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Presentation

Revista de Educación is a scientific journal published by the Ministerio de Educación, Cultura y Deporte. Founded in 1940, and since 1952 called *Revista de Educación*, it has been a privileged witness of the development of education in the last decades, and an acknowledged means for the dissemination of education research and innovation, both from a national and international perspectives. It is currently assigned to the Instituto Nacional de Evaluación Educativa within the Dirección General de Evaluación y Cooperación Territorial and it is published by the Subdirección General de Documentación y Publicaciones of the Ministerio de Educación, Cultura y Deporte.

Each year we publish four issues. Starting next issue (No. 361), the magazine will have three sections: Research, Essays and Education Experiences, all of them submitted to referees. In the first issue of the year there is also an index of bibliography, and in the second number a report with statistic information about the journal process of this period and the impact factors, as well as a list of our external advisors.

From 2006 to the second number of 2012 (May-August 358), *Revista de Educación* was published in a double format, paper and electronic. The paper edition included all the articles in the especial section, the abstracts of articles pertaining to the rest of sections, and an index of reviewed and received books. The electronic edition contains all articles and reviews of each issue, and it is available through this web page (www.mecd.gob.es/revista-de-educacion/), where it is possible to find more interesting information about the journal. From the 358 number *Revista de Educación* becomes exclusively an online publication.

Revista de Educación assesses, selects and publishes studies framed in well established lines of research, mainly: methodologies of education investigation and assessment; analysis of education systems and public policies; evolution and history of contemporary education systems; education reforms and innovations; quality and equity in education; curriculum; didactics; school organization and management; attention to diversity and inclusive education; educational guidance and tutorship; teacher selection, training and professional development; international cooperation for the development of education.

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Research

Research

Beyond cognitive-skills: The attitude towards school and its determinants in Spain with PISA 2009[1]

Más allá de los logros cognitivos: la actitud hacia la escuela y sus determinantes en España según PISA 2009

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Abstract

Educational processes can provide both cognitive –knowledge and abilities– and non-cognitive –expectations or attitudes– outcomes. Despite the relevance of the latter, they have frequently been neglected in the Economics of Education literature. The aim of this paper is to contribute to the study of non-cognitive results, by means of the analysis of their determinants; in particular, this study analyses the determinants of the attitude towards school of 15-year-old Spanish students. A bivariate multilevel model is estimated, which simultaneously explains non-cognitive and cognitive achievements, using data from PISA 2009. Results suggest that the determinants of both types of skills may differ. Indeed, home educational resources, academic history, and teacher-student relationships are more influential than socioeconomic status or possession of material resources in explaining students' motivation.

(1) A previous version of this work was presented at the XLVIII Annual Meeting of the Asociación Argentina de Economía Política (Rosario, Argentina, 2013). The authors thank Dr. H. Gertel for his comments. Agurtzane Lekuona thanks the Basque Government for its support (Project IT-56813).

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Keywords: non-cognitive skills, attitude, pisa 2009, Spain, multivariate multilevel models.

Resumen

Los procesos educativos pueden generar tanto resultados *cognitivos* –conocimiento y aptitudes– como *no cognitivos* –expectativas, valores y actitudes–. Estos últimos han sido con frecuencia relegados en la literatura de la economía de la educación. Sin embargo, su relevancia en el desarrollo de las trayectorias académicas y laborales, así como en el bienestar personal y social, ha sido ampliamente documentada. El primer paso para proponer medidas que promuevan la generación de habilidades no cognitivas es conocer sus determinantes. Por lo tanto, este trabajo tiene como objetivo contribuir a su comprensión para el caso de España. En particular, se centra en la actitud hacia la escuela –la percepción personal de la utilidad y los beneficios de asistir al colegio– de los alumnos de 15 años. Con este propósito se estima un modelo de regresión multinivel bivariado, empleando datos del Programa para la Evaluación Internacional de Alumnos (pisa, por sus siglas en inglés) del año 2009. El análisis busca explicar simultáneamente la actitud hacia la escuela y las puntuaciones en las pruebas de aprendizaje, identificando el efecto relativo de los atributos personales, familiares y escolares. Los resultados sugieren que los factores que influyen en ambos tipos de logros pueden diferir. El nivel socioeconómico de los padres o de los compañeros, por ejemplo, de gran incidencia en los resultados de las pruebas, parece no influir en la actitud hacia la escuela. En la determinación de esta última, la historia académica previa y las variables que indican la posesión en el hogar de recursos educativos, culturales y específicos para la resolución de las tareas escolares son más significativas. Entre los factores escolares, aparece como relevante el clima socioafectivo, reflejado en la calidad de las relaciones entre alumnos y profesores.

Palabras clave: logros no-cognitivos, actitud, pisa 2009, España, modelos multinivel multivariados.

Introduction

Even though there is consensus surrounding the multidimensional character of educational achievements, economic literature has concentrated almost exclusively on the study of the determinants and

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effects of cognitive skills acquisition. Thus, other educational outputs linked to motivational aspects and personality traits, that can be equally relevant to personal and social development, have been relegated (Carneiro, Crawford and Goodman, 2007; Heckman and Rubinstein, 2001).

This is mainly due to the difficulty in reaching a consensus regarding a definition of the skills that form part of the human capital, without belonging to the cognitive dimension. According to the Royal Spanish Academy, the word cognitive means "relative to knowledge". Therefore, these kinds of achievements are linked to students' knowledge, while values, attitudes and habits would be non-cognitive skills.

As stated by Heckman and Rubinstein (2001) or Levin (2012), the lack of trustworthy methods to measure these characteristics has constituted another limitation for the research. However, in the last few years several empirical studies provide evidence in favor of the economic and social relevance of non-cognitive factors (Brunello and Schlotter, 2011; Holmlund and Silva, 2009). According to this literature, their influence is seen in the educational and work careers, in cultural and citizenship participation, and even in risk behavior. Moreover, it is suggested that these competencies would not be innate and permanent traits, but they would respond to the circumstances faced by individuals, and could be boosted in early educational interventions (Heckman, Stixrud and Urzua, 2006; Heckman et al., 2010; Skinner and Pitzer, 2012). The first step in the process to improve non-cognitive skills is to know their determinants. Therefore, this work pretends to make a contribution to the comprehension of the same for the Spanish case.

Among the diverse non-cognitive factors, here we study the attitude towards school in particular. The perception of the usefulness of attending school may indicate the predisposition of the student towards studying, his degree of responsibility, his valuing of knowledge, and his expectations regarding his future educational career. All of these are attributes that can have an independent explanation, even if they are closely related to the cognitive dimension.

In line with the literature on Economics of Education in Spain –see Cordero, Crespo and Pedraja (2013) for more detail– the working hypothesis defends that the main determinants of attitude towards school are individual and family factors, the influence of schools being relatively minor. At the same time, it postulates that the school variables that

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positively affect the attitude towards school are those linked to the social-affective environment in which students cohabit.

The data used to contrast this hypothesis corresponds to the Programme for International Student Assessment (pisa) 2009 elaborated by the Organization for Economic Co-operation and Development (oecd). The chosen methodology attempts to capture the hierarchical structure of educational data and, at the same time, avoid possible estimation biases due to the double causality existing between non-cognitive and cognitive skills (Brunello and Schlotter, 2011). Accordingly, a three-level bivariate regression model is applied in which both the attitude towards school and the test results are taken into account.

The paper is structured in the following way: in the next section the non-cognitive achievement literature is revised, deepening on conceptualization and the justification of its relevance. In addition, the main available results are summarized. In the third section the methodology is detailed; in the fourth, the data and variables are described; in the fifth the results obtained are exposed; and finally, the sixth section gathers the conclusions of the analysis.

Evidence and substantiation

Non-cognitive achievements in the literature

In spite of its marginal place in the economic literature, the formation of non-cognitive skills has been discussed in the academic environment since the middle of last century. For instance, Bloom (1956) classifies educational objectives in three main domains: cognitive, psychomotor, and affective. The last one includes the targets expressed in interests, attitudes and appreciations, and their development at school would imply that students respond positively to what is learned (Krathwohl, Bloom and Masia, 1964).

Dreeben (1968) argues that what is learned at school is not limited to what is taught, nor can it be visualized exclusively through learning tests; but school is designed to transmit behavior, values, and capacity for both commitment and adaptation. As a consequence, educational results are multiple and exceed the development of cognitive competencies.

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In the literature there is a great variety of examples of non-cognitive skills: discipline, self-confidence, commitment, tenacity, perseverance, assistance, sociability, autonomy, expectations about the future, etc. (Brunello and Schlotter, 2011; Cervini, 2003; Heckman and Rubinstein, 2001). These kinds of competencies are being increasingly weighed in the explanation of economic and social well-being. Next, some examples of such studies and their general conclusions are presented.

In their research of 2011, Brunello and Schlotter revised the empirical evidence regarding the effects of non-cognitive attributes and concluded that: i) they affect the assessment of cognitive competencies positively-which is supported by the works of Valle, González, Barca and Núñez (1996) and Holmlund and Silva (2009)–; ii) they promote the permanence and completion at different levels; and iii) their contribution to success in the labor market and future income is greater than or equal to that of cognitive skills.

With regard to the last point, Levin (2012) argues that a broad definition of human capital must include not only knowledge but also inter and intra-personal competencies, attitudes, values, and habits. This explains the modest association regularly observed between *performance* in learning tests and future income or labor productivity.

Together with his colleagues, James Heckman is the academic that has worked the most to understand the role non-cognitive skills play in both educational and economic results (Levin, 2012). His studies in the US demonstrate that they are just as important as cognitive achievements for productivity at work, school graduation, future income and personal well-being. In Heckman and Rubinstein (2001) and Heckman et al. (2006), the authors find that non-cognitive competencies can be developed in schools, and they have and incidence not only on the education and work careers but also on several risk behaviors, related to health and criminality. This is supported by Carneiro et al. (2007) and the meta-analysis of Durlak, Weissberg, Dymnicki, Taylor and Schellinger (2011).

To sum up, these skills are valuable in themselves, exceeding the effect they may have on school achievements and work performance, and are essential for success in the life of individuals (Heckman and Rubinstein, 2001). Fortunately, everything seems to indicate that these attributes are malleable, and are affected by contextual factors like the actions and characteristics of both families and schools (Heckman, 2000; Dreeben, 1968).

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Attitude towards school

As previously mentioned in this paper, non-cognitive achievement is related to *attitudes,* which according to the Royal Spanish Academy are mood dispositions. Noro (2004) indicates that they are not innate but arise from the interaction between the individual and the environment –friends, family, school, society.

In this sense, Skinner and Pitzer (2012) refer to the malleable state of the academic attitude, which is related to effort, determination, perseverance, enthusiasm, concentration, and predisposition towards schoolwork. They indicate that determinants of attitude are personal as well as social, and therefore, they comprise the quality of interactions with parents, teachers and classmates. For instance, it is possible that the children who are most committed and with a positive attitude towards school join groups of children with a similar attitude, and receive greater support and attention from parents and teachers, thus reinforcing their positive self-perception. In the same way, they defend that this favorable attitude contributes to permanence and good performance at school; and protects children from risks such as delinquency, unsafe sexual attitude, or the consumption of alcohol and drugs.

Similar assertions can be found in Baker, Sigmon and Nugent (2001); Martínez-Ferrer, Murgui, Musitu and Monreal (2008); Schunk and Mullen (2013); and Valeski and Stipek (2001). Their works mention that a positive attitude towards school may be linked to better levels of emotional well being, lower absenteeism and school abandonment, as well as minor violence problems, both within school and outside of it.

Determinants of educational achievements

Since the Report by Coleman (Coleman et al., 1966), the international literature has attempted to identify the incidence of different personal, family, and school factors on school performance. Mainly, the latter has been measured through scores obtained in standardized testing –see Calero and Escardíbul, 2007; Formichella, 2011; or Formichella and Krüger, 2013; for a detailed revision.

In the specific case of Spain, there is abundant research dealing with this objective. As an example, the works of Calero and Escardíbul (2007);

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Escardíbul (2008); Calero, Choi y Waisgrais (2010); and Choi and Calero (2013) can be mentioned. Cordero et al. (2013), conduct a revision of empirical studies that use data provided by PISA, from which they extract some general conclusions: i) greater inequalities are observed among students within schools than among educational centers; ii) the most relevant school factor is the socioeconomic and cultural environment in the centers; iii) the students' characteristics that seem to have greater impact are related to the socioeconomic context, especially the parents' educational level, although the immigration status and the history of repetition also have an incidence.

Now, those works that attempt to explain non-cognitive results differ in the choice of concepts and the indicators used, which makes their conclusions difficult to compare or generalize. Some of these available antecedents are described briefly below.

Battistich, Solomon, Kim, Watson and Schaps (1995) analyze the determinants of both cognitive and non-cognitive results in a group of schools in the US, using multilevel and hierarchical models. They consider factors such as liking school, motivation and academic self-esteem, educational aspirations, etc. Among their main results, they find that the students' "sense of community" –if they feel taken care of and at ease at school– is positively related to the attitudinal variables; while living in poverty would deteriorate such results.

The non-cognitive variable studied by García and Méndez (2011) for Italian students, is the students' expectation about completing the tertiary level. They conclude that some individual attributes such as being a woman, a greater occupational hierarchy of the father, and higher spending on educational resources in the home, are positively associated with the expected schooling. They also find an impact on some school characteristics: negative for the percentage of students repeating and private ownership, and positive for peer expectations and the proportion of foreign students.

Both Cervini (2003) for the Argentine case, and Opdenakker and Van Damme (2000) for that of Belgium, analyze the determinants of a number of cognitive and non-cognitive results –among them, interest in learning, academic self-concept and educational aspiration– estimating several multilevel models. They find that personal, family and school factors have a different incidence on cognitive as well as non-cognitive results. The role of the school in the explanation of academic performance appears to be

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more relevant than in the conformation of attitudes, on which the family context would have greater weight.

Lastly, it is worth mentioning that the works of Cervini and Dari (2009) and Cervini (2010) are similar to this study in their methodology: the estimation of multilevel bivariate models.

Methodology

The educational data provided by pisa is collected by means of a two-stage sampling system in response to the hierarchical structure they present: the students (lower level) are grouped in schools (higher level). In this case, the specialized literature recommends carrying out a multilevel regression analysis (Calero et al., 2010; Formichella, 2011; Hox, 2002).

The multilevel method implies estimating a regression line for each higher level unit, and enables studying the effects of variables of different hierarchies simultaneously. In the same way, it considers the existence of a greater correlation between the variables of those units belonging to the same group, thus obtaining more efficient estimations (Cervini, 2012; Hox, 2002; Levacic and Vignoles, 2002; oecd, 2009). Moreover, it is possible to decompose the variance of the dependent variable on the different levels of aggregation, in order to assess the relative weight of the attributes at each level. Thus, this estimation technique enables us to observe the decomposition of the variation in attitude "among students within schools" and "among schools".

Although the central variable is the *attitude towards school,* if an estimation of the same was carried out independently there could exist a bia, due to its interaction with cognitive achievements. Therefore, the use of a more sophisticated multilevel model is recommended: the multivariate multilevel model.

This model enable us to calculate the determinants of all the response variables simultaneously, since each is part of a unique equation system. This facilitates the estimation of correlations between the dependent variables and of these with each one of the regressors at each nesting level (Cervini and Dari, 2009). Furthermore, the advantage of doing it simultaneously is that reliability of the statistical significance *tests* increases,

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which is observed in the reduction of standard errors. This fact is most relevant when the dependent variables are strongly correlated, which is very frequent in the educational results corresponding to the same individual (Snijders and Bosker, 1999).

The final estimated model has two response variables: students' *attitude towards school (ATSCHL),* and the *average grade* on the tests *(GRADE)*. Thus, each observation unit has two values that form the lowest hierarchy level (level 1). Both are nested within the student (level 2), which is included in the school (level 3). Therefore, technically, level 1 exists exclusively to define the bivariate structure (Rasbash, Steele, Browne and Goldstein, 2012).

The specification of the final model was carried out in the conventional form (Bryk and Raudenbush, 1992; Hox, 2002), starting from a null model (without explanatory variables) to evaluate the variance decomposition of the dependent variables between the proposed levels; explanatory variables of different levels and types of effects were then added, until we arrive at the final model, which is formally expressed in the following way (Equation 1):

$$Y_{hij} = \beta_{0j}\,\omega_{1hij} + \sum_{p=1}^{p}\beta_{po}\omega_{1hij}X_{p_{ij}} + \sum_{q=1}^{q}\beta_{qj}\omega_{1hij}Z_{q_{ij}} + e_{1ij}\omega_{1hij} \qquad (1)$$
$$+\alpha_{0j}\omega_{2hij} + \sum_{p=1}^{p}\alpha_{p0}\omega_{2hij}X_{p_{ij}} + \sum_{q=1}^{p}\alpha_{qj}\omega_{2hij}Z_{q_{ij}} + e_{2ij}\omega_{2hij}$$

Where:

- Y_{hij}: It is the expected educational result of student *i* at school *j*. Sub-index *h* indicates what response variable is present in the estimation, 1 (*ATSCHL*) or 2 (*NOTA*).
- $\omega_{1hij} = \begin{cases} 1 \text{ si } h = 1 \\ 1 \text{ si } h = 2 \end{cases}$
- $\omega_{2hij} = 1 - \omega_{1ijk}$
- β_{0j} (α_{0j}): it is the intercept of the regression line for school *j*.
- $X_{p_{ji}}$: set of *P* independent variables at level 2 with fixed effects.
- β_{p0} (α_{q0}): it is the coefficient that accompanies the explanatory variables *X*, therefore, it does not vary between centers.
- $Z_{q_{ij}}$: set of *Q* independent variables at level 2 with random effects.
- β_{qj} (α_{qj}): it is the coefficient that accompanies the explanatory variables *Z*, therefore, it varies between centers.

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- e_{1ij} (e_{2ij}): it is the random deviation of student *i* with regard to the school average (within each center *j*). This error is supposed to be normally distributed with zero mean and constant variance. Such variance, denominated (σ^2_{e1} (σ^2_{e2})), represents the variation in *attitude (grade)* which is verified within schools.

The intercept β_{0j} (α_{0j}) incorporates level 3 as indicated in Equations 2 y 3:

$$\beta_{0j} = \beta_{00} + \sum_{n=1}^{N} \beta_{0n} S_{nj} + r_{10j} \quad (2)$$

$$\alpha_{0j} = \alpha_{00} + \sum_{n=1}^{N} \alpha_{0n} S_{nj} + r_{20j} \quad (3)$$

Where:

- β_{00} (α_{00}): it is the global average value of outcomes: the average of all the schools when the explained variable is *ATSCHL* (*GRADE*).
- S_{nj} : set of *N* independent variables of school level.
- β_{0n} (α_{0n}): it it is the coefficient that accompanies the set of S explanatory variables.
- r_{10j} (r_{20j}): it is the random deviation of school *j* with regard to the global average. This error is supposed to be normally distributed with zero mean and constant variance. Such variance, called σ^2_{r1} (σ^2_{r2}) represents the variation in *attitude (grade)* verified between schools.

Meanwhile, level 2 variable coefficients with random effects $\beta_{qj}(\alpha_{qj})$, are conformed by a fixed and a random part, as observed in Equations 4 and 5:

$$\beta_{qj} = \beta_{q0} + r_{1qj} \quad (4)$$

$$\alpha_{qj} = \alpha_{q0} + r_{2qj} \quad (5)$$

Where:

- β_{q0} (α_{q0}): It is the average effect of variable Z for all schools.
- r_{1qj} (r_{2qj}): It is the deviation of school *j* with regard to such average effect.

