

# *Four Explanatory Hypotheses on the Relationship Between University Research and Teaching: A Reflection Based on Empirical Data*

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**ABSTRACT:** The aim of the present article is to respond to the formulation of hypotheses about the relationship between University teaching and research. To do so, we analyzed some empirical data on the activity and thoughts of university professors in response to the following four hypotheses: first, university teachers require and need their research; second, the relationship between research and teaching is significantly mediated by the professional category of the professor; third, the different areas of knowledge show different profiles as regards the teaching-research relationship, and fourth, there is a greater relationship between teaching and basic research than between teaching and applied research. The results obtained reveal the depth of interest of the discussion posed, a discussion that is still ongoing, and offer important delimitations based on our analysis and reflection.

**RESUMÉ:** Dans cet article, la relation existante entre l'enseignement et la recherche à l'université est analysée. Pour ce faire, quelques données empiriques sur l'activité et la pensée des enseignants universitaires sont étudiées à fin de répondre à ces quatre hypothèses: premièrement, l'enseignant universitaire demande et a besoin de sa propre recherche; deuxièmement, le rapport entre l'enseignement et la recherche est médiaité de manière significative par la catégorie professionnelle de l'enseignant; troisièmement, les différents types de connaissance présentent différents profils dans le rapport enseignement-recherche; finalement, il existe un rapport plus étroit entre enseignement et recherche de base qu'entre enseignement et recherche appliquée. À partir de notre analyse et réflexion, les résultats obtenus mettent en évidence la richesse et l'intérêt du débat posé qui s'avre un débat inachevé.

The relationship between research and teaching in the university forms part of an old and much debated topic of interest. Nonetheless, the dilemma has not yet been solved. It is well known that the university has traditionally carried out social functions regarding both teaching and research, but we should not overlook two questions inherent in the very essence of the university: first, that the university is an institution created to transmit knowledge, although it was later coupled with the possibility of creating knowledge, and second, that its main responsibility is, above all, to the students, a commitment that UNESCO contemplated in the *World Conference on Higher Education for the Twenty-First Century: Vision and Action*: "updating and improving pedagogical skills, through appropriate staff development programmes, encouraging constant innovation in curriculum, teaching, and learning methods" (UNESCO, 1998).

However, research became necessary in the university because it was essential to educate graduates in how to apply the knowledge being generated and the use demanded by society, although it is true that until the 19<sup>th</sup> century, when new needs arose, this had been an issue traditionally limited to the field of thought and the humanities (Ramos, 1999). Thus there seems to be no doubt that the university nowadays should ineluctably assume two inseparable functions, which are the *creation* and the *transmission* of knowledge. Nor should we overlook the reflection made by UNESCO when it highlights that "the relationship between scientific research, education, technological innovation and practical benefits is nowadays much more diversified and complex, and many persons besides researchers often take part in them" (UNESCO, 1999).

### *The Research-Teaching Relationship in the University*

As obvious as it may seem, it is pertinent to reiterate that the institution of the university was originally created for the purpose of transmitting knowledge, when in 1809 the founder of the University of Berlin, Wilhelm von Humboldt, suggested and proposed the idea of a university that, besides *teaching*, should *investigate*. From that moment this new model of university prevailed successfully, and it did so in detriment to other models and types of university.

The context of the relationship between research and teaching in the university is an essential part of an old debate (Pelikan, 1992). Hernández Pina (2002) has made an exhaustive reference of the large number of research studies that have been carried out which tend to be

grouped around four large categories established in the form of hypotheses: a) teaching and research are positively related (Neumann, 1992; Halsey, 1992; McCaughey, 1994); b) teaching and research are negatively related (Hattie & Marsh, 1996; Mooney, 1991; Ramsden & Moses, 1992); c) teaching and research are two independent activities (Barnett, 1992; Hattie & Marsh, 1996); and d) the relationship between teaching and research is determined by moderating or intervening factors (Hattie & Marsh, 1996; Friedrich & Michalat, 1983, Marsh & Hattie, 2002).

Here we would like to present and defend four hypotheses regarding the relationship between university research and teaching. It is our understanding that the idea that both professional dimensions are independent cannot be defended neither can the idea that their relationship is positive or negative. It is our view, then, that the relationship between teaching and research is mediated and conditioned by certain factors of great importance which we intend to approach using empirical data.

