty to POM teaching, the student-teacher ratio, the interest in research work, etc.

We should add, lastly, that the teaching and assessment methods, evaluation methods, didactic material and support tools have not been compared in function of the particular university, given the relatively large numbers involved (43 universities, consisting of 74 centers). Such an analysis would have proved excessively extensive and detailed, and we have not considered it appropriate to include this in the objectives of our study. Nevertheless, the clear tendencies observed in respect of the aspects analyzed strongly suggest that the situation in the great majority of Spanish universities is generally very similar.

Final remarks

From the results of this study we conclude that, in Spanish universities, POM teaching is not given the importance it merits. As evidence for this, we have observed that the size of the contingent of POM teachers is smaller than that of other business disciplines. However, in recent years there has been a notable increase in the total number of POM teachers, although, in our opinion, this is still clearly insufficient in relation to the demand for qualifications in the discipline from both students and companies. But despite this, within this general picture, there is a small group of universities that, from their numbers and the professional category of their POM teachers and researchers and from the number of POM courses offered in their curricula, represent today a potentially important focus for the development of the discipline. Similarly, in relative terms, there exists a promising research capability in this field of study. Taking BA and IE degrees together: more than half of total teachers (52 percent) hold doctorates, and of these 62 percent presented a thesis oriented toward POM issues.

Having said this, however, significant differences are recorded in many of the characteristics of POM faculty in Spanish universities in function of whether they teach on BA or IE degrees. Two factors with a decisive effect in producing such differences are the length of service of POM teachers and the numbers of students per class. In the first case, the teaching of POM began earlier in IE degrees as the importance of the discipline was recognized sooner than in BA courses; in the second, particularly in BA degrees, action must be taken to reduce significantly the student-teacher ratio, which is much higher than in IE. The extent to which corrective measures are taken on these factors will determine the progress made toward consolidating the discipline in BA degrees and toward improving the level of training given to BA graduates.

Concerning the way POM is taught in Spanish universities, the large number of students in classes, the limited number of POM courses in the

academic degrees, and the widening area of topics relevant to modern POM seem to be the causal factors for the master lecture being the teaching method almost inevitably selected in Spanish universities, even though this may not be what the teachers would prefer. However, it also seems clear that, all too frequently, it is the limitations and deficiencies of the centers themselves that oblige teachers to opt for a traditional form of teaching, preventing the adoption of more innovative methods into their courses. We believe that the causes identified here have sufficient specific weight to state that, in the short term, it is going to be difficult for the teaching of POM to progress beyond its clearly traditional approach. In the current context, when Spanish universities are immersed in a generalized process of seeking quality improvements, these results we have obtained should serve to call to the attention not only of the POM teaching profession, but also of the academic authorities and the Government. We hope these results will guide all parties in adopting corrective measures to enable the continual improvement in the teaching of POM and its adaptation to the technological evolution and training needs of companies now and in the future.

We would emphasize that the results obtained have confirmed to us the opinions expressed in the opening section of this article: that is, it is necessary to undertake in-depth studies of POM teaching in various countries. This is the only way to determine, on the one hand, whether or not we are adequately meeting the needs of companies today in terms of personnel well qualified in operations and production management, and, on the other, what are the causes of the possible deficiencies that exist and how we resolve them. In other words, let us practice what we preach (and teach): having identified the needs of “our clients” and, from these, having established our objectives, we should conduct an in-depth analysis of the external environment in which we conduct our activities, then a further internal analysis. In this way we should be able to identify both the external restrictions and our own strengths and weaknesses. This done, we should then propose the alternative courses of action to enable us to achieve the objectives set, in the most effective way. If we do everything that is in our own power as professionals, we can then legitimately call on the competent authorities to facilitate our efforts in reaching goals that provide a clear benefit in the improvement of the competitiveness of businesses through the operations function.

To finish, we repeat our hope that this study of POM teaching, which we began in 1995 and which is the first conducted in such depth and scope in any EU country, may be followed by other similar work in other countries, for which we offer our collaboration. In addition to the benefits already referred to, this would allow comparative studies to be conducted, and collectively would at last provide a clear and detailed picture of the situation of POM teaching in the EU.

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