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In addition to the regression coefficients, what interests us is the decomposition of the variance between the different levels. We compute the "*intraclass correlation coefficient*" of the null model $(\rho = \sigma_r^2 / (\sigma_r^2 + \sigma_e^2)$ an indicator that represents the proportion of results variance explained by differences among schools[2]. In the same way, the final model residual variance is analyzed in relation to the null model. It gives an idea of the explanatory capacity of the model. The calculation of the same is the following: $1-[(\sigma^2_r + \sigma^2_e)_{final\ model} / (\sigma^2_r + \sigma^2_e)_{null\ model}]$, and can be carried out both globally as well as for each level. Lastly, the *deviance* or likelihood-ratio, can be estimated by means of the Maximum Likelihood procedure. The better the adjustment of the model, the lower the value of the same (Cervini, 2012; Hox, 2002).

Data and variables

The study employs the PISA 2009 dataset corresponding to Spain, and the sample consists of 24,478 students and 889 schools. The program assesses 15-year-old students' learning. At this age students are about to finish mandatory schooling. During this round, reading comprehension is studied in depth, keeping Mathematics and Science as supplementary. In addition to the results obtained on the tests, PISA provides information about the students' individual and socio-familiar characteristics, as well as of the educational centers. The variables used, together with their basic descriptors, are presented in Table 1 and are the following:

Dependent Variables (Level 1)

Non-cognitive achievements: attitude towards school index (ATSCHL)

This index is an approximation to the perception that 15-year-old students have of the usefulness and benefits of school (OECD, 2010). It is a composite index published in the PISA report based on the opinion of students regarding: i) school preparation for adult life; ii) usefulness

(2) If that value was zero, it would not make sense to propose a multilevel model.

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of schools; iii) contribution of schools when making appropriate decisions; and iv) usefulness of school to find work.

Cognitive achievements: mean grade on Reading, Science and Mathematics tests (GRADE)

It is the average Reading, Science and Mathematics standardized tests scores[3]. Its role is to control the possible correlation between cognitive and non-cognitive results when calculating the determinants of the latter.

Explanatory variables at the student level (Level 2)

Students' personal characteristics

- *Female*: takes value 1 for the feminine sex.
- *Age*: it is calculated as the difference between the year and month of the test, and the year and month of the student's birth.
- *Native student*: takes value 1 if the student is native Spanish.
- *Mother tongue*: takes value 1 if the student has done the *test in* his/her mother tongue.
- *Prior academic career*: indicated by two variables: I) *Attended Preschool*: takes value 1 if the student attended children's education for two or more years; II) *Repeating student*: takes value 1 if the student has repeated a grade at primary or secondary school.

Home and school contextual characteristics

- *Nuclear family structure*: takes value 1 if the student's family is nuclear and 0 in the opposite case (single parent, stepfamily, etc.).
- *Secondary education parents*: takes value 1 if the parents' education level is Baccalaureate or the formative levels (middle or superior grade).

(3) PISA outcomes are reported as a set of five "plausible values" (PV) which represent student proficiencies. When the sample contains more than 6400 observations, there is no significant difference between employing only one plausible value or all five of them, in the estimation of the mean and the standard error, or in the probability of committing a type I error (OCDE, 2009). Thus, we have chosen to average the PV1 values for all three competencies to calculate the GRADE variable.

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- *Tertiary education parents*: takes value 1 if the highest educational level of the parents is the university level.
- *Mother works full-time*: takes value 1 if the mother works full-time. Only the mother's activity level is considered because, theoretically, it is the main agent of socialization, responsible for the transmission of education (Berger and Luckmann, 1984).
- *Parents' occupational status* (*HISEI*): it is a composite index elaborated by PISA that represents the highest occupational status ofparents, and reflects the attributes of the occupations which translated into income.

Home cultural possessions index (CULTPOSS): it is a composite index that represents the presence of classic literature, works of art or poetry books.

Resources related to school activities[4]:

- *Employment of ICT in school tasks index (HOMSCH)*: it is a composite index that represents the frequency in the use of information and communication technologies for studying.
- *Home educational resources index (HEDRES)*: it is a composite index that makes reference to the availability of space and materials favorable to studying.

Explanatory variables at the school level (Level 3)

- *Average socioeconomic level*: it reflects the social composition of the student population, and it is formed as the average of the students' Economic, Social and Cultural Status Index (ESCS). This indicator summarizes the information about the parents' occupational status, their educational level, and home material and cultural possessions (OECD, 2010).
- *Internet Access (COMPWEB)*: it is defined as the proportion of computers for educational purposes connected to Internet at the establishment.
- *Average quality of student-teacher relationship (Average relationship)*: it is formed as the average of the school's STUDREL index. The latter refers to the students' perception of the attitude and treatment on the part of the teachers. The greater the value, the better the relationship is perceived.

(4) These are the only two variables included with random effects.

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- *Average disciplinary climate in the classroom (Average climate)*: it is the average of the school's DISCLIMA index. It indicates the students' perception of the order and organization existing in the classroom during language lessons. The greater the value, the better the perceived disciplinary climate.
- *Private:* takes value 1 if the school is private (whether it receives any State subsidy or not) and 0 if the school is public.

TABLE I. Description of used variables

VARIABLES		CUALITATIVE	CUANTITATIVE
		Percentage of students	Mean and Standard Deviation
Individual level	Attitude towards school		0.11 (1.00)
	Average grade		492.51 (83.39)
	Female	49.24	
	Age		15.82 (0.28)
	Native student	90.75	
	Mother tongue	84.51	
	Attended Preschool	93.96	
	Repeating student	19.40	
Family level	Nuclear family	85.30	
	Mother works full-time	47.87	
	Parents with secondary-education	27.14	
	Parents with tertiary-education	48.85	
	Parents' occupational status		46.59 (17.20)
	Home educational resources		-0.12 (0.89)
	Home cultural possessions		0.20 (0.86)
	Use of ICT		-0.02 (0.95)
School level	Private	39.55	
	Internet access		0.98 (0.09)
	Average socioeconomic level		-0.25 (0.55)
	Average relation		-0.04 (0.33)
	Average disciplinary climate		0.07 (0.44)

Source: Own elaboration based on the PISA 2009 (OCDE) data set.

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Results

The software Stata 12 together with the computational program *MLWIN* was used for the estimation of the models, as stated in Leckie and Charlton (2012). Thus, the coefficients that accompany the explanatory variables were estimated simultaneously through iterative methods that maximize the function of maximum likelihood.

The observations were weighed by the final weights per student (*W_FSTUWT*) as well as per school (*W_FSCHWT*), provided by the PISA program. These weights attempt to compensate the possible biases arising from the sampling methods or from the non-response on the part of the school and students, and their use enables us to derive appropriate estimations of population values (OECD, 2010).

On Tables II and III presented below, we can observe the main results obtained with the null and final models.

Starting from the decomposition of the variance in the null model (see Table II), we can see that the total variance in *ATSCHL* is explained mostly by the differences among students within schools (92.6%), being the variance due to differences among centers much lower (7.4%). This preponderance is also verified for the cognitive results, since 78.3% of the variance in the GRADE is explained by the differences among students. Thus, it is observed that the relative role that personal and family differences fulfill is greater in the case of the non-cognitive result studied here, which is coherent with the conclusions of Cervini (2003) and Opdenakker and Van Damme (2000).

Although in the case of the *ATSCHL* variable the difference between the centers is relatively low –with an *intraclass correlation coefficient* of 7.4%–, it is statistically significant. In the same way, the *intraclass correlation coefficient* for the *GRADE* is equal to 21.7% and the variance between schools is also significant. Therefore, it is convenient to estimate a multilevel model.

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TABLE II. Multilevel Regression. Random Effects: Variance of constants

	ATSCHL		GRADE	
	Null model	**Fin al model**	**Null model**	**Final model**
Variance between schools**: σ^2_r	0.075 (7.4%)	0.038	1482.043 (21.7%)	520.915
Variance between students**: σ^2_e	0.938 (92.6%)	0.848	5,344.501 (78.3%)	3,372.990
Total variance: $\sigma^2_r + \sigma^2_e$	1.013	0.887	6,826.544	3,893.905
Percentage of the residual variance that is explained by the variables over the null model: school level		48.9		64.8
Percentage of the residual variance that is explained by the variables over the null model: students level		9.5		36.9
Percentage of the residual variance that is explained by the variables over the null model: total		12.4		42.9

Source: Own elaboration based on the PISA 2009 (OCDE) dataset. Note: **Significant at the 0.05 level.

In the same way, since covariances between the dependent variables are statistically significant at the student level (see Table III), the use of multivariate models is pertinent, as they take into account the correlation between dependent variables in the simultaneous estimations.

TABLE III. Multilevel Regression. Random Effects: Covariances of the constant and deviance statistic

	Null model	**Final model**
Cov (ATSCHL, NOTA) School level	0.473	0.269
Cov (ATSCHL, NOTA) Student level**	6.572	1.678
Deviance	350,167.72	248,060.91

Source: Own elaboration based on the PISA 2009 (OCDE) dataset. Note: **Significant at the 0.05 level.

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The analysis of the Final Model on Table IV enables us to know which factors present a significant association with the 15-year-old students' valuing of school, and to compare them with the determinants of the cognitive results represented by the *GRADE*.

It can be observed that, among personal characteristics, being a woman is positively associated with the school attitude, whereas, on average, women have worse grades. In the same way, having attended two or more years at the preschool level also affects positively the non-cognitive result, even though it is not significant when explaining academic performance.

Meanwhile, having repeated at least a grade significantly reduces not only the *ATSCHL* value but also the grade on *tests*. This can be reflected on the impact of repeating itself –experience that could generate a demotivation, a feeling of failure or detachment, by interrupting the school career continuity and separating the student from his group of peers– or it can be capturing the effect of personal and family variables that have an incidence on academic performance and attitude at the same time.

Regarding family factors, results suggest that the parents' occupational status is not relevant for determining *ATSCHL,* but their educational level is. However, the effect is not the expected one: the parents' higher education decreases their children's valuing of school. On the contrary, the effect on performance is positive. Even though this result deserves further investigation, the following hypothesis is posed: parents that have not had access to higher education value more the fact that their children can study, transferring them such enthusiasm; at the same time, they possess fewer competencies to help their children on their student path, in comparison with the more educated parents.

Also, it is observed that having educational elements, as well as materials and an appropriate place for studying, and having access to works of art or literature, are positively associated with the attitude towards school. It is probable that, to a great extent, these factors are reflected in the family attitude –the role given to education at home, and the effort parents make to guarantee that their children have the necessary resources, regardless of their income–.

These results coincide with those referred to in the *GRADE* with the exception that in this case the parents' occupational status is significant. In the same way, having computer resources to carry out school tasks has a positive incidence on motivation as well as on academic results.

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As regards family structure, we find that belonging to a nuclear family allows us to expect greater valuing of school. Probably, this is due to the fact that the presence of disruptive episodes in the dynamics of the family, such as a separation, may affect the educational process and interest for the same (Björklund and Chadwick, 2003). However, this variable is not significant in order to explain performance.

In the case of school factors, the level of material resources and the socioeconomic profile of the group of peers do not seem to have a relevant impact on the determination of a positive attitude towards school. On the contrary, the socioeconomic composition of student population influences cognitive results significantly.

Students' perception of their teachers' attitude does have an incidence on the *ATSCHL* index. Thus, when on average students consider that their relationship with teachers is positive, and that they worry about their learning and well being, they value school more.

Lastly, it is worth pointing out that the type of management of centers does not present a significant association with the student's interest in school or with their academic performance.

TABLE IV. Multilevel Regression. Coefficients of the Fixed-part

EXPLANATORY VARIABLES		**DEPENDENT VARIABLES**	
		Attitude towards school	**Average grade**
Constant		0.513	353.368***
Individual level	Female	0.144***	-9.438***
	Age	-0.020	7.713***
	Native student	-0.090	20.85***
	Mother tongue	0.043*	5.011**
	Attended Preschool	0.142***	6.395
	Repeating student	-0.156***	-79.103***

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Familiar level	Nuclear family	0.051**	1.147
	Mother works full-time	-0.028*	1.898**
	Parents with secondary-education	-0.046**	3.152**
	Parents with tertiary-education	-0.089***	3.059**
	Parents' occupational status	-0.000	0.4619***
	Home educational resources	0.113***	3.784***
	Home cultural possessions	0.062***	11.275***
	Use of ICT	0.084***	-8.348***
School level	Private	-0.018	-2.549
	Internet access	-0.143	-3.845
	Average socioeconomic level	-0.013	19.877***
	Average relation	0.528***	-11.665***
	Average disciplinary climate	0.030	14.815***

Source: Own elaboration based on the PISA 2009 (OCDE) dataset. Note: ***Significant at level 0.01; **Significant at level 0.05; *Significant at level 0.01.

With respect to the relative magnitude of the effects mentioned, in order to analyze it the coefficients of the explanatory variables that ended up being statistically significant were standardized, so that they were more easily compared (Table v).

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TABLE V. Standardized coefficients of the variables at the student level with respect to the dependent ATSCHL

Explanatory variables	Standarized coefficients
Female	1.355
Attended Preschool	1.334
Repeating student	-1.459
Nuclear family	0.483
Parents with secondary education	-0.432
Parents with tertiary education	-0.831
Home educational resources	0.954
Home cultural possessions	0.502
Use of ICT	0.753
Average relationship	1.633

Source: Own elaboration based on the PISA 2009 (OCDE) dataset.

It can be observed that among the individual variables, having repeated presents a greater impact on the attitude towards school, decreasing the *ATSCHL* index value by 1.5 standard deviations (SD). Being a woman, on the other hand, increases the attitude towards school by 1.35 SD. In the same way, having attended the preschool level increases the index by 1.33 SD, and belonging to a nuclear family by 0.5 SD. The effect of parents' secondary and tertiary education is minor and negative.

Regarding the variables related to home resources, an increment of one SD of *educational resources, cultural possessions, or employment of the ICT,* is associated with an increment of 0.9; 0.5 and 0.7 SD of the *ATSCHL* variable, respectively.

The only variable at school level that was statistically significant was the index that reflects the average quality of the relationship between students and teachers: if it increases in one SD, the *attitude towards school* improves in 1.6 SD.

As regards the incorporated variables with random effects, for the *home educational resources* the random effects were not significant; although they were in the case of technological resources aimed at school tasks. This means that the use of ICT –or the family attitude towards education that it may be capturing– does not have the same effect on the student attitude

in all the centers and schools seem to have a role as mediators, modifying the students' initial situation to a certain extent.

Finally, Table II shows that the final model proposed enabled us to reduce the non-explained variance of the variable of interest by 9.5% for the student level and by 48.9% for the school level. In sum, a 12.4% of the total inequalities in *Attitude towards school* was explained. This percentage is consistent with the literature on the topic (Cervini, 2003). Lastly, it is worth mentioning that the statistical *deviance* decreases.

Conclusions

Non-cognitive skills have an incidence on the possibility that people perform more fully in the personal-affective, family, work, and civil spheres. Thus, the development of these skills is closely related to the promotion of individual and social well-being. Throughout this work we have studied the determinants of non-cognitive educational results represented by the variable defined as *Attitude towards school.* The hypothesis has been that the variables that influence the most on it correspond to both the individual and family levels and that, among school variables, the most influential are linked to their socio-affective climate. Thus, the evidence is in favor of the hypothesis.

The results show that the greater proportion of the variance is explained by the students' level, and that the only variables that are statistically significant at level 2 are factors that refer to the atmosphere students breathe at school. Therefore, a better school climate affects students' attitude *positively.*

Among the individual variables that are statistically significant, the role of those that indicate the possession of educational and cultural resources, as well as those specific ones for carrying out school tasks is highlighted. These variables would evince a double effect. On the one hand, it would seem that if students have the necessary resources to carry out the educational activity, their attitude towards school improves. On the other hand, the fact that a home has the educational resources implies that in the expenditure decisions of such home the purchase of this type of resources has been valued; this reflects the positive attitude of adults in the home towards education, which may influence the students positively.

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For these reasons, if policy makers wished to improve non-cognitive results they would have to put an emphasis on policies that exceed the educational sphere. However, this does not mean that nothing can be done from schools, since the model also shows that the inclusion of random effects in the variable that reflects the use of ICT for studying has been significant. Thus, the fact that the centers differ in their capacity to compensate for the inequalities of origin is highlighted.

Given that some schools have a better performance than others when equating initial differences, there is room for seeking improvements in educational policies that attempt to match the results of different institutions.

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The arithmetic Knowledge of prospective teachers. Strengths and Weaknesses[1]

Conocimiento de aritmética de futuros maestros. Debilidades y fortalezas

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Abstract

The media has recently alerted public opinion to a situation which research into mathematical education has been highlighting for the last two decades: the poor quality of primary teachers' mathematical training. This failing of prospective primary teachers (PPTS), which has been noted at an informal level in our universities for some time, is the focus of this study. Against this background, the paper describes an exploratory study using a survey about the mathematical knowledge required for teaching with 737 trainee primary teachers at three

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Andalusian university training centres, carried out under the auspices of a Teaching Innovation Project at one of them. Using the framework of the Mathematics Teachers' Specialised Knowledge (MTSK), and specifically, the sub-domain concerning knowledge of mathematics topics, a questionnaire was developed which contained items relating to fractions, decimals and percentages, chosen as much for their inherent importance as for their application to other mathematical contents and other disciplines within the scope of primary education. By this means we were able to explore the prospective teachers' knowledge of these contents. The results highlighted a significant number of weaknesses, some already described in the literature, and some strengths. In both cases, the findings represent baseline data which can be compared with the situation in other primary training centres. We hope they also provide food for thought for the educational authorities in regard to university entrance selection procedures. More specifically, the study should be a starting point for training centres to redesign their programmes.

Keywords: MTSK, Prospective Primary Teachers, Initial Training, Professional Knowledge, Arithmetic

Resumen

Los medios de comunicación han alertado recientemente a la opinión pública acerca de una realidad que la investigación en educación matemática llevaba evidenciando las dos últimas décadas: la deficiente formación matemática de los maestros. Estas deficiencias, que habíamos venido constatando de manera informal en nuestras universidades con los estudiantes para Maestro (EPM), son el objeto de estudio de nuestra investigación. En ese contexto, este artículo describe un estudio exploratorio tipo *survey* sobre el conocimiento matemático necesario para la enseñanza que tienen 737 estudiantes para Maestro de tres centros de formación de maestros de universidades andaluzas, realizado en el contexto de un Proyecto de Innovación Docente de una de ellas. Usando el marco de conocimiento especializado del profesor de Matemáticas (MTSK) y, dentro de él, el subdominio relativo al conocimiento de los temas matemáticos, se elaboró un cuestionario que contenía ítems relativos a fracciones, decimales y porcentajes, contenidos que fueron elegidos tanto por su trascendencia intrínseca como por su aplicación a otros contenidos matemáticos y a otras disciplinas en el ámbito de la Educación Primaria. Esto nos ha permitido explorar el conocimiento que estos futuros profesores poseen sobre esos contenidos. Los resultados han mostrado un número importante de debilidades, algunas de las cuales ya habían sido descritas por la literatura de investigación, y también algunas fortalezas. En ambos casos, la información obtenida supone un referente para explorar la realidad de otros centros de formación de maestros; un elemento de reflexión para las autoridades académicas acerca de los procesos de selección para el acceso a la universidad y,

más concretamente, a estos centros de formación; y un punto de partida para el rediseño de sus programas de formación.

Palabras clave: MTSK, estudiantes para Maestro, formación inicial, conocimiento profesional, aritmética.