In our opinion, one cannot speak of incompatibility between teaching and research but rather of a professional duality that generates a problematic determined by new challenges and horizons. These challenges and horizons must be responded to and illuminated starting with how the professors themselves appraise their daily activity.

### *The Professional Practice of the University Professor*

We intend to take a look at what university professors do and how they perceive it, by examining the procedures used to recognize and explain their activity. We shall also explore how in tune the problem posed here is with the real professional situation that each professor perceives based on his or her teaching and research activities.

### *Context and Objectives of the Research Carried Out<sup>1</sup>*

To do this we start from the information obtained from 1205 university professors at four public universities in the Autonomous Regional Community of Castile and Leon (Spain), specifically, the Universities of Salamanca, Valladolid, Leon, and Burgos.<sup>2</sup>

Our research sought to describe the professors according to their *personal and professional characteristics*, detecting their *level of dedication*, degree of *motivation and satisfaction* concerning teaching-related activities, and identifying and evaluating their concerns

regarding pedagogical training. All of this with a view to establishing the possible and desirable relationship between teaching and research work, then to develop "typical profiles" of university professors according to the different sample segments.

### *Research Design: Population and Sample*

We considered that the most suitable research model for our objectives should be non-experimental (Campbell y Stanley, 1978), based on the application of *questionnaires*. Information was collected using an anonymous questionnaire sent personally to all the teachers in the public universities mentioned above. It was a closed questionnaire, with *fixed* answers in the text, with additional information on how to answer it and with an address to return it to once completed. The questionnaire was written based on the theory generated about the different professional aspects of university teachers, taking into account the technical characteristics required for this type of instrument for data collection (Martínez, 2002).

*Table 1. Teaching Staff of Public Universities of Castile & Leon (Spain): Population\* and Sample*

| University   | Population  |            | Sample      |            |
|--------------|-------------|------------|-------------|------------|
|              | N           | %          | N           | %          |
| Burgos       | 491         | 8.7        | 1e+11       | 9.8        |
| Leon         | 656         | 11.6       |             | 16.0       |
| Salamanca    | 1963        | 34.7       |             | 34.5       |
| Valladolid   | 2541        | 45.0       |             | 39.7       |
| <b>TOTAL</b> | <b>5651</b> | <b>100</b> | <b>1200</b> | <b>100</b> |

\* Data contributed by each University at the time of the study.

The relationship between *population* and *sample* is reflected in the table above where, as can be seen, there was in the first place a response of 21.2% of the total population, which is a *sufficient* amount for this type of study. Furthermore, there were *no significant differences* between the *percentages* of the *sample* obtained and the total teaching population of each of the Universities in question ( $c^2=1.6642$ ;  $p=0.6449$ ), which, from the perspective of the results to be obtained, is of great comparative and explanatory interest. In this respect, however, we should also keep in

mind the problems involved in this type of sampling (Rodríguez Osuna, 1993; Gaviria, 2000).

### *Formulation of Hypotheses*

Although in this type of research it is not necessary to formulate strict hypotheses, subjected to direct control and linked to experimental verification, we can speak of a hypothesis of indirect control when it affects a considerable set of relationships or very general concepts from which directly verifiable consequences can be deduced. We thus start from certain suppositions that will allow us to glean certain consequences.

Despite the fact that our research was aimed at checking and verifying several statements, in the present article we attempt to respond to the four hypotheses that we are currently interested in, and which are related to the link between University teaching and research. These are set up in the following terms:

*Hypothesis 1:* University teachers require their research as a way of *transmitting their own critical attitude as a researcher to their students.*

*Hypothesis 2:* The relationship between research and teaching is significantly mediated by the professional category of the professor.

*Hypothesis 3:* The different types of knowledge present different profiles in the teaching-research relationship.

*Hypothesis 4:* There is a stronger relationship between teaching and basic research than between teaching and applied research.

### *Prior Descriptive Characteristics: Sex and Years of Teaching*

We shall now go on to describe some characteristics of the *sample*, which, although they will not clarify relevant aspects of interest for our objectives, will allow us to establish a general framework of characteristics from which to successively deduce conclusions we may consider to be of interest.

In the first place, we differentiate jointly the sample of analysis according to two sociological variables, *sex* and *years of teaching*. The data obtained were the following:

Table 2. Description of the Variable *Sex / Years of Teaching*\*

| SEX<br>Vari-<br>able | Years of Teaching |     |               |      |                |      |              |      |       |      |
|----------------------|-------------------|-----|---------------|------|----------------|------|--------------|------|-------|------|
|                      | -5<br>years       |     | 5-10<br>years |      | 11-20<br>years |      | +20<br>years |      | TOTAL |      |
|                      | N                 | %   | N             | %    | N              | %    | N            | %    | N     | %    |
| Male                 | 40                | 7.4 | 167           | 30.9 | 182            | 33.6 | 152          | 28.1 | 541   | 1001 |
| Fem.                 | 13                | 5.1 | 76            | 29.7 | 96             | 37.5 | 71           | 27.7 | 256   | 00   |
| Total                | 53                | 6.6 | 243           | 30.5 | 278            | 34.9 | 223          | 28   | 797   | 100  |

\* 14 lost values

According to the distribution shown above there are significant differences according to *sex* ( $\chi^2=80.920$ ;  $p=0.000$ ); however, if we look at the percentages in this variable taking into account each of the pairs according to *years of teaching*, we can see that there are no significant differences in any of the categories ( $\alpha=0.05$ ).

We can confirm, then, that according to *years of teaching*, the teaching staff of the *sample* have been teaching for a long time in the University, which leads us to determine the importance of their opinion, thus affording greater consistency for our conclusions.

*Hypothesis 1:  
University Professors Require and Need  
Their Own Research*

The truth is that research constitutes an activity that in itself is fundamental and essential for the University, whether as a support and strengthening of teaching or as the teaching of the research itself, as well as in the training of researchers. We can therefore agree that

research and teaching are joined almost inseparably, and admit, in principle, that it is impossible to separate them.

The distribution and dedication of time that, on average, the teaching staff spends on carrying out their different activities is a good indicator for answering some of the concerns posed.

Within the set of rules regulating *professional activities and duties*, we have considered six categories of *tasks*: the first two are linked exclusively to teaching, although the next two can also have a teaching aspect, as well as admit a great variety of tasks that also have a certain link with the research training of the students. The final two categories are associated with the *research activity* of the teaching staff, as well as with *administrative and management functions*.

The following Table shows the mean number of hours that the teaching staff says it devotes weekly to each of the activities we have considered to be of interest, expressing accurately those essential functions that they usually take on professionally.

Table 3. Mean Dedication in Weekly Hours by Professional Activity

| Professional Activities/Duties   | N    | $\bar{x}$ Hours | Sd   |
|----------------------------------|------|-----------------|------|
| Teaching                         | 1140 | 7.16            | 2.98 |
| Class Preparation                | 1129 | 9.04            | 5.36 |
| Assessment Activities            | 1013 | 2.77            | 3.11 |
| Directing papers, Student visits | 1087 | 5.03            | 3.19 |
| Research                         | 980  | 13.54           | 8.97 |
| Management and Administration    | 857  | 4.71            | 4.88 |

If we had to somehow qualify the above distribution we could say it was as expected, although the standard deviations obtained show a high index of dispersion as concerns research activity, an indicator that shows, logically, the broad time interval used to carry out this activity. On the other hand, it is of interest to highlight that there is a lower dispersion index in teaching activity, which clearly indicates how even the dedication to this activity is.

The work of university professors, owing to its very nature and function, is especially lacking in precisely defined contours, both because of the variety of the teaching dimension and, even more so, because of the research aspect. To this we must add other functions ineluctably

linked to the administration and management of the institutions themselves, besides the broad field related to the training of professors, especially in the teaching aspect. All of this comprises a conglomeration of functions and competencies which each professor may respond to differently, but especially where the satisfaction obtained in doing them can serve as an indicator for the qualitative analysis of each of the areas around which the professional activity is developed.