Introduction

Out of all the primary level topics relating to arithmetic, the most important, in terms of both the actual content and its application to other mathematical content and other disciplines, is that coming under the umbrella of fractions, decimals and percentages. In consequence, primary teachers' mathematical knowledge requires special attention regarding the structure, contents and associations relating to this area. It is the area in which algorithms and procedures are frequently covered, and where pupils often display significant gaps in their knowledge at the end of their period of compulsory education (PISA; TIMSS).

There are no specific entry requirements for Primary Education courses in Spain. Nor is the area amongst the most popular, which means that for many students, the degree was not their first choice. Added to this, it must be recognised that a significant number of students have had little contact with mathematics for many years, which may be the reason why their grasp of elementary mathematics has proved to be lacking (Contreras, Carrillo, Zakaryan, Muñoz-Catalán and Climent, 2012).

Evidence of this can be found in both national and international studies. In the area of fractions, decimals and percentages, specifically, we can cite the work of Putt (1995) with regard to the representation and ordering of numbers as decimals; Post, Harel, Behr and Lesh (1991) with respect to decimal and fractional representations; Castro, Castro and Segovia (2004), and Zazkis and Campbell (1994) regarding decimals less than one, calculation rules for decimal numbers, and adjusting positional value in estimates; and Muñoz-Catalán and Carrillo (2007) in terms of the use of formal methods of simplifying fractions, and the concept of fraction itself.

It should be added that, in our model of teachers' knowledge, this area of mathematical knowledge plays a very significant role, for which reason

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it is important to have a very clear idea of each student's starting point before undertaking any training.

In this respect, we have been working on a Project for Teaching Innovation at the University of Huelva entitled "Prospective Primary Teachers' Knowledge for Teaching Mathematics: Analysis of Difficulties" (PIE 1101), with the aim of identifying the strengths and weaknesses of prospective primary teachers (PPTS) at the start of their studies, and of gaining insights into the possible causes, such that the training they are offered can fill the gaps at the same time as developing the specialised mathematical knowledge they are to need.

In the first stage of the project, we developed a process for the identification and analysis of the students' incomplete and erroneous primary level mathematical knowledge. That is to say, we started from the mathematical knowledge held in common by the PPTS. However, the subsequent analysis of this knowledge brings with it two further considerations: awareness of the points of difficulty and frequently occurring errors associated with specific topics, and familiarity with learning strategies that can be applied to these, both of interest to primary teacher training.

In this paper, we focus on the task of identifying the PPTS' strengths and weaknesses with respect to fractions, decimals and percentages.

Theoretical Background

Teachers' professional knowledge has been the object of much debate and theorisation, and has given rise to multiple programmes aimed at its improvement. In Shulman's (1986) seminal work, this knowledge is divided into two large macro-components: knowledge about the subject to be taught and pedagogical knowledge associated with this content. These macro-components are then further sub-divided into seven sub-domains, among which the teacher's knowledge can be classified. This initial distinction is of special interest when it comes to developing initial and in-service training programmes in that, whilst recognising the integrated nature of teachers' knowledge, it suggests that it is possible to achieve a detailed characterisation of each of the two components. Building

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on Shulman's work, various such characterisations of teachers' knowledge have been developed (Fennema and Franke, 1992; Davis and Simmt, 2006; Rowland, Turner, Thwaites yand Huckstep, 2009), and in keeping with Shulman's decision to separate out the two macro-components above, the research group at the University of Michigan developed the model, "Mathematical Knowledge for Teaching" (MKT: Ball, Thames and Phelps, 2008), not only as an instrument of analysis, but also as the foundation on which to build teacher-training courses. The model defines three sub-domains for each macro-component defined by Shulman. Of particular interest for this paper are those associated with knowledge of the subject, that is, Common Content Knowledge (CCK), Specialised Content Knowledge (SCK), and Horizon Content Knowledge (HCK). CCK is defined as the kind of knowledge of the subject that anyone using mathematics might require in their profession, including those working outside the field of teaching. It is thus the knowledge associated with the theory and practice of mathematics, and its potential application to other fields; in short, the kind of mathematics to be found in textbooks. SCK is one of the chief contributions of the Michigan group, as it recognises the difference in the mathematical knowledge required by a mathematics teacher, as opposed to, say, a physicist or mathematics researcher. In the paper in which the model was presented, the specialist nature of this knowledge is given shape in terms of the actions it enables the teacher to perform: "*responding to students why questions', [...] and giving or evaluating mathematical explanations*" (Ball et al., 2008, p. 400), amongst others. Finally, HCK, defined as "an orientation to, and a familiarity with, mathematical knowledge" (Jakobsen, Thames and Ribeiro, 2013), is the knowledge enabling the teacher to understand how mathematics works (from which the 'familiarity with'), and to take a prospective view of the mathematical topics to be dealt with in class (from which the 'orientation to'). Nevertheless, this model has encountered problems in the definition between the different sub-domains (Silverman and Thompson, 2008), which led the research group at the University of Huelva to develop a refinement. This new model, denominated "Mathematics Teachers' Specialised Knowledge" (Carrillo, Climent, Contreras, Muñoz-Catalán, 2013), starts from the premise that the mathematics teacher's knowledge is specialised by virtue of being part of the knowledge required to give lessons, irrespective of whether other professions might draw on it. Nevertheless, in the design of the model, only the knowledge specific to

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mathematics teachers is considered, all other general knowledge of use to teaching, but alien to mathematics, being excluded. To this extent, despite its synthetic nature, the mathematics teacher's knowledge is considered amenable to an atomistic analysis. In the course of conducting their teaching, the teacher understands, puts into action and reflects on different elements. These elements comprise, in terms of mathematical knowledge, the concepts, procedures and structures inherent in mathematical thinking, and in terms of pedagogical content knowledge, systems for organising content for teaching, the pupils' ways of approaching content, and curricular constraints. These six elements of teachers' knowledge and reflection give rise to six different sub-domains.

We will first describe those fitting the characterisation of the macro-component described by Shulman relating to subject knowledge. The sub-domain *Knowledge of Topics* (KOT) takes mathematical content as its object, and contains the knowledge of different dimensions (which we organise into categories) associated with each topic, including properties and their theoretical underpinnings, the procedures which can be undertaken with the topic, the phenomenology (Freudenthal, 1983) and applications of the content to real or mathematical situations (such as different examples in which the topic becomes evident), the different meanings and definitions of the concept, and the representations of the content. These categories will enable us to design the structure of the data-collection instrument and subsequent analysis.

We recognise that this knowledge can be shared with other professions, but that certain dimensions, such as the meanings of a topic, are particularly relevant to the work of the mathematics teacher, making it specialised, to the extent that they represent a tool for exercising the profession of teacher. *Knowledge of the Structure of Mathematics* concerns understanding the mathematical context of an item to be taught. It is the kind of structural knowledge which enables the teacher to consider content prospectively, in the sense that he or she approaches "basic mathematics from an advanced perspective," or conversely, approaches "advanced mathematics from a basic perspective". It is these considerations, together with the idea of Felix Klein of understanding mathematics from a higher perspective, providing the teacher with a synthesised view of the structure of mathematics, which constitute this sub-domain. Finally, *Knowledge of the Practice of Mathematics* (KPM) consists of knowledge about how mathematics is constructed. It involves elements of a general nature, such

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as knowing different kinds of demonstrations or forms of reasoning, like syntax, and notions of classification and generalisation, and elements associated with a specific topic, such as the logic underpinning the idea of equivalence class, fundamental to considering equivalent fractions. These three sub-domains together comprise, in this new perspective, the content which in Shulman's terms would be subject matter knowledge, and which in this case, given the mathematical contextualisation of the teacher to be considered, we denominate mathematical knowledge.

In the domain of pedagogical content knowledge (Shulman's second macro-component), if we focus attention on the means of organising mathematical content for teaching, the sub-domain *Knowledge of Mathematics Teaching* (KMT) emerges. This consists of different strategies, materials, resources and aids that enable mathematical content to be organised in the way the teacher would like. Included within this sub-domain are theories of teaching, such as the features of problem-solving as a methodological gambit. In the same way, if we focus on the teacher's knowledge of the pupil as learner, we arrive at the sub-domain *Knowledge of the Features of Learning* (KFLM), which includes the teacher's knowledge of the pupils' difficulties, errors and obstacles, conceptions and initial ideas about concepts, the language and vocabulary typically employed by pupils to talk about certain concepts, and knowledge of the steps along the way to learning a particular item. Also included in this sub-domain are theories of learning, such as APOS. Thirdly, based on curricular questions, there is the sub-domain *Knowledge of Mathematics Learning Standards* (KMLS), which contains guidelines that the teacher might take into account when sequencing content, such as research literature, documents supplied by professional associations (e.g. NCTM), and of course the national curriculum of the country in question.

Method

Given our interest in identifying the strengths and weaknesses of the PPTs' knowledge of fractions, decimals and percentages, we settled on using a *Survey* methodology (Colás and Buendía, 1998), designing a multiple-choice questionnaire. The analysis of the data thus obtained first involved

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a frequency count of five categories of knowledge about fractions, decimals and percentages[2]: phenomena and applications; meanings and definitions (including images of the concepts); properties and their fundamental principles; representations; procedures.

As primary teacher trainers in three university centres –the University of Huelva, the Cardenal Spínola CES Seville CEU (University Centre for Teacher Training), and the University of Seville– gave us access to 737 primary trainees (or around 1,500 in total). None had received tuition in Mathematics Education relating to arithmetic in the course of their degree, such that their previous contact with the topics took place during the compulsory education phase, or in some cases from 16 to 18 years of age.

The questionnaire as data collection instrument

A pilot questionnaire was put to the test with a group of 52 students in their second year of a degree in Primary Education at the Cardenal Spínola CES Seville CEU. This gave us the opportunity to refine the data collection instrument. The questions selected for inclusion were drawn chiefly from the work of Dickson, Brown and Gibson (1991), Hill, Schilling and Ball (2004), Ball (1990 a, 1990 b), Hernández, Noda, Palarea and Socas, (2003), Contreras et al. (2012), but also included items written by the participating teachers themselves, based on frequently occurring errors they had noted in previous years.

Bearing in mind the results of the pilot, especially in terms of estimated and real turn-around times, the definitive questionnaire was given the form of 17 multiple-choice questions of four options each and only one correct answer. In addition, amongst the three incorrect responses, there was an *expected answer* drawn from the above literature on the topic.

Questions 4 and 8 dealt with discounts as applications of percentages. Questions 1 and 13 considered the meanings of fractions (as part of a whole), understood as phenomenology. Likewise, questions 1, 11, 13, 15 and 16 demanded knowledge of the definitions of fraction (and the role of the unit), improper fractions, rational numbers, decimals, and meaning of positional value. In terms of properties and their fundamental features, questions 3, 9, 10, 16 and 17 focused on the density of rational numbers, the hierarchy of operations, and the nature of ordering in rational numbers (with an emphasis on negative numbers). Regarding the

(2) We assume that different organisational criteria are possible. We apply these due to their adjustment to our theoretical framework.

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category of representations and their interpretation, all the questions required an understanding of the expression of different registers for rational numbers and irrational decimals (including percentages), with questions 1, 12, 13, 15 and 16 particularly focussed on this aspect. Finally, with respect to the category of procedures, questions 4, 5, 6, 9, 10, 11, 12, 14 and 17 involved the ordering of decimals and fractions, and operations on fractions and decimals (including basic operations and changes of register).

Key amongst the instructions that the students were given for completing the questionnaire was the injunction against using a calculator.

Mathematics teachers' specialised kowledge of fractions, decimal numbers and percentages as support to the questionnaire

A mathematics teacher's specialised knowledge, especially of the content in hand, matters not only in terms of its mathematical value, but also in that it provides instruction with tools for organising, making sense of, and communicating this content. Ma (1999) claims that lack of content knowledge (in this case, the division of fractions) causes problems when it comes to creating useful representations in teaching, and that "*even pedagogical knowledge may not compensate for their ignorance of the concept*" (p. 89). We will thus make a connection between the required knowledge and the corresponding sub-domains within the MTSK model.

With respect to Knowledge of Topics (KOT), we were interested to find out the meaning which the PPTs gave to fractions (for example, part-whole), particularly to improper fractions, as part of their phenomenology. Equally, we were interested in their knowledge about definitions, representations and the ordering of, and operations using, fractions, decimals and percentages (associated with the category "procedures"). Taking these three latter items as alternative ways of representing rational numbers, we were keen to discover the extent to which the students were able to move from one to another while retaining the numerical value, and to learn the meaning they attached to this value (Llinares and Sánchez, 1988), ordering rational numbers, and taking into account throughout the property of density of rational numbers. Connected to the foregoing, is the concept

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of rational number, which we associate with knowledge of its definition. In the same way, the location of rational numbers along the real number line is also relevant, with the additional difficulty of identifying and locating the decimal numbers, and the problem of the negative decimal numbers. Another point of interest was that of percentages. In phenomenological applications (such as calculating discounts), we were interested in students ability not only to calculate the direct percentage of a number, but also to reverse the procedure of "making a percentage discount", and the means of chaining together two percentages as just one, a procedure very closely related to the meaning of the product of fractions, and to which we would add other procedures such as the addition of fractions, the obtaining of equivalent fractions, and the hierarchy of operations. One element which we believe should form a fundamental part of primary education students' KOT is the Decimal Number System (DNS), which can be explored through questions about its properties and fundamental features, tackling the issue of place value and the meaning of each one of the elements.

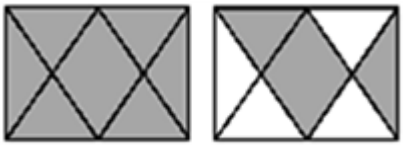
Additionally, we were interested in the knowledge relating to the relation between fractions and the area of a shape through the identification of fractions in models representing area as part of the whole, as well as Knowledge of the Structure of Mathematics (KSM), in working with generic quantities, expressed in the form of an unknown or variable item. We were also interested in the students' Knowledge of the Practice of Mathematics (KPM) linked to inducing the need to generalise a procedure. Nevertheless, although we believe that these aspects of a PPT's potential knowledge are fundamental to the putting into effect of their work, they did not originally receive special attention during the development of the questionnaire. It was during the *post hoc* analysis that we realised that this knowledge might be brought into play in answering the questions, given the way they were formulated. For this reason, the questionnaire which we explain in detail below is chiefly focussed on exploring the KOT associated with fractions, decimals and percentages (relative to the elements highlighted in the foregoing paragraphs), aiming to identify both the strengths and weaknesses of the prospective teachers' knowledge.

Below, we present the questions forming the questionnaire, along with the data we hoped it would provide about the KOT of the PPTs.

FIGURE 1. Question 1 in the questionnaire

1. If the shaded parts of the drawing below represent the part of two chocolate bars that we have eaten, and the unshaded what we have not eaten, indicate which of the following options represents what we have eaten:

a) 10/14 of a bar
b)12/16 of a bar
c) 6/8 of a bar
d) 6/4 of a bar



This question is based on problem number 5 posed by Hill et al. (2004), with the intention of calibrating responders' conception of unity and focussing attention on the improper fraction. Llinares (2003) notes that the idea of unity appears when we need to reconstruct it given the representation of the part.

The solution requires the responder to be aware that there are two units and that the result is larger than a unit: the fact that each of the options includes the phrase "of a bar" should make it clear that this is to be taken as the unit. Once this premise is assimilated, options *a*, *b* and *c* can be discarded, and *d* checked. To do this it is sufficient to observe that each bar is composed of 8 triangles of equal size, and that half of the second bar is shaded. It is also necessary to know the equivalence of fractions and to know how to decompose 6/4 as 1 (4/4) plus 4/8, and even the mixed number, 1 4/8.

From amongst the wrong answers, the more expected are 12/16 and 6/8, as in each the idea of improper fraction is not present. The option 10/14 suggests the responder has difficulties in identifying an appropriate unit of measurement to calculate the shaded area.

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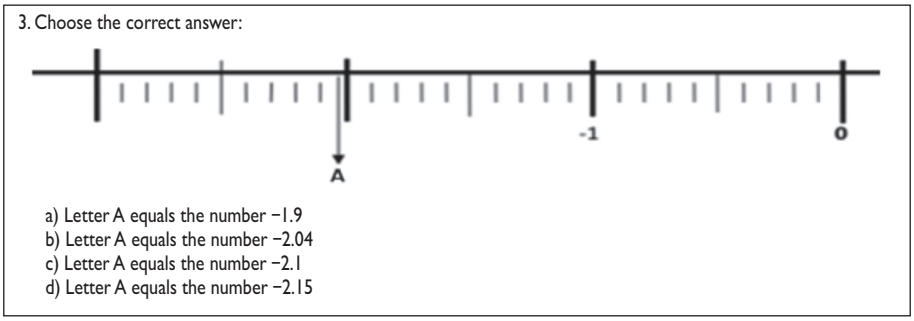
FIGURE II. Question 3 in the questionnaire



This question is posed in Castro (2001), in which it is noted that the comparison of decimal numbers can be problematic because there is a tendency to consider the decimal part as a natural number. What is more, the difficulty is augmented by being located on the negative axis of the number line; as González Marí (2001) points out about whole numbers, notions associated with negative numbers are not easy to assimilate, even though they can be met with in everyday situations. This question demands the responder to identify A as a negative number smaller than -2, to recognise that each line between the units represents a tenth, and to know how to put both decimals and negative numbers in order so as to locate A between -2 and -2.1. For their part, Castro and Torralbo (2001) note that this kind of representation of rational numbers along the number line cause doubts to emerge when several numbers are involved.

Option a suggests the responder is unaware that A is less than -2 (or, which is the same, believe that $-1.9 < -2$). Options c and d might suggest that the responder is not aware that the evenly spaced vertical bars represent tenths of a unit. All three wrong answers imply difficulties in putting decimals and negative numbers in order.

FIGURE III. Question 4 in the questionnaire

4. If I paid 12.710€ for a second-hand car, what was its factory price if the previous owner sold it to me with an 18% discount?

a) The original price was 15.600€
b) The original price was15.500€
c) The original price was 14.997.80€
d) None of the above

This question draws on Dickson et al. (1991) observation underlining the "clear importance that an understanding of percentages exerts in everyday life and in commercial activities" (p. 323).

In this question it is essential to recognise the fact that we do not have the starting price, but that if we have had an 18% discount, the price that we have actually paid is 82% of the original price. In a recent study, Contreras et al. (2012) demonstrated that the most frequently occurring error consists in applying the percentage to the known price, that is the figure which has already been discounted, and adding the stipulated percentage to this amount, that is, assuming that the final price determines the percentage discount of the original price.

Solving the proportionality (which is, in one way, the inverse of applying a discount) requires an ability to handle basic operations with rational numbers. Option *c* is the most expected of the wrong answers as it stems from the idea that "undoing" the discount means applying the percentage to the final (i.e., the discounted) price and adding the amount thus obtained to the same, a frequently occurring error (Ariza, Sánchez, Trigueros, 2011).

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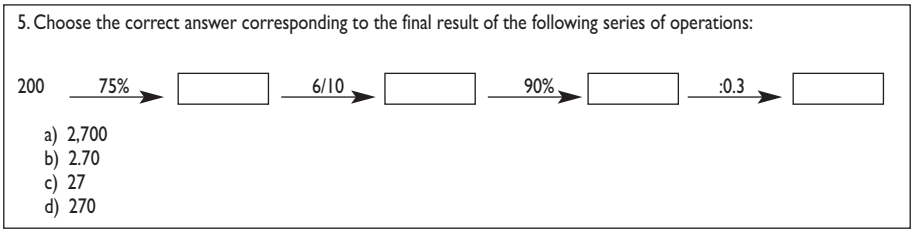
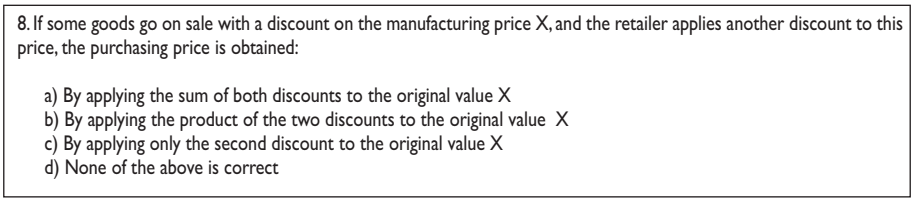
FIGURE IV. Question 5 in the questionnaire



This question supposes being able to handle the different expressions of a rational number, its equivalents and the operations on them (Llinares and Sánchez, 1988), and probably estimating, given that the calculations are to be done without a calculator. It is foreseeable that the greatest difficulty lies with the final division, as difficulties often accompany understanding that a higher number than the dividend can be obtained after division. Likewise, if the division is achieved by transforming the decimal number into a fraction, difficulties again arise, since, as Ball (1990b) and Ma (1999) assert, the algorithm for dividing by a fraction is known to most people, but not the mathematical foundations underpinning it.

FIGURE V. Question 8 in the questionnaire



As in question 4, we are again faced with a non-direct application of percentages, the essence of which is the correct identification of the values to which these should be applied in each case (Contreras et al., 2012). The question seeks to identify a widespread error in applying consecutive percentages: the natural tendency to add both percentages together to arrive at the final figure. We also sought to check whether the students

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were able to interpret the percentages as fractions, in which case identifying the solution as the product of both should be immediate.

FIGURE VI. Question 9 in the questionnaire

9. Indicate the correct answer:

a) Between 0.21 and 0.22 there is no decimal number
b) Between 0.21 and 0.22 there are more than 10 decimal numbers
c) Between 0.21 and 0.22 there are exactly 10 decimal numbers
d) Between 0.21 and 0.22 there are exactly 9 decimal numbers

FIGURE VII. Question 10 in the questionnaire

10. Between 3/7 and 4/7:

a) There is no fraction
b) It is not possible to know whether or not there are fractions
c) There is an infinite number of fractions
d) There is a finite number of fractions

Drawing on Ruiz and Castro (2011), in these two questions (9 and 10) we aimed to identify knowledge of the process which allows us to find a rational number between two given numbers, determining as the chief error the notion of a following number in Z (answer *a*), question 9 being in the decimal register.

Question 10 aims to identify the knowledge required to locate a fraction between two given fractions, beyond merely comparing the numerators (answer *a*), by means of equivalent fractions, or by first converting the given fractions into decimal expressions. As in the previous question, we also wanted to explore the erroneous idea that there is a finite number of fractions between two given fractions, indicating a lack of awareness of the density of rational numbers (Pehkonen, Hannula, Maijala and Soro, 2006). In this instance, we expected a higher percentage of errors than for question 9, as the representation of rational numbers through coefficients between whole numbers tends to accentuate the misconception.

Answer *a* draws on the intuitive idea that between two fractions consisting of the same denominator and consecutive numerators (en Z), there cannot be any further fractions. Answer *b* represents a distracter,

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playing on the doubt arising from the conflict between the intuitive idea expressed in *a* and an intuition of the property of density of rational numbers. Answers *c* and *d* concern the ability of the PPTs to generalise the process of making fractions which lie between those given, opting either for a limited number, answer *d*, or an infinite number, answer *c*, the correct one.

FIGURE VIII. Question 11 in the questionnaire

11. The number which is three thousandths from 2.347 is:

a) 2.344
b) 2.647
c) 2.317
d) None is correct

This question deals with understanding the DNS (basic ideas, Ma, 1999), but this time through the concept of distance. The question was designed with a subtraction (answer *a*), as opposed to an addition, in order to make the association with the concept of distance less evident. The wrong answers were designed to highlight a lack of awareness of the positional value of the thousandths, with the value being mistakenly interpreted as a tenth or hundredth. Konic, Godino and Rivas (2010) note that, as an essential item on the primary curriculum, difficulties in grasping the concept of positional value are frequently detected in the course of learning decimal numbers.

FIGURE IX. Question 12 in the questionnaire

12. Indicate which one, or ones, of the representations below can be written as 1.75:

a) 15/10 x 5/10
b) 100 x 0.75
c) ¾ + 100/25
d) 12/8 + 50/200

As in Muñoz-Catalán and Carrillo (2007), this question aims to analyse –although from a different perspective– the ability to estimate and operate, using fractions and decimals in combination, without the use of a

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calculator. It requires a certain flexibility of thought in recognising the underlying structures, and demands a sound understanding of the equivalent forms of expressing a rational number. Some of the answers can be discarded through the process of estimation, such as *c*, in which a fraction equivalent to 4 is added to a positive number.

FIGURE X. Question 13 in the questionnaire

13. Indicate the diagram equivalent to the fraction 7/8

a) 

b) 

c) Both a and b are correct
d) None of the above is correct

In the same way that the first question analysed improper fractions, this question considers the concept of proper fraction. In this case, however, the numerical expression is provided and it is the corresponding diagrammatic equivalent that must be identified. The expected error is answer *c*, which also gives further information on the conceptualisation of improper fractions.

FIGURE XI. Question 14 in the questionnaire

14. Indicate which percentage is equivalent to 2/10:

a) 2%
b) 20%
c) 0.2%
d) 0.02%

This question requires a simple identification of the equivalence between fractional and percentage registers for a number. The expected most likely error in this case is offered in option *c*, which is decimal equivalent of 2/10.

In this question, we aim to explore the common difficulty pupils have in associating a fraction with a percentage, something which Dickson et al.

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(1991) mention as one of the weaknesses detected in studies into the area. We included the possibility of difficulties with DNS arising from the position of the decimal point after dividing by 10 and then converting it to a percentage.

FIGURE XII. Question 15 in the questionnaire

15. In 1.237 there are

a) 23 tenths
b) 12 tenths
c) 237 tenths
d) There are only 2 tenths

As in question 11, the focus is on understanding the DNS, in this case in respect to decimal expressions and the meaning of each of the terms, in particular the positional value of the elements within the non-whole part.

Konic et al. (2010) note that the way certain problems are expressed in primary textbooks can lead children not to consider the relation between the position a number occupies and the value that is assigned to it; in our case, the expected answer is *d* 'There are only two tenths', echoing this situation of frequently badly constructed knowledge.

FIGURE XIII. Question 16 in the questionnaire

16. Choose the correct answer:

a) $1{,}23 < 1{,}23\hat{2} < 1{,}\hat{23} < 1{,}2\hat{3}$
b) $1{,}2\hat{3} < 1{,}23\hat{2} < 1{,}\hat{23} < 1{,}23$
c) $1{,}23 < 1{,}2\hat{32} < 1{,}23\hat{2} < 1{,}2\hat{3}$
d) None of the answers is correct

In this question it is necessary not only to know how to put decimal numbers in order, but also to understand the system of recurring numbers. In effect, knowing how to sequence the numbers by comparing their positional value here demands full understanding of how this positionality operates.

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FIGURE XIV. Question 17 in the questionnaire

17. Indicate the result of the following operation:

2/10-[1/4+3/2+(-8-1/5)]=

a) 133/20
b) 1197/180
c) 117/20
d) a and b are both correct

Finally, this last question aims to evaluate the capacity to operate with fractions, focussing in this instance on the addition and subtraction of fractions, the hierarchy of operations and equivalent forms of expressing fractions, as the correct answer requires recognising equivalent solutions.

Results and conclusions

Graph I shows the percentage of correct answers as against incorrect answers for each of the questions in the questionnaire.

Questions 1 and 13 (the meaning and representation of fractions, improper fractions), 8 and 14 (percentages as an application and operator), 15 (meanings of the DNS) and 17 (procedural aspects of fractions) returned the lowest percentage of correct answers; in question 4 (application of percentages) the percentage of wrong answers is also greater than the correct answers. By contrast, in questions 3 (the properties and meanings of negative decimals), 5 (combined operations), 11 (the meaning of distance as subtraction in the DNS) and 12 (the representation of, and operations with, fractions) the percentage of correct answers is significantly high, while in questions 9 and 10 (finding a rational number between two given numbers in decimal and fractional expressions) and 16 (the representations of decimals) the figures are much closer, although the correct answers outnumber the incorrect.

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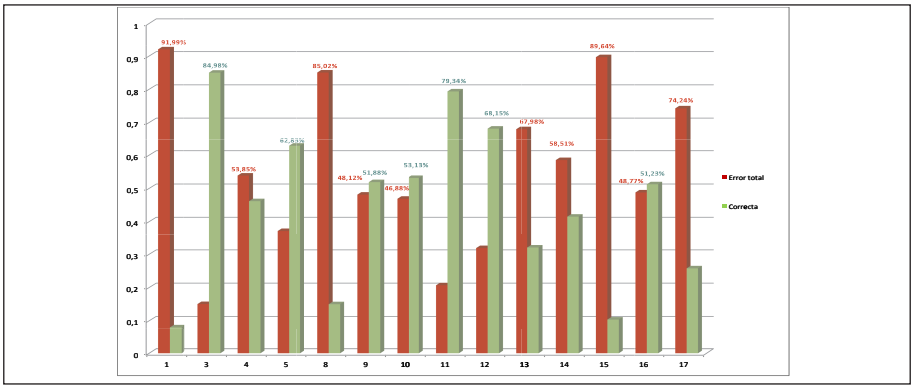
GRAPH I. Distribution by percentage of correct answers against total number of errors



During the obligatory period of schooling, improper fractions are far less frequently taught than proper fractions, and hence the low number of correct answers in questions 1 and 13 was to be expected. Further, given that the interpretation of fraction as parts of whole is most easily understood (Castro and Torralbo, 2001), there is a tendency to present it this way at school; unless the concept of unit is dealt with adequately, a false construction of the concept of fraction can result when the parts are greater than the unit.

Dickson et al. (1991) refer to other studies tackling this question, which highlight the failure to understand improper fractions due to their representation as sub-areas of an area unit. The authors give the example of the addition of two proper fractions which results in an improper fraction, noting the confusion created by a poor acquisition of the concept of unit, which is reinterpreted when they see the improper result.

The meaning of fraction, which can be associated with parts of a whole (continuous or discrete), operators, ratios, and quotient (of two integers), is often approached at primary level from the first of these perspectives, using examples based on parts of a single unit. The fourth approach –quotients– naturally leads to the idea of improper fractions, and is associated with a meaning of fraction which the primary pupils will have seen previously (partitive division), and is not usually associated with parts of a whole. What is more, it is this approach which comes closest to the

formal definition of fraction. Being unaware of this definition typically leads some PPTs to identify 3.5/7 as the answer to question 10.

In the same way, using percentages for more than the mere application to a specific number tends to challenge the PPTs, as in the case of questions 8 and 14. The result in the former came as no surprise, as this tends to feature prominently amongst the errors we usually find on the teacher training courses. The consecutive nature of the discounts leads trainees to identify addition as the appropriate operation, in the same way that in order to calculate the original price from the discounted price, they tend to apply the percentage discount to this latter and then add to it the resultant amount (option *c* in question 4). In both questions 4 and 8, the key issue (in different ways) is which figure the percentage should be applied to. This is a more cognitively demanding operation than that of simply applying a percentage to a particular figure (which could be identified with the fraction as operator). In question 14, it is precisely the absence of the number on which to operate which usually leads to error (Contreras et al., 2012). If the question had been couched as "What percentage of A (given) corresponds to 2/10 of this number?" the results would have been the same as those for question 5.

Indeed, naming or recognising decimal expressions in non-conventional expressions is a difficulty highlighted in other studies (Ball, 1990 a). There tends to be little importance given to the Decimal Number System, familiarity with which has significant implications at all levels of primary education, such that it is considered of cross-curricular significance. Furthermore, Kamii (1994) notes that learning arithmetic algorithms without a sound understanding of number generates a vicious circle, as it "'misteaches' positional value and prevents the correct development of the concept of number" (p. 49), as the positional value is fundamental for an in-depth understanding of the number system which will enable pupils to manipulate it correctly further down the line. Understanding the underlying structure means more than identifying the role of the units in each order. Question 15 focuses on a particular aspect of this understanding, that relating to the reading and writing of numbers, emphasising the order of any unit. Here, the difficulty does not lie in recognising that the number is made up of one unit, two tenths, three hundredths and seven thousandths, but rather reading the amount in different ways, mixing tenths and hundredths, understanding the definition of a decimal number and the sense of units. Another aspect which includes

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this sense of understanding of the DNS is tackled in question 11 (the meaning of distance between two rational numbers). However, in this instance the solution involves adding or subtracting 3 thousandths from the given figure, which accounts for the difference in results for both.

It is also interesting to note the closeness in frequencies of the correct and incorrect answers to questions 9 and 10, both designed to study the understanding of the property of density in rational numbers. This finding, irrespective of whether the rational numbers are expressed as decimals or fractions, runs counter to reports of a predominance of incorrect conceptual constructs on the part of the PPTs (Ruiz and Castro, 2011).

Question 17, as mentioned above, requires the responders not only to operate with fractions, but also to recognise hierarchy, to be able to use equivalent fractions and to know how to apply the calculations involved in the lowest common denominator. The confluence of these various aspects determines the difficulty facing the PPTs and reflected in the outcome.

If we now turn to the elements of KOT mentioned in section 4, it seems to us that both the definition and meaning which the PPTs attach to improper and proper fractions (questions 1 and 13), in addition to their understanding of the representations and procedures that can be carried out using fractions, decimals and percentages, in all the aspects dealt with (questions 14, 15 , 4 and 8), constitute part of the weaknesses of the PPTs participating in the study. Likewise, both the formation of equivalent fractions, and the hierarchy of operations (question 17) represent significant weaknesses. Knowledge of the Decimal Number System (DNS) would also seem to belong to this group, as, despite the relatively high percentage of correct answers to question 11 about the meaning of the distance between two decimal numbers, questions 14 and 15 –dealing with the structure of the DNS in more depth– returned a significant number of incorrect answers.

With respect to the density of rational numbers and their order, although the number of correct answers to the corresponding questions (9, 10 and 16) exceeds the number of incorrect answers in each case, the difference is so slight that we are inclined to think that they, too, show weaknesses, specifically in regard to knowledge of the properties and foundations of the density of rational numbers, which are perhaps compensated in this instance by the associated procedural knowledge.

On the positive side, in terms of strengths, it is only fair to acknowledge the capacity to place a decimal number on the number line (question 3), even when this is a negative number and as such increases the degree of difficulty and makes the achievement more noteworthy. Also included is the use of the algorithms for adding and multiplying fractions (in the full sense), including the interpretation of distance between to decimal expressions as a subtraction, and the processes of estimation and operation using two fractional and/or decimal expressions (questions 11 and 12), this being an area which is amply covered throughout the primary years as well as over the course of the first cycle of secondary.

A final reflection

To finish, we would be gratified if this study was to contribute to the reflection of those with decision-making powers in theeducational system. First, the work should help improve the understanding of which aspects relating to fractions, decimals and percentages require attention in Primary Education, and what form that attention should take. Secondly, the educational authorities should define more precisely the mathematical knowledge required of trainee Primary Teachers, as the university is hardly the most appropriate place to go back over knowledge which should have already been assimilated. It is also apposite here to return our attention to the theoretical framework underpinning this study. Although our focus has KOT), knowledge involving the Structure of Mathematics (KSM) and the Practice of Mathematics (KPM) can also be detected. Together, these three components make up the teacher's Mathematical Knowledge (MK), and are closely related to the four properties proposed by Ma (1999) as the defining features of what she terms as the teacher's *profound understanding of fundamental mathematics*: basic ideas (simple but powerful), related to KOT and KSM, which will enable them to guide their future pupils towards "doing true mathematical activity" (Ma, *1999* p. 148); connectivity, regarding the connections between concepts and procedures (KOT and KSM); multiple perspectives of the same situation or approach to solving a problem (KOT); and longitudinal coherence, which concerns knowledge of the curriculum. The sub-domains comprising our theoretical

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framework, and in particular the categories of KOT analysed in this study, together represent a grounded structure of what initial teacher training should concern itself with. For this to happen, it is essential to start with well-founded mathematical knowledge which offers certain guarantees when it comes to tackling the components of Pedagogical Content Knowledge, and developing the specialised mathematical knowledge required by primary teachers if they are to do a good job. One possibility for achieving a better level of mathematical knowledge at the start of initial training, which is being debated at the moment (Castro, Mengual, Prat, Albarracín, Gorogorió, 2014), is the use of specific entry tests for the training courses.

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Students and employers perception about the development of digital skills in higher education

Percepción de estudiantes y empleadores sobre el desarrollo de competencias digitales en la Educación Superior

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Abstract

The competence-based pedagogical model is having a significant influence on the debate about aligning higher education to labour market requirements. For that reason, each discipline needs to continuously monitor job prospects and adjust the university's competence curricula accordingly. In this context, the purpose of this research is to analyse the existence of a possible gap between market requirements and education in relation to students' digital competence level, and possible mismatches by sex and field of knowledge. To verify the correct match between the market and the development of digital competencies, a two-phase research was conducted. In the first phase, the content of job offers was analysed, as methodology to determine the digital competences needed to perform a job. In the second phase, a survey was carried out among undergraduate students and their potential employers to evaluate their digital competence level. Employers were asked to evaluate the perceived level of digital competences that graduate students have (or, "what level of digital competence have graduate acquired at the university?"). In the case of students the questionnaire was self-evaluative (or, "what level of digital competence do you think you have acquired at the university"). The results of the study show some differences or gaps amongst university students in the use and digital competence level by both sex and field of study. Additionally,

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this study shows differences between the competence level perceived by the students and the level perceived by the labour market, which represents a clear mismatch between education and labour market.

Keywords: e-competences, digital competences, employability, higher education, labour market.

Resumen

La implantación del Espacio Europeo de Educación Superior y de un modelo educativo basado en competencias influye en el debate sobre el encaje educación superior-mercado laboral y en la necesidad de monitorizar las perspectivas laborales para ajustar el currículum competencial que ofrecen las instituciones de educación superior. En este contexto, el objetivo de este trabajo es analizar el encaje entre mercado-formación en relación a las competencias digitales, así como posibles diferencias por sexo y ámbito de estudio. Para verificar si se está logrando el encaje entre el mercado y la formación en competencias digitales se llevó a cabo una investigación en dos fases. La primera fase analiza el contenido de ofertas de empleo para delimitar los componentes del perfil que demanda el mercado laboral en relación a la competencia digital, como metodología para determinar las competencias digitales necesarias para trabajar. La segunda fase se llevó a cabo a través de una encuesta dirigida tanto al alumnado de grado como a potenciales empleadores. Mientras a las empresas se les pidió evaluar el nivel e-competencial percibido en los graduados (o "¿qué nivel competencial han adquirido los graduados en la universidad?"), en el caso de los estudiantes el cuestionario tenía un carácter auto-evaluativo (o, "¿qué nivel competencial crees que has adquirido en la universidad?"). Los resultados del trabajo muestran algunas diferencias o brechas en el alumnado universitario en el uso y nivel competencial tanto por sexo como por ámbito de estudios. Además, los resultados muestran diferencias significativas entre el nivel competencial percibido por el alumno y el percibido por el mercado de trabajo, lo que representa un claro desajuste entre educación y mercado de trabajo.

Palabras clave: e-competencias, competencias digitales, empleabilidad, educación superior, mercado de trabajo.