We shall thus pay special attention to those areas of professional activity that professors find particularly satisfying above all others. When the teachers were asked this question, we obtained the percentage of responses that are reflected in the following Table:

*Table 4. Percentage of responses concerning the activities that University professors carry out with the greatest degree of satisfaction*

| Activities  | %    |
|---|------|
| 1. Research Tasks                                     | 69.5 |
| 2. Giving Regular Classes                             | 68.8 |
| 3. Directing Papers, Student Visits                   | 43.3 |
| 4. Helping in Training Activities                     | 41.9 |
| 5. Preparing Classes                                  | 29.5 |
| 6. Giving Doctoral Courses                            | 20.8 |
| 7. Participation in Masters and Post-Graduate Courses | 17.1 |
| 8. Management and Administration                      | 2.9  |
| 9. Assessment   | 2.2  |

The data in the table above show the university teaching staff's evident inclination towards research and teaching, which seems to suggest that the established professional model gives pleasure and satisfaction to the professors involved in it. The development and practice of both activities can hardly be understood without establishing a scientific relationship between them, by way of a single and solid intellectual aggregate.

It seems evident that both teaching and research constitute the harmonious development of professional university work. However, the question is not whether teachers need to be researchers, or need only their own research; the *question we pose and defend* is that university teachers require their research as a way to transmit to their students *their own critical attitude as researchers*, from the moment when they

contribute to the creation and development of knowledge, even though their contribution may be modest and discreet (Gómez & Maciá, 1998).

It is our understanding, therefore, that there should be a fluid movement between research and teaching in the University, teaching being that which, in short, is favoured and perfected by the critical spirit and attitude of a methodology applied in the search of new fields of knowledge already explored or simply, to be explored. To this we must add that the forming of an inquisitive, observant, and efficient mind allows one to understand much better the research carried out by others, besides contributing to the building of great ideas based on small details in which the researcher-teacher could have creatively participated.

### *Perception of the Benefits That Research has for Teaching*

Starting from the conviction that there is a relationship between teaching and research, in this section we analyze the question once the opinions of university professors have been heard, both from their position as teachers and from their perception of the possible effect that their research can have on teaching. The item through which we collected the information analyzed below ("*the results of the research I carry out benefit my teaching*") formed part of a questionnaire developed to obtain information on the different professional aspects of University professors.

This item poses the question directly and without breaking it down into specific disciplines or subjects, in an attempt to learn the precise opinion of the teaching staff on this topic. There were four possibilities of response to the *item* as can be seen in the following table, which presents the quantification of the frequencies observed. We thus attempt to verify in what terms our initial hypothesis on the question is reflected:

Table 5. Carrying Out Research/Benefits Teaching

| Categories / Responses | N    | %    |
|------------------------|------|------|
| Yes                    | 701  | 62.6 |
| Somewhat               | 268  | 23.9 |
| No                     | 123  | 22.0 |
| Don't Know             | 28   | 2.5  |
| TOTAL                  | 1120 | 100  |

\* 85 Values lost

The frequencies obtained admit little doubt as to interpretation, in the first place underscoring the high number of professors answering the question posed, with a low percentage that do not do so, and in second place, the clarity of the answers themselves, since 86% of the teaching staff is favorably inclined to understanding the question posed as relevant. We shall evaluate below the opinion of the teaching staff as a function of the variables we consider most pertinent.

Admitting a certain statistical arbitrariness, we transformed the scale in order to graphically express the mean values obtained in each response category. To do this, we assigned a value of 4 to the category *Yes*, 3 to *Somewhat*, 2 to *No*, and 1 to *Don't know*.

The first element of interest is that there are no significant differences of opinion between the different *Universities*, since there is no significant difference of opinion among the professors working in them ( $\alpha = 0.05$ ). We consider this to be a highly positive situation, as it marks a trend of thought that can be perceived as equal, regardless of the University in question.

*Hypothesis 2:  
The Relationship Between Research  
and Teaching is Significantly Mediated by the  
Professional Category of the University Professor*

If we take into account the variable *professional category* of the teaching staff, we can observe some significant differences that will be discussed below. For purposes of description, we established a scale of greater to lesser rank or professional category among the teaching staff of Spanish universities: 1-University Professor or Chair; 2-Associate Professor; 3-University College Professor<sup>3</sup> or Chair; 4-Associate University College

Professor; 5-Assistant Professor; 6-Associated Instructor (Full Time 8 hours); 7-Associated Instructor (Part Time 6 hours); 8-Associated Instructor (Part Time 3 hours).