Introduction

Since the Bologna Declaration of 1999 and the implementation of the European Higher Education Area (EHEA), the debate on the possible fit

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between education and the labour market has attracted increasing interest from universities and the business world. In the academic world, this controversy has led to the opening of new lines of research, ranging from the identification of competences that are relevant for professional success (García-Aracil & Van der Velden, 2008) to curriculum design (Hoogveld, Paas & Jochems, 2005) and its subsequent evaluation (Belfield, Bullock and Fielding, 1999; Yang, You & Chen, 2005); and studies devoted to the analysis of the fit between the competences developed at university and the requirements of the market; a research line undertaken by García-Aracil and Van der Velden (2008), García Espejo and Ibañez Pascual (2006), Heijke, Meng and Ris (2003), Hennemann and Liefner (2010), Martín-del-Peso, Rabadán-Gómez and Hernandez-March (2013), in addition to this study.

In Europe, the CHEERS study (Careers after Higher Education. A European Research Survey, 1998-2000) was one of the pioneering research studies in the assessment of the competences acquired by graduates in the classroom and the level required by the labour market. Similarly, in 2006 the REFLEX survey highlighted the differences between what was considered to need reinforcement from a conceptual point of view, and the actual requirements of a job, and showed the discrepancies between what is demanded and what is actually required. For the objectives of the university system to be met successfully, these shortcomings must not only be detected, but must also be remedied (García Montalvo & Mora, 2000).

In a situation of contracting and extremely competitive labour markets, confirmation of the fit between the profile required by the market and the profile achieved during the training process becomes particularly important. The relationship between training and employment, its impact on the employability of future university graduates and the enhancement of professional mobility must be taken into account (Alonso, Fernández & Nyssen, 2009).

For universities, ensuring this employability entails participating in a planned way in developing the transferable competences and qualifications that enhance individuals' ability to take advantage of the training opportunities presented to them, in order to find and retain a job, progress within the company, change their professional profile and adapt to the changing labour market. Employability means skills and attitudes, a curriculum vitae and good personal qualities; in other words, better or worse opportunities for access and adaptation to the workplace.

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But is the current framework of competences adapted to the explicit requirements of the labour market? Are there imbalances that impair graduates' employability? To examine these issues in depth, we must once again return to the perspective of the main parties involved: graduates and employers.

In this context, this study was designed to evaluate Spanish university students' perception of the level of competences they achieve during their studies, and the level perceived by their employers when these students start a job.

In specific terms, and in view of the wide range of measurable competences, this study focuses on the development and evaluation of digital competences included in the Digital Agenda for Europe, which are aimed at smart, sustainable and inclusive growth. Digital competence has also been recognized as an important priority by the European Commission (European Commission, 2010*a*, 2010*b*) and as one of the eight key competences for lifelong learning (European Parliament and Council, 2006). This research focused on the case of a Catalan public university, which incorporated the development of competences in its Strategic Teaching Plan in 2003.

The article begins with a discussion of the current framework of competences at university, with particular reference to digital competence. The research methodology is then described, and the results are discussed in order to determine whether the University studied is training digitally competent professionals from the standpoint of the education-market fit. The results show that despite the change in the teaching-learning model defined by the Bologna process, there is a mismatch between the classroom and the market, and a low level of satisfaction by the market with the digital competences acquired at university. The resulting analysis of the data is of interest to both university graduates and those responsible for study plans and associated competency frameworks, as well as to employers.

Digital competence in the current higher education context

In Spain, Royal Decree 1393/2007 ordered the preparation of University undergraduate and postgraduate qualifications, and stipulated that one of

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the general principles in the design of future courses should be that "the courses should be organized with the objectives of adapting teaching and learning methods to the objective of the acquisition of competences by students." The EHEA was therefore established as a model based on the development of competences, which prepares students for meeting the complex and changing demands of the environment (OECD 2002). With this justification, competences are integrated into a new competitive curriculum which is designed to train graduates who are able to function as autonomous, conscious and responsible individuals in different situations and contexts (Cano, 2008), and who are able to cope with job insecurity (Echazarreta, Prados, Poch & Soler, 2009; Kohler, 2004). The professional competences include the digital competences necessary for personal fulfilment and development, active citizenship, social inclusion and employment (European Parliament, 2007).

The document Key Competences for Lifelong Learning European Reference Framework (European Parliament, 2007) defines digital competence as "the confident and critical use of information society technology (IST) for work, leisure and communication." This is underpinned by basic skills in ICT: the use of computers to retrieve, assess, store, produce, present and exchange information, and to communicate and participate in collaborative networks via the Internet. Digital competence (or e-competence) must be considered a transversal competence that enables other key competences to be acquired, such as languages or the ability to learn to learn.

Based on the definition of digital competence and within the European framework, various authors have attempted to break down the constituent parts in order to ascertain what it means to be digitally competent, how to plan for its inclusion in the university curriculum, and how to assess the achievement of learning objectives and competence levels.

For example, Ferrari (2013) studies digital competence based on five components: information, communication in digital environments, content-creation, safety and problem-solving. In Spain, Cubillo (2010) constructs a model of 27 indicators that illustrate the various components, grouped into three categories: connection indicators, knowledge indicators and use indicators.

Meanwhile, in Assessment and Teaching 21st Century Skills (ATC21S[1]), digital competence is included in tools for work, with a distinction made

(1) http://atc21s.org/

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between informational literacy and ICT literacy; while in the document Partnership for 21st Century Skills (P21[2]), skills in information, technology and media, are broken down into: information literacy, media literacy and ICT literacy. A similar proposal is made by Ala-Mutka (2011).

As can be seen in the cases studied, there are common elements that lead to the conclusion that except for terminological variations, the work done in the European context has defined the foundations of digital competence very clearly. It is therefore not surprising that higher education institutions have developed their competence frameworks based on the definition of their components, based on the studies by Ferrari (2013) and Cubillo (2010) mentioned above.

However, planning how to teach digital competence in the European higher education framework entails first, a preliminary assessment of the level of digital competence of university graduates (as González, Espuny & Gisbert did, 2010), and second, its incorporation into curricula.

Based on this working method, in the 2003-04 academic year the university studied included the competence "advanced use of information and communication technologies" as a core competence; in other words, as a competence common to all its qualifications, regardless of the area of knowledge.

The university defines three areas to define this competence: the computer's hardware, the operating system, and the specific software, focusing on the use of computers as a communication tool (software for offline and online communication). Its components are also defined, and related to the need for the student to be able to use ICT s in an advanced manner, in order to be able to adapt their communication style to the new technological environment and at the same time, to be able to work collaboratively in virtual teams; all these items are included in the models by Ferrari (2013), Ala-Mutka (2011) and the EU.

Likewise, this competence is defined in terms of learning outcomes and levels, enabling the development of competences and their fit with the demands of the market to be assessed accurately (Gerard & Bief, 2008; Scallon, 2004). This assessment process is one of the biggest challenges for the EHEA, because it must be linked to the student's future professional career. This is impossible without a prior sound diagnosis of competences (Fallows and Steven, 2000) that first determines the students' level

(2) http://www.p21.org

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of competence when they start university and second, the level of competence they need to achieve in order to meet the requirements of the labour market.

The fact is that despite the existence of competence frameworks that have led to a change in the teaching-learning process, and the active role that universities have acquired in the development of digital competence, mismatches persist, like the one between the knowledge of basic information technology tools required by businesses and the knowledge acquired by students (Marzo-Navarro, Pedraja-Iglesias & Rivera-Torres, 2009). If this is true for information technology tools, what is happening in the case of more advanced ICT competences, such as using tools for online collaborative work? Is there also a significant mismatch between classrooms and the market? In the next section, we describe the empirical study we performed that seeks to answer these questions.

Description of the work: methodology, sample and data

Methodology

As noted above, the objective of this research is to analyse the classroom-market fit in relation to digital competence. The study was based on primary sources (content analysis of job offers, Phase 1) in order to define the components of the e-competence profile demanded by the labour market, and on quantitative methods (sending a questionnaire to undergraduate students and to employers, Phase 2) to confirm the classroom-market fit.

Components of the e-competence profile demanded by the market

As a general rule, surveys of employers are usually the most widely used methodology for determining the competences associated with a job and/or professional profile. This method was used by Bahram, Salah and

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Darkish (2008), Hernández-March, Martín-del-Peso and League (2009) and Martín-del-Peso et al. (2013). However, in this study, rather than asking for the employer's subjective opinion in order to define a generic competence profile, we attempted to define the profile by a content analysis of job offers, in order to determine the competence profile that companies are really seeking in their job offers. We believe that as it is more realistic, this approach provides a better analysis of the classroom-market fit.

The Internet was used as a primary source of data collection to define the "e-competence" profile, because of its increasing importance as a tool for intermediation in the labour market[3]. In specific terms, we selected the employment portal Expansión y Empleo (http://www.expansionyempleo.com), as its offers list the competences associated with each job vacancy.

(3) In this case, the results were not differentiated by the field of study because an initial comparison of the proportions (Table 2) revealed an absence of statistically significant differences. We believe that this is evidence that in the case of digital competence, the market demands a competence profile that is unique and independent of the job to be filled.

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TABLE I. Job offers, total offers and final sample analysed (3)

FIELD OF KNOWLEDGE	CATEGORIES	TOTAL OFFERS	% OVER TOTAL	FINAL SAMPLE
Social Sciences*	Marketing-sales	1,077	53.3%	53.3%
	Finances-accounting	514	25.4%	25.4%
	Administration	293	14.5%	14.5%
	Human Resources	119	5.9%	5.9%
	Operation Management	17	0.84%	0.84%
	Subtotal	*2,020*	*69.9%*	*150*
Engineering**	ITC	533	61.4%	61.4%
	Engineering-industry	209	24.1%	24.1%
	Quality, R+D and innovation	126	14.5%	14.5%
	Subtotal	*868*	*30.1%*	*150*
	Total	**2,888**		**300**

Source: Own elaboration

(*) The term Social Sciences includes: anthropology, archaeology, business administration, law, economics, geography, history, philosophy, journalistic communication and psychology.

(**) The term Engineering includes chemical, electrical, electronic, computer, mechanical and industrial automation engineering, and architecture.

(3) Data collected in December 2010.

After using stratified sampling to randomly select 150 offers in each area of knowledge, according to the distribution shown in Table I, we analysed their contents. Table II lists the competences related to ICTs and e-competences, grouped by area of knowledge, based on the number of times that the competence appeared in the 150 job offers analysed. The verification of a possible specific e-competence profile by area of knowledge is also listed. To that end, we compared the content of the job offers in the Social Sciences field with the content of the offers in Engineering using a statistical proportions test (p-value) for a level of error of 0.05 (α=0.05).

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TABLE II. Analysis of contents of job offers

Requested competences	Social Sciences Frequency	Engineering Frequency	Total	p-value ($\alpha = 0.05$)
Word processors	28	16	44	0.050 No
Spreadsheets	33	17	50	0.0132 Yes; higher presence in Social Sciences
PowerPoint	29	14	43	0.0135 Yes; higher presence in Social Sciences
Hardware	0	9	9	0.0023 Yes
Operating Systems	0	34	34	0 Yes; only in Engineering
Internet	19	14	33	0.3562 No
E-mail and online Communications	21	12	33	0.0968 No
Network security	0	13	13	0 Yes; only in Engineering
Networks	0	26	26	0 Yes; only in Engineering
Programming (different languages)	4	56	60	0 Yes; higher presence in Engineering
Web programming	1	29	30	0 Yes; higher presence in Engineering
Communication protocols	1	20	21	0 Yes; higher presence in 1 Engineering
Other	0	41	41	0 Yes; only in Engineering

Source: Own elaboration.

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The results of Table II show that in the competences related to the use of word processors, Internet browsing, use of e-mail and online collaboration it can be concluded, from the proportions test performed (p-value), that the market requires the same competence level of both Social Sciences and Engineering students. As these are core or transversal competencies, the curriculum design should ensure the same competence level for all graduates, regardless of their degree.

Some competences related to using social networks for employability were found to be absent from the competences demanded by the market (Table II), and these in turn have a constant presence in the competence frameworks analysed (Ferrari 2013; Ala-Mutka 2011 and the EU). This competence, linked to the creation and management of a personal brand on the Internet, is essential for ensuring employability in the digital age. As evidenced by the I Infoempleo Report on Social Networks and the Labour Market in Spain (2012), 80% of those responsible for recruitment check prospective interviewees' activities on social platforms, and the Internet is becoming a major channel for establishing and managing contacts. We consequently believe that it is impossible to discuss digital competences without including this new component, which has been defined as "using social networks for employability" (Table III).

Given these considerations, i.e. the competence model of the university studied and the extracted components of the market analysis[4], the analysis variables were classified in three groups, listed in Table III: Competences for computer use, Computer basics and Internet life. The variable Internet use for searching for information (Internet life) should be seen as a variable that addresses the importance of information competence within an organization. According to Ortoll (2004), this variable should be seen as the ability to analyse the reliability and relevance of information found on the Internet.

A variable to analyse the level of perceived relevance in relation to ICTs and the fit with the market was added at the end of the questionnaire. This variable shows whether the students are satisfied with the training they have received, and whether the companies are satisfied with the competence level of university graduates after they have left university.

(4) From the content analysis of the offers, the non-transversal competences have been excluded, such as programming. Those belonging to the competences framework of each analyzed university are included in this study.

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TABLE III. Summary of the variables analysed

	VARIABLES
Competences for the use of key applications	Level of competence in the use of spreadsheets (Excel) Level of competence in the use of word processors (Word) Ability to communicate ideas through presentations (e.g. PowerPoint) (PPT)
Computer basics	Hardware and peripherals (Hardware) Operating systems (Software)
Internet life	Electronic communication and online collaboration (Online communication) Internet use for searching for and analysing information (Infosearch) Level of competence in using social networks for employability (SocialNetwork) Legal and security issues related to the Internet (SecurityLegal)
Relevance to the labour market	Perceived overall level of relevance in relation to digital competences (ICT satisfaction)

Source: Own elaboration.

A questionnaire for the assessment of the students' e-competence level was prepared based on the variables in Table III, using a Likert-type scale from 1 to 5. While the companies were asked to evaluate the perceived e-competence level of the graduates or interns, the students' questionnaire involved self-assessment, as in the study by Camuffo, Gerli, Borgo and Somià (2009).

Sample and data

The university studied is a regional one, with a high percentage of graduates employed in the local region. The study population was selected according to the thesis of García Espejo and Ibañez Pascual (2006), who

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argued: "competence analysis must be performed as close as possible to the job, meaning that it is unwise to extrapolate the findings of a local analysis to an entire country" (p. 146). For this reason, we sought companies using the University's employment service in order to guarantee results that were qualitatively more powerful.

For the companies, the final sample consisted of 142 valid questionnaires out of a total of 573 job offers for 2011. Of the total job offers, 74.83% were in the two areas analysed, and of these, 53.4% were related to the Social Sciences and 46.5% to Engineering. In the final sample, 47.8% were job offers in the Social Sciences and 52.1% were in Engineering.

The student population consisted of 13,790 degree course students, with a final sample of 578 students. 52.6% were women and the remaining 47.4% were men, and by studies, 50.2% were taking studies related to the Social Sciences and 49.8% studies related to Engineering.

The questionnaire was administered to the participants –students and businesses– over three weeks in the first four-month period of the 2011-12 academic year. Google Docs was used for data collection.

Results and discussion

We present and discuss the main results of the study in the following sections.

E-competence profile perceived by students

The results for the e-competence profile perceived by students differed by sex, in a similar manner to the studies conducted by Castaño, Martín and Martínez (2011), and Tondeur, Sinnaeve, van Houtte and van Braak (2010), and by study area. In the case of this second variable, although González et al. (2010) have shown differences in the level of digital competence when entering university, this study goes further by analysing what happens to the competence of the students after admission to university. In order to determine whether there are any significant differences (by sex and area

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of studies) in the university students' e-competence profile, a statistical test was performed to compare the means of independent populations using Levene's test for the equality of variances, with a level of significance below 0.05.

Analysis by sex

The results of the comparison by sex (Table IV) show no statistically significant differences in the level of satisfaction with the level of digital competence developed in the classroom and the level demanded by the market. However, significant differences are apparent in three variables: Online communication, Social networks and Legal and network security aspects. These results are consistent with those of Shapka and Ferrari (2003), and also suggest the disappearance of gender differences in this area of competence. Female students have a higher level of competence for the latter two variables. Some studies account for the greater amount of social networking by women on the grounds of the greater use they make of them to connect with people and solve problems in real life (Moghaddam, 2010), or a higher emotional level of competence (Lin, Shih & Lu, 2011) and a different level of motivation and attitude (Rodríguez Lajo, Vila & Freixa, 2008).

It is possible that the gender differences are related to the students' self-perceived level of skills. As evidenced by Gras-Velazquez, Joyce and Debry (2009) and McCormack (2010), while men usually tend to overestimate their abilities, women do not usually do so, which may affect their online behaviour and results. Women use the Internet more for social reasons, while men use it more for instrumental and recreational reasons (Tondeur et al., 2010). This brings us to the thesis of Abbiss (2011), who says that men are considered more proficient in the field of technology because technical skills, which are considered to be more masculine, are thought of as more legitimate as skills than those related to communication (which are perceived as typically feminine).

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TABLE IV. Digital competence classroom-market fit by sex

	Sex	N	Mean	Stand. Dev.	Err. Estand. Mean	F	Sign.
Excel	Male	274	3.62	.72	.04	.43	.51
	Female	304	3.41	.83	.05		
Word	Male	274	3.87	.94	.06	.11	.74
	Female	304	3.83	.93	.05		
PPT	Male	274	3.68	.74	.04	.40	.53
	Female	304	3.79	.82	.05		
Hardware	Male	274	3.77	.94	.06	1.96	.16
	Female	304	3.43	.93	.05		
Software	Male	274	2.60	1.19	.07	2.05	.15
	Female	304	2.60	1.11	.06		
Online communication	Male	274	2.61	1.22	.07	7.33	.01
	Female	304	2.55	1.08	.06		
InfoSearch	Male	274	4.27	.74	.04	.54	.46
	Female	304	4.14	.77	.04		
Socialnetwork	Male	274	3.87	1.18	.07	6.54	.01
	Female	304	3.95	1.07	.06		
SecurityLegal	Male	274	3.93	.99	.06	6.36	.01
	Female	304	4.15	.85	.05		
ICT Satisfaction	Male	274	2.92	1.10	.07	.92	.74
	Female	304	3.01	1.05	.06		

Source: Own elaboration.

Analysis by field of knowledge

By field of study (Table V), there are four variables in which significant differences were detected: Hardware, Online Communication, Social Networks and legal and security aspects of the Internet. Engineering students have a higher level of competence in the first two and the opposite is true in the last two. This may be due to the nature of the

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qualifications and the fact that a command of hardware is more extensively developed in Engineering, while legal issues are more highly developed at a conceptual level, for example, in the law degree, which is in the Social Sciences field. As in our case, engineering students were also more competent in the study by Herrera-Batista (2009).

Analysis by field of knowledge

TABLE V. Digital competence classroom-market fit by field of study

	FIELD OF KNOWLEDGE	N	MEAN	STAND. DEV.	ERR. STAND. MEDIA	F	SIGN.
Excel	Social Sciences	290	3.42	.80	.05	.19	.66
	Engineering	288	3.60	.76	.04		
Word	Social Sciences	290	3.83	.94	.06	.24	.63
	Engineering	288	3.87	.93	.05		
PPT	Social Sciences	290	3.76	.79	.05	.18	.67
	Engineering	288	3.71	.78	.05		
Hardware	Social Sciences	290	3.50	.91	.05	5.58	.02
	Engineering	288	3.69	.99	.06		
Software	Social Sciences	290	2.56	1.11	.07	1.81	.18
	Engineering	288	2.64	1.19	.07		
Online communication	Social Sciences	290	2.53	1.06	.06	12.13	.00
	Engineering	288	2.61	1.23	.07		
Info search	Social Sciences	290	4.15	.77	.04	.78	.38
	Engineering	288	4.26	.75	.04		
Social network	Social Sciences	290	3.93	1.09	.06	5.89	.02
	Engineering	288	3.90	1.15	.07		
Security legal	Social Sciences	290	4.11	.86	.05	4.95	.03
	Engineering	**288**	**3.98**	**.99**	**.06**		
ICT satisfaction	Social Sciences	290	2.88	1.04	.06	.06	.81
	Engineering	288	3.06	1.11	.07		

Source: Own elaboration.

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As regards the use and maintenance of hardware, as in Moghaddam (2010), a greater degree ofspecialization was observed in the male group, who was considered more competent. As in the study by Cabra-Torres and Marciales-Vivas (2011), we observed a high level of confidence among students in their command of the Internet to search for information (Infosearch), which was higher among men and Engineering students.

As with the gender variable, there were no differences by field of study in terms of the level of satisfaction with the training received in terms of digital competences and the classroom-market fit. These results should be interpreted while bearing in mind that according to the study by ANECA (2009), there is some degree of ignorance and little appreciation of the professional competences required of university graduates by the market; this is something that needs to be remedied by the EHEA. Students should be aware of the true value of the competences acquired as a motivational factor (Solanes, Núñez & Rodríguez, 2008).

In any case, the fact that the results show a possible lack of market relevance may be due to a natural underestimation by students, and their lack of awareness that the digital competences acquired at university, by using virtual learning environments, may be transferable to the workplace, as mentioned by García, González and Ramos (2010). Despite the obvious impact of ICTs on higher education, the digital competences acquired by students may be overestimated.

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E-competence profile perceived by businesses

As regards participants from companies and the key applications of the results of the study, it can be seen that the labour market generally values the level acquired by the students in relation to the competence analysed, and the possible relevance of this level to the requirements of a real job, more negatively than the students themselves do. For the variables related to Computer basics, the companies perception is higher in relation to the command of Hardware and peripherals in the command of Software (operating systems).

The results (Table VI) show that except for the Hardware and Social Networks variables, the perception of the level of digital competence acquired differs considerably, and that companies have the most negative view.

TABLE VI. Group statistics and comparison of means

	GROUP	N	MEAN	STAND. DEV.	STAND ERR. MEAN	F	SIGN.
Excel	Company	142	2.72	1.23	.10	74.11	.00
	Student	578	3.51	.79	.03		
Word	Company	142	3.55	1.06	.09	5.01	.03
	Student	578	3.85	.93	.04		
PPT	Company	142	2.79	1.31	.11	98.60	.00
	Student	578	3.74	.78	.03		
Hardware	Company	142	3.45	.95	.08	.07	.79
	Student	578	3.59	.95	.04		
Software	Company	142	2.37	.99	.08	9.98	.00
	Student	578	2.60	1.15	.05		
Online communication	Company	142	2.94	1.46	.12	21.07	.00
	Student	578	2.57	1.15	.05		

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Info search	Company	142	3.06	1.37	.12	128.82	.00
	Student	578	4.20	.76	.03		
Social network	Company	142	3.39	1.09	.09	1.81	.18
	Student	578	3.91	1.12	.05		
Security legal	Company	142	3.16	1.37	.11	66.79	.00
	Student	578	4.05	.93	.04		
ICT satisfaction	Company	142	2.91	1.44	.12	36.99	.00
	Student	578	2.97	1.07	.04		

Source: Own elaboration.

Although some studies show that both companies and graduates are not satisfied with the level of skills and competences acquired, Salas (2010) suggests that the new teaching and learning models that are being implemented play a key role in the development of competences. However, the level of satisfaction among companies is not very high in this study. This result is a cause of concern bearing in mind that informational and technological skills, among others, are a guarantee of employability for companies (Yusof, Bunian, Aziz & Mustapha, 2010).

At first sight, it would appear that the labour market does not generally perceive a worse classroom-market fit than the students. To confirm whether this is the case, both with respect to this variable and to the other variables analysed (see Table III), we conducted a comparison of the mean populations between the two groups analysed: students and company.

We believe that the discrepancies between the levels of satisfaction of students and companies could have a single origin, arising from the students[7] ignorance of the labour market's demands, and the lack of clarity by companies when specifying their needs to universities. For example, the previous research shows that although half of employers consider management skills to be the most important for competitiveness, only 20% of companies describe the level of their leaders as good (Jackson, 2009). Reducing the conceptual ambiguity about the digital skills needed is a decisive factor in achieving the desired results.

(7) In this case, the results were not differentiated by the field of study because an initial comparison of the proportions (Table 2) revealed an absence of statistically significant differences. We believe that this is evidence that in the case of digital competence, the market demands a competence profile that is unique and independent of the job to be filled.

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The lack of an observed correlation in our study between the competence profile of graduates and the work they do may originate in the lack of a direct or uniform relationship between the content of the curriculum and the competences required, and the fact that most employers do not seek a specific profile but instead a graduate with a specific set of competences (Chaves & Noguera, 2006).

At the same time, the use of a single source to ascertain the demands of the market implies a limitation that could affect the results and how they are interpreted. Future research should therefore as it's a whether similar results would be achieved when using other job offer databases as a primary source, as well as sources of qualitative information.

Conclusions

According to the European statistics, a convergence is taking place between the general level of competence of Spanish and European employees; however, a gap between what university education offers and what businesses demand persists. Over 30% of Spanish graduates have a higher educational level than the level they need to work (Marzo-Navarro, 2009). At the same time, in countries like Spain, which have been heavily affected by the economic crisis, the labour market has been negatively influenced by high rates of unemployment that create job insecurity at all levels of qualification (Peiró, Sora and Caballer, 2012). Hence the growing concern about the mismatch between the skills and competences of the labour force and the needs and demands of the labour market. One of the possible solutions to address this mismatch and improve the employment rate involves individuals receiving the appropriate training, which could consist of the correct development of the competences necessary for engaging in a profession (Foncubierta, 2010; González, Piñero & Santa, 2009). Unfortunately, in this study we have detected a classroom-market mismatch in the field of digital competences.

Although digital competence is a core and transversal competence which should be uniform, the results of our study show some differences among university students in terms of the use and competence level of ICTs by both gender and by area of studies. The competence standardization

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process in the degree courses adapted to the Bologna process is considered effective, but we believe that it is not complete. Further work is still necessary to make the development of (digital) cross-disciplinary competences at universities a reality that homogenizes university graduates, especially by area of knowledge, as we believe there should be no gaps related to gender or field of study in digital citizenship. At the same time, the power of the ICTs must be harnessed to define network-based learning environments (Nawaz & Kundi, 2010) and to move towards a holistic concept of digital competence (Eshet-Alkalai, 2012), as a requirement and right of citizenship in the digital era (Ferrari, 2013) that universities should foster. According to the recommendations of the European Parliament (2007), their presence is essential for lifelong learning and professional training.

It is also important to remember, as noted by Alonso et al. (2009), that close links between the university and society are essential. We are facing a labour market that is increasingly complex and competitive, in which high quality employment is an increasingly scarce resource, and as such it is necessary to reduce the gap between university education and the requirements of the labour market, while simultaneously reducing students' possible lack of awareness of the demands of the market demand and vice versa. The similarities between employers' demands and expectations must continue to increase, and this is also true of students' satisfaction with the level of competences they have acquired, as confidence in one's own skills is a factor affecting students' perception of their own employability (Rothwell, Herbert & Rothwell, 2008).

It is therefore necessary to design a curriculum that enables students to develop the competences that companies really require. In relation to this necessary industry-university cooperation, McArthur (2011) suggests that in order to properly meet the objectives of the Bologna process, classrooms should be integrated with work-based learning environments in order to achieve the desired levels of employability.

Our research focused on analysing the perception of students and employers in relation to digital competence, although it is clear that the inclusion of the three parties involved –University, students and employers– in the employability process is important for achieving the best results. The effectiveness of the process, as indicated by Zhiwen and van der Heijden (2008), depends on the quality of the curriculum, whether it is consistent with current requirements, and its regular annual review. In the case of

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digital competence, the results presented could be the basis for initiating this curriculum review.

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Has the teaching and research productivity of Spanish Public Universities improved since the introduction of the LOU? Evidence from the bootstrap technique

¿Ha mejorado la productividad docente e investigadora de las Universidades Públicas españolas desde la aprobación de la LOU?: Evidencia a partir del *bootstrap*

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Abstract

In the framework of the European Higher Education Area, the Organic Law on Universities 6/2001 (LOU) established a management model based on the need for Spanish universities to become more efficient and productive in their various activities. However, there have been no studies analysing whether such objectives have been accomplished in the Spanish Public University System. This study, therefore, aims to measure the variation in productivity in Spanish Public Universities after this reform, both globally and with reference to teaching and research activities separately, and also to find out the causes of such changes. We use a sample of 39 Spanish Public Universities between 2002/03 and 2008/09 and apply both the Malmquist Productivity Index to measure changes in productivity between two periods and to find out their causes, and the bootstrap technique to determine if the observed changes in productivity are statistically significant. Our findings reveal an improvement of 13.4% in the global productivity rate since the introduction of the LOU with a significance level of 5%, although the increase in

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research productivity (48.5%) is higher than that in teaching productivity (4%). They also show the importance of technological progress in this growth in productivity. Our results therefore provide useful information for political and academic decision-makers regarding the steps that Spanish universities have followed, and should also be of use in future decisions aiming to improve teaching and research productivity.

Key words: Teaching productivity, Research productivity, Spanish Public Universities, Malmquist Productivity Index, Bootstrap.

Resumen

En el marco del Espacio Europeo de Educación Superior, la Ley Orgánica de Universidades 6/2001 (LOU) establece por primera vez un modelo de gestión basado en la necesidad de que las universidades españolas sean más eficientes and productivas en sus distintas actividades. Sin embargo, no existe ningún trabajo previo que haya analizado si, efectivamente, el Sistema Universitario Público de nuestro país ha logrado tal objetivo. Por esta razón, el presente estudio pretende medir la variación de la productividad en las Universidades Públicas españolas, tanto a nivel global como en las actividades docentes e investigadoras, desde la aprobación de dicha reforma universitaria, así como conocer las causas de los cambios productivos observados. Para ello se parte de información relativa a una muestra de 39 universidades presenciales entre los cursos académicos 2002/03 y 2008/09 a fin de aplicar tanto el Índice de Productividad de Malmquist, que permite medir el cambio de productividad entre dos periodos de tiempo y determinar sus causas, como la técnica de re-muestreo *bootstrap,* que confirma si los cambios productivos encontrados son estadísticamente significativos. Así, con un nivel de significación del 5%, nuestros hallazgos indican que la productividad global universitaria ha mejorado un 13,4% desde la implantación de la LOU, si bien el incremento de la productividad investigadora ha sido bastante superior que el de la productividad docente (un 48,5% frente a un 4%). Además, también ponen de manifiesto la importancia del progreso tecnológico en los crecimientos productivos observados. Por tanto, los resultados obtenidos proporcionan información útil para los responsables políticos and académicos a fin de conocer el camino seguido por nuestras universidades and determinar hacia donde debe encaminarse la toma de decisiones futura de cara a mejorar su productividad docente e investigadora.

Palabras clave: Productividad docente, Productividad investigadora, Universidades Públicas españolas, Índice de Productividad de Malmquist, *Bootstrap.*

Introduction

A country's Higher Education system can bring a decisive dose of competitiveness to its economy and contribute to its social and cultural progress because universities create knowledge through their research activity, pass it on through teaching and transfer it to society by supporting enterprises and producing patents (Gómez-Sancho and Mancebón, 2012). This very relevant role of universities on an economic and social level, greater competition among them and limited public funds to finance their activities have sparked interest in improving their performance (Parteka and Wolszczak-Derlacz, 2013). The creation of the European Higher Education Area (EHEA) –a project for university integration and cooperation set up at the end of the 20th century to promote European convergence among universities– has changed the scenario for universities in Europe, encouraging them to be competitive and introducing for the first time criteria of management efficiency and productivity in order to enhance their performance (Mira-Solves et ál., 2012).

Up to the 1970s, the Spanish Higher Education system was hidebound, standardised, elitist, focused on teaching and detached from the country's production and social needs (Hernández Armenteros and Pérez García, 2011). But at the end of that decade a process of change began which led to a consolidated and structured university system that was also characterised by a substantial increase in the number of students and universities, greater research activity and the aim to meet the new demands arising in Spain (Corominas and Sacristán, 2011). In this context and in order to meet the challenges of the EHEA, the Organic Law on Universities 6/2001, dated 20 December (LOU), was passed. This marked the start of a new stage in university policy after almost two decades under Organic Law 11/1983 on University Reform, dated 25 August (LRU). In particular, one of the main challenges was to improve the productivity of the Spanish Public University System in order to increase its economic and social performance. Later on, Organic Law 4/2007, dated 12 April, which amended the LOU (LOMLOU), also helped harmonise Spanish universities within the framework of the EHEA, requiring them to be more efficient and productive in their use of public resources.

Over recent years, the Spanish Public Universities have considerably increased their resources and performance, but there have been problems of productivity stemming from inefficiency in the use of inputs and

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shortcomings in the quality and international relevance of the services provided. For this reason, both the LOU and the LOMLOU introduced certain technical measures to improve their productivity: a) further re-structuring of Higher Education into three cycles – bachelor's degree, master's degree and doctorate – which required significant curricular and organisational changes as well as different teaching methods and resources, with the aim of stepping up the number of students who qualify and improving their training and employability; b) strengthening of relations between universities and business by means of research staff mobility, recognition of their right to take leave to set up technology-based enterprises, and joint R&D&I programmes between universities and businesses; c) promotion of technological innovation in both classroom and distance teaching, improving the dissemination of knowledge, and in research, promoting communication among researchers; and, finally, d) promotion of international mobility for students and teachers, as well as collaboration between Spanish and foreign universities in order to establish relations that will help create synergies.

Improved productivity in the Spanish Public University System is therefore a priority, and the various political and university authorities are interested in knowing if university activities are maximising their performance given the existing resources (Mira-Solves et ál., 2012). However, although the LOU entrusts Spanish universities, for the first time, with the task of becoming more productive in their various functions and both this Law and the LOMLOU introduced new measures to improve performance, there have been no studies analysing whether this purpose has been achieved as a result of the reforms.

This paper therefore focuses on the productive behaviour of Spanish Public Universities since the approval of the LOU. In particular, its objectives are to assess the change in productivity both globally and in the two main university activities –teaching and research– and to determine the causes of such variations, during a period that covers the four alternating academic years between 2002/03 and 2008/09, this being the year for which the latest data are publicly available at institutional level. To achieve these objectives, the Malmquist Productivity Index (MPI) is applied, using Data Envelopment Analysis (DEA) to estimate productivity change over time and its causes, as well as the bootstrap re-sampling technique to determine if the changes observed in productivity are statistically verified.

The study focuses on two basic university functions –teaching and research– for the following reasons. First, although the transfer of

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knowledge is becoming increasingly relevant, it still does not bear the great relative weight of teaching and research in the activities performed by universities (Gómez-Sancho and Mancebón, 2012). Second, there is a close relation between the outputs of research and knowledge transfer activities, which can be channelled both through contracts with enterprises and institutions and by publishing the results of research in important scientific journals so that enterprises can use them (Corominas and Sacristán, 2011).

Our research aims to enrich the literature in the field of the Economics of Education as follows. *First*, it enhances knowledge on the productivity change in the Spanish Public University System, adding new empirical evidence to the limited research carried out to date. *Second*, it analyses the change in productivity both globally and separately for teaching and research activities. Although decisions are usually taken by the institutional authorities for each type of activity, there have been practically no studies in the prior literature on the productivity change of universities that differentiate between their main functions. *Third,* this is the only study, to date, which focuses on measuring the change in teaching and research productivity in Spanish universities since adoption of the LOU. Since both this Law and the current situation of budgetary cutbacks have made improved productivity essential for the Spanish Public University System, it is of interest to ascertain whether this objective has been achieved since approval of the reform. *Four*, it uses the bootstrap technique to test the robustness of its findings. Although this is the most rigorous and powerful methodology for confirming the statistical significance of the MPI results, apart from a recent study by Parteka and Wolszczak-Derlacz (2013), it has not been applied in any studies in the field of Higher Education.

The rest of the paper is organised as follows. The second section reviews the background literature. The third describes the methodology used and the research design. The fourth presents the results, and the fifth concludes.

Background

Productivity in the High Education sector measures the link between the production of universities, mainly teaching and research, and the resources

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used to obtain this production. Even though in recent years improved productivity has become a priority, both nationally and internationally, there have been few academic contributions aiming to assess the productivity change in this sector and most studies focus above all on the global productivity of universities without distinguishing between their basic activities, by using the MPI.

Regarding the change in global productivity, a distinction can be made between studies on institutions in a single country and those that compare the institutions of several countries. The former include research in several English-speaking countries. In the United Kingdom, Glass, McKillop and O'Rouke (1998) studied 54 universities during the period 1989-1992 and showed an average reduction in global productivity of 4%; Flegg, Allen, Field, and Thurlow (2004) revealed average productive growth of 51.5% in 45 institutions from 1980/81 to 1992/93; and Johnes (2008) found a 1.1% improvement in productivity in 112 universities between 1996/97 and 2004/05. In Australia, Carrington, Coelli and Rao (2005) analysed 35 institutions and found an average productivity increase of 1.8% between 1996 and 2000. Finally, in the United States, Sav (2012) showed a slight decrease of 1.3% in productivity in 133 universities between 2005 and 2009. Within Europe, Agasisti and Dal Bianco (2009) found an average improvement in productivity of 17% in 74 Italian universities between 2001/02 and 2003/04. And a single study by Fernández-Santos, Martínez-Campillo and Fernández-Fernández (2013) measured the change in productivity of Spanish universities, finding an average increase of 8.1% in a sample of 39 institutions between 2002/03 and 2008/09.

From a cross-country approach, three studies compare the change in global productivity of universities in different countries: Agasisti and Pérez-Esparrells (2010) concluded that Italian Public universities saw a greater increase in productivity (48.2%) than Spanish ones (6%) between 2001/02 and 2004/05; Agasisti and Johnes (2009) found that Italian universities were only 0.9% ahead of English universities between 2002/03 and 2004/05; and, finally, Parteka and Wolszczak-Derlacz (2013) compared a sample of institutions from seven European countries (Austria, Germany, Italy, Poland, Switzerland and the United Kingdom) between 2001 and 2005 and, after applying the bootstrap technique to check the robustness of results using the conventional MPI, found statistically significant changes in productivity, varying between a 2% drop in Austria and a 9% increase in Switzerland.

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A review of this literature leads to the general conclusion that improved global productivity is mainly due to technological progress, while a decline is largely due to poorer technical efficiency.

Finally, to our knowledge, only three studies have analysed the change in productivity of universities, distinguishing between their main activities. Worthington and Lee (2008), taking a sample of 35 Australian universities, showed that the increase in research productivity was greater than that in teaching during the period 1998-2003 (6.3% as opposed to 2.9%), and Mahmoudi, Tabandeh and Fathi (2012), taking Iranian universities during the decade from 1999 to 2009, also concluded that the improved productivity in research was greater than that in teaching (9.5% as opposed to 3.8%). So, in both these studies, research productivity grew more than twice as much as teaching productivity, bearing in mind that improved teaching productivity was exclusively due to technological progress although the latter contributed less than the growth in technical efficiency to improving research productivity. In Spain, García-Aracil, López-Iñesta and Palomares-Montero (2009) carried out an analysis by functions, considering 42 Spanish universities between 1995/96 and 2005/06. This study concluded that the productivity of research and knowledge transfer activities saw average increases of 5.4% and 12.5% respectively, largely because of improved technical efficiency, while teaching productivity dropped by 1.5%, largely because of backward progress in technology.