Based on this description, we established the proper comparisons:

Table 6. Analysis of variance as a function of the variable *Professional Category*

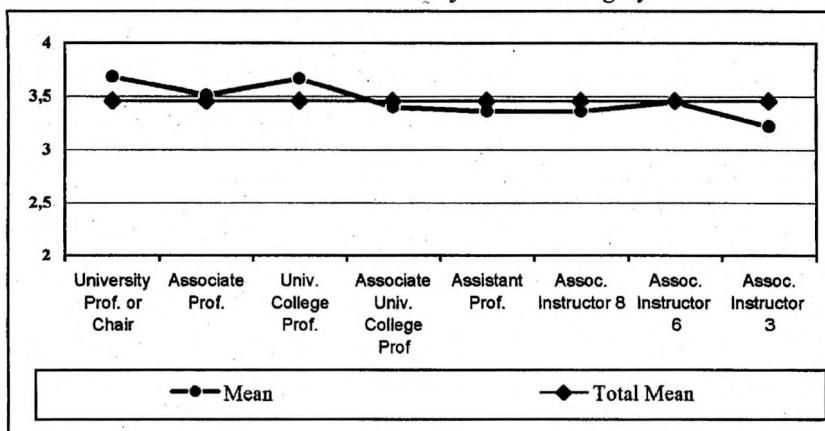
| Professional Category      | F     | P | Significant Differences (*) |     |           |       |
|----------------------------|-------|---|-----------------------------|-----|-----------|-------|
| Research benefits teaching | 2.751 | 0 | 1/2,4,5,6,7,8               | 2/1 | 3/4,5,6,8 | 4/1,3 |

(\*) n.s. 0.05

Essentially, the significant differences occur between University Professor or Chair and all the rest. According to the *mean values* obtained, the most favourable opinion on the question posed came from, in this order, University Professor or Chair, University College Professor or Chair, and Associate Professor. It seems, then, that professional category decisively affects this perception, being more favorable the higher the professional category, and supposedly, the longer the person has been working at the University.

The following graph reliably represents the initial assessment made:

**GRAPH 1**  
*Mean for the Item "Research benefits teaching"*  
 as a function of the variable *Professional Category*



*Hypothesis 3:  
Different Areas of Knowledge Present  
Different Profiles in Relation to Research-Teaching*

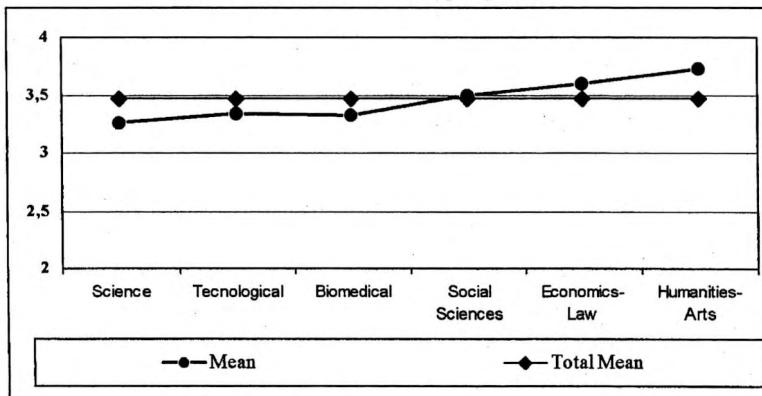
If in our analysis we take into account the *type of centre* (1-*Scientific*, 2-*Technological*, 3-*Biomedical*, 4-*Social Sciences*, 5-*Economics-Law*, 6-*Humanities-Arts*), there are also significant differences on this question, as can be seen in the following Table:

| TYPE OF CENTRE             | F     | p     | TABLE 7 |     |     |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------|-------|-------|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|                            |       |       | 1/2     | 1/3 | 1/4 | 1/5 | 1/6 | 2/3 | 2/4 | 2/5 | 2/6 | 3/4 | 3/5 | 3/6 | 4/5 | 4/6 |
| Research benefits teaching | 8.816 | 0.000 |         |     | *   | *   | *   | *   | *   | *   | *   | *   | *   | *   | *   | *   |

(\*) *n.s. del 0.05*

The teaching staff in *Humanities-Arts* and that of the *Economics-Law* area show the most favorable opinion in the perception of this relationship; on the other hand, professors of science, technology, and biomedical sciences give a less positive judgement. There are thus significant differences between the professors according to the different centres or fields they work in. The graph below confirms the existence of these differences:

**GRAPH 2**  
*Mean for the Item "research benefits teaching"*  
As a function of the variable *Type of Centre*



The data above are in consonance with the studies carried out by Jacobsen (1990), which show that there is a stronger interaction between teaching and research in the area of the humanities and social sciences than in other centres or fields. However, both Becher (1993) and Smeby (1998) highlight that the differences between centres or fields or types of knowledge are rooted in the hierarchy established that imposes a strong specialization in science, technology, and bio-medical sciences which is not always in consonance with the curricula set up for the students. These differences tend to diminish as the student reaches a post-graduate level, since in these scientific fields the students work and do research on topics previously determined by their directors (when not in collaboration with them). Thus, the interaction between teaching and research would be solidly supported by the way *the students work*, and in this sense, undoubtedly, as Berg (1997) maintains, students in social sciences and the humanities usually work more independently throughout their training. Thus, the results obtained here coincide to a great extent with those obtained in Anglo-American and Nordic countries; nonetheless, this parallelism should be studied further with other more specific variables.

*Hypothesis 4:*  
*There is a Greater Relationship Between*  
*Teaching and Basic Research Than Between*  
*Teaching and Applied Research*

This hypothesis and the data obtained seem to have given rise to a highly interesting debate concerning the research generally carried out by professors in the three centres or fields considered together (*science, technology, and biomedical sciences*), since these are areas where, besides the inevitable basic research orientated towards the generation of knowledge, *applied research* is also carried out, not only channelled to improve people's quality of life, but also economic and business interests. There seems to be a *greater relationship* between a positive perception and *basic research*, than there would be with *applied research*, as can also be seen in the graph above.

### *General Conclusions and Proposals for Analysis and Discussion*

The research described here is based on the analysis of empirical data obtained from a sample fulfilling all the requirements for representativeness of the population in question. We have therefore extracted three blocks of conclusions with enough consistency to be considered worthy of explanation.

In the first place, we highlight the great homogeneity and balance underlying the professional activity of university professors, which is not generally affected by the type of University or how old it is.

We saw how there was a certain *equality* underlying *teaching* work, and the tasks related to it, whereas the differences were more marked as refers to research. However, we must point out that both activities are carried out with a high level of quality, regardless of certain differential variables. The distribution and time devoted to the different professional activities that professors usually carry out was also highly balanced.

Another and very important observation was that, in general, research is not carried out to the detriment of teaching. There was no clear invasion of competencies between teaching and research, or vice-versa.

A second block of conclusions was focused on how closely the university professors link teaching and research activities, as well as the satisfaction they say they receive from both. These two activities seem to evidently distinguish their professional commitment, although research seems to be a more completely settled activity the higher the *professional category*. Thus, *professional category* made a difference in how the professors perceive some activities or others and in how much time they devote to them. These differences are less marked if the independent variable to be considered is the *type of centre or field*.

In the third place, regarding the relationship between teaching and research and how professors perceive the effect of the latter on the former, the majority trend is to value this effect positively, the response being more favorable the more time the professors devote to research. According to our analysis, we can affirm that there is a *smooth transfer* of scientific knowledge and methodological rigor between the research and teaching carried out, and this seems to be more so in the case of basic research than in the case of applied research. These differences

seem to arise from the narrow specialization required by some types of knowledge and type of centre or field.

To end, we would like to point out that reflection on this topic should continue in three different areas. The first would be to consider the weight that the most relevant variables, such as professional category, type of centre or professional seniority, have in research. Second, the bases maintaining and rationally supporting certain activities should be considered; thus, topics such as financing, the carrying out of and involvement in individual or group projects, fostering entities (public and private), and so forth are aspects that must not and cannot be overlooked when delving deeper into this question. And finally, the whole situation should be analyzed all together, with reflection on its influence on the values and attitudes of professors, focusing particularly on professional expectations, an aspect of great influence and personal interest.

#### NOTES and ACKNOWLEDGMENTS

1. Research financed by the Regional Ministry of Education of the Regional Government of Castile and Leon.
2. Two of them with a long history: that of Salamanca, created in the 13<sup>th</sup> century, and that of Valladolid created in the 14<sup>th</sup> century; the other two of more recent creation: the University of Leon dates from 1979 and that of Burgos was set up in 1994.
3. The Spanish university system contemplates differences between professors in full four or five year degree programs and those teaching in University Colleges, which offer three year diplomas in areas such as nursing, physical therapy, and technical engineering.

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