Methodology and design

Malmquist Productivity Index (MPI)

The most popular approach for evaluating productivity change between two periods is the Malmquist Productivity Index (Malmquist, 1953) (MPI). Färe, Grosskopf, Norris and Zhang (1994) specifically developed this index to measure productivity change in management so that, when the MPI is greater than 1, it indicates an improvement in productivity between periods t and $t+1$, while an MPI less than 1 suggests a decline in productivity.

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To calculate the MPI, the distance function (D) introduced by Shephard (1953) has to be considered in two different time periods (t and $t+1$) with their respective technologies, which, in this case, assume constant returns to scale. However, to avoid arbitrariness in the choice of the reference technology for the two periods, we must solve four distance functions. In two of them, the observation and the production technology are defined in the same period ($D^t(x^t,y^t)$ and $(D^{t+1}(x^{t+1},y^{t+1}))$ in the others, the observation and the technology correspond to different periods, ($D^{t+1}(x^{t+1},y^{t+1})$ and $D^{t+1}(x^t,y^t)$) when x is the input vector and y is the output vector. This indicator can therefore be broken down into the product of two components (Fare et ál., 1994): the first is Technical Efficiency Change (TEC), which shows improvement or worsening in the management of available resources, and the second is Technological Change (TC), i.e., growth or decline in the technology used.

$$MPI^{t,t+1} = \frac{D^{t+1}(x^{t+1},y^{t+1})}{D^t(x^t,y^t)} \text{ x } \left[\left(\frac{D^t(x^{t+1},y^{t+1})}{D^{t+1}(x^{t+1},y^{t+1})}\right)\left(\frac{D^t(x^t,y^t)}{D^{t+1},(x^t,y^t)}\right)\right]^{1/2} = TEC \text{ x } TC \qquad (1$$

The MPI, therefore, has the following advantages (Bogetoft and Otto, 2011): a) it can be calculated without price data; b) it does not need a performance that minimizes costs or maximizes revenue; and c) it allows the productivity change to be broken down into technical efficiency change and technological change, thus making it possible to determine the causes of the productivity change.

In this paper, we use the MPI based on the DEA methodology. This methodology is a non-parametric linear programming technique which allows calculation of the relative efficiency of a set of Decision Making Units (DMUs) regarding the best practices observed, taking into account the inputs and outputs involved in the production process. More specifically, we adopt an output-oriented DEA model, which measures how much universities' outputs can be proportionately increased given an observed level of inputs. The reasons for this choice are the rigidity of university resources, which are usually established by higher-level public authorities based on predetermined criteria, as well as the difficulty of making changes in such resources, at least in the short term. This means that university administrators have little control over the inputs and, therefore, they focus more on achieving better results than on minimising the resources used (Gómez-Sancho and Mancebón, 2012).

The bootstrap technique

An important limitation of the conventional DEA model is the sensitivity of results to data errors, to the absence of DMUs that cannot be included in the study and to the presence of outliers. Moreover, its deterministic nature means that measures of sample noise, due to missing variables, incorrect values for some variables or other discrepancies are included in the estimates.

One option to overcome these weaknesses is to use the bootstrap re-sampling technique. In particular, in this study we use the non-parametric estimator developed by Simar and Wilson (1999), which has statistical inference properties. This estimator makes it possible to evaluate the statistical significance of the productivity change values from the MPI and, therefore, to conclude if the results obtained indicate a real change in productivity or are simply sampling noise.

We use the FEAR in R statistical package (Wilson, 2008) to obtain the bootstrap results.

Population and sample

The Spanish university system today comprises 77 universities of which 50 are Public universities (approximately 65% of the total) and 27 are private. Of the Public universities, one is for distance learning (UNED) and two only run specialist postgraduate programmes (Universidad Internacional Menéndez Pelayo and Universidad Internacional de Andalucía). The target population for this study therefore comprises 47 Spanish universities. The period of study covers four alternating academic years between 2002/03 and 2008/09. These are the last years for which institutional information is available since approval of the LOU.

The need to use a full data panel to apply the MPI means that eight universities had to be eliminated from the empirical study because information was missing on some variable of interest for the whole period. We therefore ended up with a total sample of 39 Public universities (or DMUs to use the DEA terminology) for each academic year. Our sample therefore represents 83% of the population of universities considered, which amounts to an acceptable margin of error of 6.5% with a confidence level of 95%.

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Selection of variables and specification of models

The first step for measuring productivity change in the Higher Education sector is to select the input and output variables that define the process of university production. For this purpose it is essential to have available data, which has traditionally been a serious limitation in Spain. In addition, in order for the estimates to be reliable, the number of DMUs must be at least the maximum between m x s or 3 x (m+s), with m and s being the number of input and output variables, respectively (Cooper, Seiford and Tone, 2007). In this study, all the estimates meet this requirement.

In particular, our specification of inputs and outputs is the same as that given recently by Parteka and Wolszczak-Derlacz (2013). They use as inputs the number of academic staff, the total number of registered students and the amount of university revenue and, as outputs, the total number of graduate students (teaching) and the number of quality publications (research). However, in order for the selection of outputs to be comparable with that given by García-Aracil et ál. (2009) –the only prior study that has measured the productivity change of Spanish universities distinguishing between their main activities– an additional variable is added, that of R&D revenue.

The three input variables were defined as follows:

- *Academic Staff* (ACSTAFF): Total number of full-time equivalent academic staff, whatever their category, per fiscal year. This variable measures the contribution of academic staff to university education, adding the number of full-time and part-time teachers, weighting the teaching hours of the latter.
- *Registered Students* (ST): Total number of students registered per academic year, considering all university levels. Since official Master courses only started to be offered in Spain during the academic year 2006/07, at this level there are only publicaly available data for all universities for 2008/09.
- *Total Revenue* (TR): Total amount of university revenues in thousands of euros per fiscal year.

The three output variables were defined as follows:

- *Graduate Students* (GRAD): Total number of students achieving their qualification per academic year, considering all university levels.
- *Research Publicactions* (RP): Total number of scientific articles published and indexed in the ISI Web of Science per fiscal year. When

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an article is written by authors from several universities, this is considered a publication for each of the institutions involved.

- *R&D Revenue* (R&DR): Total amount of R&D revenues received in thousands of euros-per fiscal year. This variable includes both basic research –sums from aid for research and from research projects– and applied research–sums from contracts and agreements drawn up with third parties for the provison of research, consultancy and advisory services.

Measurement of these variables is based on the bi-annual information published on the website of the Conference of Rectors of Spanish Universities-CRUE (Hernández Armenteros, 2004, 2006, 2008, 2010), except for the number of research publications, for which the source is the ISI Web of Science published by Thomson Reuters (http://apps.webofknowledge.com/). Data expressed in monetary units are deflated to constant prices for 2002, using the GDP deflator.

Table 1 summarises, for each academic year, the main descriptive statistics for the input and output variables considered in the study.

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TABLE I. Descriptive statistics: input and output variables

ACADEMIC YEAR	STATISTIC	ACSTAFF	ST	IT	EG	ART	AYID
2002-03							
	Máx.	5,102	87,460	419,915	13,810	1,995	50,905
	Mín.	370	5,992	30,614	512	43	755
	Mean	1,580	26,047	135,754	3,600	412	14,528
	Std. Dev.	1,092	18,533	92,291	2,747	405	12,019
2004-05							
	Máx.	5,077	83,590	460,854	9,938	2,157	46,612
	Mín.	413	6,073	31,466	556	76	1,752
	Mean	1,642	25,132	155,806	3,294	470	15,383
	Std. Dev.	1,089	17,627	109,213	2,190	445	11,689
2006-07							
	Máx.	5,311	78,904	471,934	9,226	2,445	62,263
	Mín.	401	5,958	31,469	599	83	2,190
	Mean	1,711	23,957	151,023	3,153	547	20,276
	Std. Dev.	1,150	16,743	101,093	2,094	503	16,249
2008-09							
	Máx.	5,346	77,515	494,628	9,816	2,924	69,042
	Mín.	400	5,862	34,307	793	96	1,928
	Mean	1,764	24,092	171,758	3,612	647	24,188
	Std. Dev.	1,170	16,557	113,342	2,274	581	18,258

n= 39 DMUs

ACSTAFF: Academic Staff; *ST*: Registered Students; *TR*: Total Revenue; *GRAD*: Graduate Students; *RP*: Research Publications; *R&DR*: *R&D* Revenue.

Source: Own elaboration.

Starting from our specification of inputs and outputs, three different models were built: the *Teaching* and *Research* models, in order to analyse the productivity change for each activity separately and the *General* model which considers the two university functions together in order to evaluate the change in overall productivity. While the output variables for the

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Teaching and Research models differ, some of the input variables are the same because these resources are shared by both activities.

In the Teaching model, the inputs selected are Academic Staff (ACSTAFF), Registered Students (ST) and Total Revenue (TR), and the output selected is Graduate Students (GRAD). The inputs for the Research model are Academic Staff (ACSTAFF) and Total Revenue (TR), and the outputs are Research Publications (RP) and R&D Revenue (R&DR). The General model uses all the inputs and outputs defined in this section.

Results

Discussion of results

Table II shows the original estimates after applying the conventional MPI. It shows the changes in productivity, efficiency and technology for the activities performed by the universities and for each of the periods studied.

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TABLE II. Original estimates of productivity change and its components by activity and period

	IPM	ΔET	Δt
TEACHING			
2002-03-2004-05	0,952	0,949	1,005
2004/-5-2006-07	0,973	1,064	0,914
2006-07-2008-09	1,114	1,003	1,112
2002-03-2008-09	**1,032**	**1,004**	**1,028**
RESEARCH			
2002-03-2004-05	1,048	0,980	1,078
2004-05-2006-07	1,248	1,090	1,145
2006-07-2008-09	1,099	1,049	1,049
2002-03-2008-09	**1,431**	**1,087**	**1,315**
GENERAL			
2002-03-2004-05	0,958	0,947	1,011
2004-05-2006-07	1,043	1,012	1,028
2006-07-2008-09	1,106	1,019	1,085
2002-03-2008-09	**1,112**	**0,968**	**1,147**

n= 39 DMUs.
IPM: Productivity Change; TEC: Technical Efficiency Change; TC: Technological Change
Source: Own elaboration.

Although between the initial and final sub-periods the change in teaching productivity followed an upward trend as opposed to the irregular trend in research productivity, over the total period the latter saw an average increase of 43.1% as opposed to just 3.2% for the former. These improvements in productivity indicate, respectively, that per input unit, during the 2008/09 academic year, Spanish Public universities achieved 43.1% more outputs in research and 3.2% more in teaching than in 2002/03.

If the analysis focuses on teaching activity, in line with the prior empirical studies, average growth in productivity was motivated mainly by technological progress (2.8%), because the improvement in technical efficiency was insignificant (0.4%). This technological progress reflects an important change in curricular organisation in Spanish universities after approval of the LOMLOU in 2007, with the adoption of the new structure for bachelor's and master's courses which involved an increase in the ratio of

students qualifying over registered students. Since this effect first became apparent as from the 2006/07 academic year, it should be no surprise that in the last sub-period there was an increase in teaching productivity of 11.4% as opposed to drops of 2.7% and 4.8% in the two previous sub-periods.

The marked growth in research productivity mainly occurred between the 2004/05 and 2006/07 academic years, when it grew by 24.8% as opposed to 4.8% and 9.9% in the two remaining sub-periods. Therefore, the main improvement in research productivity took place once the Spanish universities had regained stability after adapting to the new requirements of the LOU, which introduced a number of technical measures to promote research activity. Regarding the causes of this improved productivity, and in line with previous studies, this seems to be due both to improved technical efficiency and, therefore, improved management of resources, and to technological progress, although the latter made a greater contribution (31.5% as opposed to 8.7%).

Analysis of both activities together reveals growth of 11.2% in the global productivity of Spanish universities between the 2002/03 and 2008/09 academic years, exclusively because of technological progress (14.7%).

Table III compares the original and bootstrap results of estimation of the three models between the 2002/03 and 2008/09 academic years. The bootstrap results are obtained after applying the algorithm described by Simar and Wilson (1999) indicating, in this case, the productivity changes that are statistically significant at a standard level of 5%. These results are therefore more robust and reliable than the original ones.

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TABLE III. Comparison of original and bootstrap estimates of productivity change and its components by activity (2002/03 to 2008/09)

	TEACHING		RESEARCH		GENERAL	
	Original	***Bootstrap*** (α = 5%)	**Original**	***Bootstrap*** (α = 5%)	**Original**	***Bootstrap*** (α = 5%)
Productivity Change (MPI)						
N.º DMUs with increase	22	20	38	33	26	23
% DMUs with increase (*)	56,4%	51,3%	97,4%	84,6%	67%	59%
Mean (**)	1,032	**1,040**	1,431	**1,485**	1,112	**1,134**
Technical Efficiency Change (TEC)						
N.º DMUs with increase	17	11	22	11	11	4
% DMUs with increase (*)	43,6%	28,2%	56,4%	28,2%	28,2%	10,3%
Mean (**)	1,004	**1,014**	1,087	**1,253**	0,968	**0,918**
Technological Change (TC)						
N.º DMUs with increase	24	16	39	25	29	25
% DMUs with increase (*)	61,5%	41,0%	100,0%	64,1%	74%	64%
Mean (**)	1,028	**1,064**	1,315	**1,357**	1,147	**1,206**

n = 39 DMUs.
(*) El % de DMUs with increase is calculated from a total of 39 DMUs for each academic year.
(**) The mean for the "Original" column refers to the 39 total DMUs, while for the "*Bootstrap*" column it refers to the DMUs with a statistically significant change.
Source: Own elaboration.

According to the original MPI estimates, of the 39 universities considered, 56.4% managed to increase their teaching productivity and 97.4% their research, with 67% increasing their global productivity after approval of the LOU. However, when the bootstrap re-sampling technique is applied, these percentages drop to 51.3%, 84.6% and 59%, respectively.

In addition, the bootstrap results confirm, with a 5% significance level, that the improvement in research productivity in Spanish universities is much greater than that in teaching so that, while the former increases on average by 49.5%, the latter only increases by 4%. These findings are in line with those of Worthington and Lee (2008) for Australian universities and of Mahmoudi et al. (2012) for Iranian universities, although in our study we find a greater difference between the productivity increases in research and teaching. If our results are compared with those of García-Aracil et ál.

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(2009), which is the only Spanish study on this topic, it can be concluded that productivity improved substantially after approval of the LOU in the two main university functions, because the latter study shows that, between 1995 and 2006, research productivity only increased by 5.4% whereas teaching productivity dropped by 1.5%. Regarding the causes of the productivity changes observed, the bootstrap technique corroborates that, after adoption of the reform, the improvement in teaching and research productivity in Spanish univeristies was mainly due to technological progress (6.4% and 35.7% as opposed to a technical efficiency change of 1.4% and 25.4%, respectively). These results therefore differ from those found by Worthington and Lee (2008), Mahmoudi et ál. (2012) and García-Aracil et ál. (2009), which only indicated the importance of technological change for explaining the change in teaching productivity.

Regarding global university productivity, the bootstrap technique indicates, at a significance level of 5%, an increase of 13.4% between the 2002/03 and 2008/09 academic years, exclusively because of a 20.6% increase in technology. Therefore, at a national level, our findings are in line with those of Agasisti and Pérez-Esparrells (2010) and Fernández-Santos et ál. (2013). With different specifications for inputs and outputs, they also found improved productivity in Spanish Public universities as from 2001 and, therefore, as from the adoption of the LOU. However, while in the former the increase in productivity is determined solely by the increase in efficiency, in the latter, technological progress is also fundamental. If a comparison is made with other EHEA countries, with the exception of Italy whose universities achieved a 17% improvement in productivity between 2001/02 and 2003/04 (Agasisti and Dal Bianco, 2009) or 48.2% between 2001/02 and 2004/05 (Agasisti and Pérez-Esparrells, 2010), of all the countries analysed, Spain is the one that achieved greatest growth in global university productivity as from the start of the 21st century.

Finally, Graph I shows the situation of the 39 Spanish Public universities after applying the MPI in the Teaching and Research models between 2002/03 and 2008/09, as well as the level of statistical significance of this indicator in both models.

Regarding teaching, 22 of the 39 universities showed increased productivity, with 56.4% of them improving their teaching productivity and the best being the Universidad Carlos III de Madrid (UCAR) and the Politécnica de Cartagena (UPCT). Regarding research, 38 institutions showed

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an improvement, that is, 97.4%, with the most outstanding being the Universidad Pablo de Olavide (UPO) and, to a lesser extent, the Universidad de Lleida (UDL).

If both activities are considered together, the Universidad Pablo de Olavide (UPO) is in the leading position, with productivity increases in teaching and research of 18% and 135%, respectively. On the other side of the scale is the Universidad de Las Palmas de Gran Canaria (ULPGC), with drops in both types of productivity of about 40% and 20%, respectively.

When the bootstrap re-sampling technique is applied, all the changes in productivity observed in these five universities are seen to be statistically significant at 5%.

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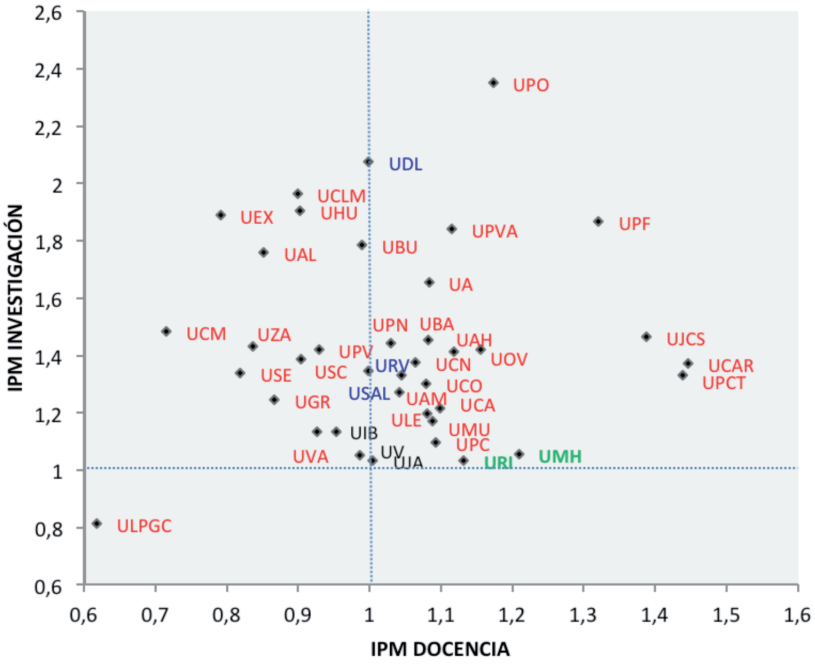
GRAPH I. Relative position of Spanish Public universities regarding productivity change in teaching and research activities (2002/03 to 2008/09)



UAL-U: Almería; UCA-U: Cádiz; UCO-U: Córdoba; UGR-U: Granada; UHU-U: Huelva; UJA-U: Jaén; UPO-U: Pablo de Olavide; USE-U: Sevilla; UZA-U: Zaragoza; UOV-U: Oviedo; UIB-U: Islas Baleares; ULPGC-U: Las Palmas de Gran Canaria; UCN-U: Cantabria; UCLM-U: Castilla-La Mancha; ubu-u: Burgos; ule-u: León; usal-u: Salamanca; uva-u: Valladolid; uba-u: Barcelona; udl-u: Lleida; upc-u: Politécnica Cataluña; UPF-U: Pompeu Fabra; URV-U: Rovira i Virgili; UA-U: Alicante; UJCS-U: Jaume I Castellón; UMH-U: Miguel Hernández; UPVA-U: Politécnica Valencia; UV-U: Valencia; UEX-U: Extremadura; USC-U: Santiago de Compostela; UAH-U: Alcalá de Henares; UAM-U: Autónoma Madrid; UCAR-U: Carlos III; UCM-U: Complutense de Madrid; UMU-U: Murcia; UPCT-U: Politécnica de Cartagena; UPN-U: Pública de Navarra; UPV-U: País Vasco; URI-U: La Rioja.

- MPI in Teaching and Research Models significant at 5%
- Only MPI in Research Model significant at 5%
- Only MPI in Teaching Model significant at 5%
- MPI in Teaching and Research Models not significant

Source: Own elaboration.

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Conclusions

The LOU established for the first time a management model based on the need for Spanish universities to be more efficient and productive in their various activities. As a result, improved teaching and research productivity became a key objective both for political decision-makers and for the administrators of Spanish educational institutions. However, there is no evidence as to whether the Spanish Public University System has actually achieved this objective since adoption of the reform.

This study therefore aims to answer the following question: *Has teaching and research productivity in Spanish Public universities improved since the LOU was adopted?* More specifically, it aims to measure the productivity change of Spanish Public universities over this period, both globally and in teaching and research separately, and to find out the causes of such changes in productivity. After applying both the conventional MPI and the bootstrap technique to information on 39 Spanish Public universities between the 2002/03 and 2008/09 academic years, two conclusions can be drawn based on statistically significant results:

1) After approval of the LOU, there were positive changes in the performance of Spanish Public universities. Their overall productivity improved by 13.4% over the period analysed, with a much higher increase in research productivity than in teaching productivity. With the same level of resources, during the 2008/09 academic year, Spanish universities obtained 48.5% more research outputs and 4% more teaching outputs than in the 2002/03 academic year.

A possible explanation for the better trend in research productivity, both nationally and internationally, could be the willingness of universities to increase their competitiveness in order to obtain a good position in the main worldwide rankings (such as The Academic Ranking of World Universities, published by the Jiao Tong University of Shanghai, The Times Higher Education Ranking, drawn up by The Times, and the Webometrics Ranking, drawn up by the Spanish Higher Council for Scientific Research -CSIC-). Within Spain, another explanation could be that Spanish Public universities adapted faster to the requirements of the LOU in research than in teaching, because both this Law and the LOMLOU emphasise the immediate promotion of research, while the new structure for official curricula was only adopted in the 2006/07 academic years for master's courses and in 2008/09 for bachelor's courses. In addition, if it is accepted

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that there is a certain trade-off between the two activities, the drop in teaching obligations for teaching staff because of the reduction in the student/teacher ratio during the period analysed (stemming from both the drop in the number of students registered, mainly for demographic reasons, and the increase in teaching staff) and the greater prestige and curricular value of research as opposed to teaching could also have intensified research activity in Spanish universities.

2) Regarding the causes of the productivity changes observed, technological progress seems to have been decisive in improving productivity in the Spanish higher education sector after adoption of the LOU. The positive trend in global productivity in Spanish universities is caused exclusively by technological progress, which contributes to a greater extent than greater technical efficiency to improving teaching and research productivity.

This technological progress reflects some changes seen in Spanish universities since approval of this reform, such as the new official curricular organisation, greater use of technological innovation, and the motivation to maximise revenue from R&D&I programmes to be adopted jointly by universities and business.

Practical implications

In the light of these findings, a number of recommendations can be made both to university authorities and political decision-makers for improving the use of the resources available for both university functions and, therefore, for enhancing the performance of the Spanish University System.

Since it would be difficult to imagine a good-quality Higher Education System with productivity problems, it should be taken into account that in this study technological progress seems to be the main factor behind the positive trend in Spanish university productivity, both globally and in teaching and research activities separately. Possible measures that could be adopted to ensure that Spanish universities continue along this path should include measures relating to technological progress. In terms of the productivity of Higher Education, such technological progress could stem from a renewed curricular structure, academic innovation, an improved process for acquiring resources and improved communication channels as well as the adoption of new university governance systems or innovative decision-making techniques.

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More specifically, the adoption of new educational tools could be vital for improving teaching productivity in Spanish universities, which is way behind research productivity and is lower than the average in the most advanced countries. It might be appropriate to draw up new models for assessing academic staff in order to obtain a rigorous diagnosis that would allow their teaching performance to be improved, to use new, active, inductive and cooperative teaching and learning techniques to encourage students to obtain better academic results or to introduce innovations that might lead to better use of university teaching resources, such as cloud computing, educational apps for mobile phones and smart campuses.

Finally, since the current legislation only covers one type of institution that must carry out both teaching and research activities to the same degree, information on the situation of each of the Spanish universities and its forward or backward progress in teaching and research productivity would be useful so that the institutional authorities can see the path followed and determine the direction of decisions to achieve a good relative position in both activities. However, the legislation has certain limitations in that, for example, some teachers are paid for research time even though they do no research, and in some universities all teachers have the same teaching load irrespective of their research performance. Therefore university productivity could be enhanced if the political decision-makers were to introduce changes allowing universities to specialise in either teaching or research, in whichever they are most productive.

Limitations and future lines of research

Although this study contributes to the field of the Economics of Education, it has certain limitations: a) it is difficult to select the input and output variables because of the shortage of data in Spain; b) it is difficult to simplify in just a few inputs the complex activities of teaching and research and to quantify outputs as these are intangible; c) inputs in the two activities overlap so, even when bootstrapping is applied, the results should be interpreted with caution; and d) the possible relations between the "before" and "after" cut-off point of the LOU and the results obtained are only provisionally acceptable hypotheses so a direct causal relationship between them cannot be established.

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For future studies it would be of interest to consider, as far as possible, more and better variables so that the study of productivity change reflects the university production process more clearly. It would also be very useful to find the determinants of the productivity changes observed, both globally and in teaching and research activities separately, by performing a second-stage analysis using DEA methodology and also performing studies on cost efficiency, in view of the current situation of budgetary cutbacks in the Higher Education sector.

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Media competence of non-university teachers. Diagnosis and training proposals

La competencia mediática en el profesorado no universitario. Diagnóstico y propuestas formativas

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Abstract

The research in which this article is framed started from the conviction that the new audiovisual and media culture in which childhood and youth unfolds is legitimately demanding attention and appropriate educational reorientation by teachers of formal education. This study is part of a R&D project funded by the Spanish government, aimed at detecting and assessing the level of media competence of non-university teachers of Spain based on responses to a questionnaire that integrates six dimensions of media competence and new communication technologies (language, technology, reception and interaction, production and dissemination, ideology and values, and aesthetics). From the diagnosis made, we intend to stablish the foundations of a credentialing or training program in media literacy targeting non-university teachers. The sample of teachers was composed of 905 teachers from public, private and State-subsidized schools in this country. An on-line questionnaire designed specifically for the intended research was applied on teachers at kinder, elementary, secondary and professional

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training. The analysis has been based on statistical calculations both descriptive and correlational. Locality, gender, level of education received, the stage in which teaching is delivered and ownership, were considered predicting variables of the teacher's media competence. The results showed that teachers achieve adequate levels of competence, and even a high percentage of them get high levels. However, other teachers show that it is necessary to focus on their training to increase their media competence. This work ends providing general guidelines of a future training program in media competence addressed to non-university teachers.

Key words: media competence, not university teachers, audiovisual communication and digital, media education, training program.

Resumen

La investigación en la que se inscribe este artículo partió de la convicción de que la nueva cultura audiovisual o mediática en la que se desenvuelven la infancia y la juventud está exigiendo legítimamente una atención y una reorientación educativa adecuada por parte del profesorado de la educación formal. Este estudio se enmarca en un proyecto I+D financiado por el gobierno español; el objetivo es detectar y evaluar el nivel de competencia mediática del profesorado no universitario de España a partir de las respuestas a un cuestionario que integra seis dimensiones de la competencia mediática y nuevas tecnologías de la comunicación (lenguaje, tecnología, recepción e interacción, producción y difusión, ideología y valores, y aspectos estéticos). A partir del diagnóstico realizado, pretendemos sentar las bases de un programa de capacitación o formación en competencia mediática dirigido al profesorado no universitario.

La muestra de profesorado fue de 905 profesores pertenecientes a centros públicos, privados y concertados de este país. Como instrumento de medida se aplicó un cuestionario online diseñado ex profeso para la investigación destinado al profesorado de Educación Infantil, Primaria, Secundaria y Formación Profesional. El análisis se ha apoyado en cálculos estadísticos descriptivos y correlacionales. Se consideraron como variables predictoras de la competencia mediática del profesorado la localidad de procedencia, el género, el grado de formación recibida, la etapa en la que se imparte docencia y la titularidad del centro. Los resultados mostraron que el profesorado alcanza unos niveles competenciales adecuados, e incluso en un alto porcentaje obtiene niveles elevados. No obstante, otro sector muestra que es necesario incidir en su formación para incrementarlos. El trabajo finaliza presentando las líneas generales de actuación de un futuro programa de formación en competencia mediática dirigido al profesorado no universitario.

Palabras clave: competencia mediática, profesorado no universitario, comunicación audiovisual y digital, educación mediática, programa de formación.

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Introduction

This article is framed within a national research that focuses on media competence of teaching staff at kinder, elementary, secondary, and professional training level in ten different provinces in Spain: Cantabria, Córdoba, Huelva, Granada, La Rioja, Lugo, Málaga, Murcia, Sevilla, and Valencia.

Our first premise is that from an educational perspective it is a mistake to keep associating univocally knowledge, culture and purely conceptual thinking, far or even independent both from the world of image and from the new audiovisual communicative and interactive environment that has emerged on childhood and youth: social networks, video games, blogs, Whatsapp, etc. These interactive media fostered by new technologies add up new audiovisual communication ways to the traditional ones (television, films, radio, and press), which they have a great educational potential which justifies its incorporation in schools.

In the new digital, audiovisual and communicative environment, the role of the teacher as manager, facilitator and promoter of media competence is critical. With this premise, it is equally critical the task of detecting and diagnosing the media competence of the teacher itself, included his perception of his own competence, diagnosis which is a previous and necessary step for an upcoming stage of training proposals in this direction. The interest for incorporating media competence within the educational field is not new but a demand of international institutions such as Unesco, specially throughout their famous Grunwald Declaration of 1982 which highlights the importance of media literacy "in a world where media are omnipresent". Since then, meetings, encounters, declarations and international projects have been organized in order to promote media literacy, being the European Union one of the political spaces that has support the educational reform in these terms. According to Aguaded (2013):

> For a decade, the EU has supported decisively media literacy in the framework of the European Union States, with the aim of fostering a more active, critic and participative citizenship in the information society (p.7).

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In words of García-Ruiz, Pavón & Guerra (2011), it seems schools need a boost to meet what society demands: competent citizens towards audiovisual media. Children and young adults are surrounded by audiovisual media outside the classroom, which is the reason why there is a need of eliminating the barrier that sometimes classroom walls mean. In the classroom the potential offered by media is not used, many times because teachers are not competent in media literacy, which is the cause why they need specific training.

Despite different training proposals to implement new technologies and media literacy in the classroom, the teaching staff does not feel competent or confident to carry out the role assigned (Gray & Lewis, 2009; Valverde Garrido & Fernández, 2010; Tirado & Aguaded, 2014). With this scenario, maybe the first task is to specify with good criteria and in a solid way which are the media competences required by teachers.

In the last ten years, there have been several attempts to specify the skills required by the teaching staff at an institutional level in the area of media and information literacy, from ACCE (2000) to ISTE (2008) (Almerich, Suárez, Jornet & Orellana, 2001, p. 30). In 2008, the Unesco launched a proposal to develop a worldwide curriculum to train teachers in media and information literacy. This publication came to light in 2011 and it was called "Media and Information Literacy. A Curriculum for Teachers" (Unesco 2011). Since its publication, it has been adapted by different countries, experimenting actively many of its proposals and recommendations (Pérez-Tornero & Tayie, 2012, p.11).

Therefore since there is no specific consensus on media skills and literacy required by teachers, we can assume that: 1) the existence of two large groups of competencies: technological and pedagogical; the knowledge and mastery of technological resources and devices, along with the knowledge and skills needed to apply them pedagogically in the classroom (Suárez, Almerich, Gargallo & Aliaga, 2013), 2) the tendency to define a comprehensive competency-based training model that puts together technological competences and language, production, and reception of messages, including ethical, civic and aesthetic aspects.

The aim is to promote a broad media education good enough to meet the needs of a democratic society (Gozálvez & Aguaded, 2012; Gozálvez, 2013) based on an adequate competence level of teachers. The mentioned report, «Media and Information Literacy. A Curriculum for Teachers», by Unesco in 2011, recognizes that the quality of information we receive has

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great impact in the decisions we make, in our capacity to exercise our fundamental rights, our projects of self-determination and the development of citizenship. From this premise and in this context, "it is vital to enhance media and information literacy as it expands the civic education movement, which incorporates teachers as the principal change agents (Unesco, 2011, p. 11). As a result, promoting media competence contributes to:

> Empowering people in all aspects of life to search, evaluate, use and create information in a more practical manner to reach their personal, social, professional and educational goals. This is a basic right in a digital world and promotes the social inclusion of every nation (Unesco, p.16).

To guarantee media and information literacy of teachers is critical in their task of empowering their students in their efforts of "learning to learn" independently so they can continue with a long-life learning. By doing this, teachers will be performing:

> Their first role as defenders of a rational and well-informed citizenship and, on the other hand, they will be responding to change in their role as teachers, as teaching evolves from a teacher-centered to a student-centered model (Unesco, p.17).

Gutiérrez-Martín (1999) stressed the need of making literate again both in the technical competence and in the pedagogical one. For this to happen, attention should be paid not only to the procedural contents but also to the reflective and critical thinking capacities, understandable uses and the right interpretation of media messages, as the European Commission pointed. However, although the massive presence of media in postindustrial societies nowadays, citizens haven't had training experiences for developing their knowledge of audiovisual and media languages, and fostering audiovisual and media. Not even the media or the civic associations and –what is more serious– nor the centers for formal training have committed decisively with media competences, which are very important for fostering a questioning citizenship competent from an audiovisual perspective (Aguaded, 2012).

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In this context, make sense the conclusion reached in a research on media competence in the Spanish society, study coordinated by Ferrés (2011) and produced on a broad notion of media competence, notion that includes aesthetic, values and ideology, language, reception and audience, production and programming, as well as the technological dimensional aspects:

> The results of his study show that there are serious deficiencies among Spanish men and women in terms of their level of media competencies understood as capacity of interpreting the audiovisual messages critically and reflexively and communicating through audiovisuals at a basic level of autonomy (Ferrés, p. 81).

Regarding formal education, this diagnostic is equally coherent with the previous results obtained in recent studies on teachers' media competence. Focusing on technological and pedagogical competences, studies have shown low levels of competence in teachers, regardless of their heterogeneity (García-Valcárcel & Tejedor, 2010; Almerich, Suárez, Jornet & Orellana, 2011; Suárez, Almerich, Gargallo & Aliaga, 2013).

Thus, the current communicative environment and the new teaching requirements related to it are the reasons for developingof an instrument to assess teachers' media literacy, as they are perceived and identified by teachers themselves, from a comprehensive and broad model of media literacy as the one offered by Ferrés (2007; 2011; Ferrés & Piscitelli, 2012), whose ultimate goal would be to make appropriate, realistic and valuable training proposals for the future, despite the complexity of integrating media in the teaching-learning process (Area, 2010; Valverde, Garrido & Fernández, 2010).

The purpose of this work is to create the general guidelines of an upcoming program on media competences that targets non-university teachers based on the diagnostic made after the data gathering. Other specific objectives are:

- Validating an instrument in order to measure media competence of non-university teachers.
- Determining the media competence levels of non-university teachers.
- Identifying the needs for training of non-university teachers according to their level of media competencies and verifying statically to what

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extent variables such as location, gender, grade, classification of the school, and level of training received in audiovisual and digital communication in the domain that the teacher perceives.

- Establishing general guidelines of action for future programs on media competence training aimed at non-university teachers. For this, we need to know where to begin the program and we need to stablish the content areas in which minimum levels of knowledge are observed, in order to include them as essential knowledge in the general guidelines of the proposed program.

Method

The research reported here reflects a non-experimental design, given that the phenomena under study were not manipulated, but the data were collected in their natural setting. The type of design used was descriptive transactional, because research focuses on analysis the level or status of variables in a given time, in order to describe these phenomena and analyze their impact at that moment (Hernández, Fernández & Baptista, 2006).

Sample

The study sample was composed of 905 non-university teachers, all of them were working at that moment and teaching in different educational stage: Preschool, primary, secondary, high school and vocational training. The ten provinces that took part in the study sample were: Cantabria, Córdoba, Huelva, Granada, La Rioja, Lugo, Málaga, Murcia, Sevilla and Valencia. Teachers took part in this study on request of the researchers, either in the schools, either through the teacher training centers. In both cases, teachers were provided a link to the questionnaire on media competence to fill it out online.

A non-probabilistic sample was selected in this research. In other words, participants were not selected on a non-probabilistic sample, but they were

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chosen by different criteria related to the characteristics of this research (Bisquerra, 2004). In this case, the criteria used were the following: Permission to carry out the questionnaire in each school, teaching in different educational stage and type of the school (public, charter and private). According to gender, there is a balance between men and women, socio-demographics results show 13% more females than males. Most of the teaching staff (71,1%) work in public schools and 70% have been working between 15-20 years. Table I shows the socio-demographics results.

TABLE I. Socio-demographic results

VARIABLE	F	%
GENDER		
Male	394	43,5%
Female	512	56,5%
AGE		
25-35	208	23%
36-46	345	38%
47-57	294	32,4%
58-67	59	6,6%
Type of School		
Public	644	71,1%
Private	64	7,1%
Charter	198	21,9%
Years in Teaching		
0-5	50	5,6%
5-15	221	24,4%
15-25	233	25,7%
+ de 25	402	44,3%
Teaching Level		
Pre-school	111	12,3%
Primary	328	36,2%
Secondary/ High School	377	41,6%
Vocational training	90	9,9%

Source: Own elaboration.

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Instruments

The data collection instrument was an online questionnaire (http://uhu.es/competenciamediatica/profesorado/). The design of the questionnaire was based on the systematic and proven definition of media competence and its six dimensions (Ferrés, 2007). In this sense, media competence is associated with knowledge, skills and abilities, all linked to six dimensions.

The instrument applied to collect the data has been elaborated *ad hoc* for this project and it is composed of 43 items. The questionnaire is distributed in seven contents: a) Identify data, b) Languages, c) Technology, d) Process of perception and interaction, e) Process of production and diffusion, f) Ideology and values, g) Aesthetics.

The questionnaire begins by collecting the information from the data on gender, age, type of school, educational stage, years of teaching practice and level of audiovisual training received. Furthermore, the questionnaire continues centering on the competence dimensions that should be measured and evaluated, and to breakdown:

- Competencies in terms of media language, including the ability to interpret the codes of messages, to evaluate the meaning of its contents in the media, the ability to express oneself using different systems of representations and the ability to modify existing contents, giving them new meanings.
- Technological dimensions of media competence, that integrates the ability in the effective use of the technical means of communication, the ability to use technological innovations, the ability to adapt the technology to other uses in the means of communication pursuing and the aptitude to create and handle images and sound.
- Competence in relation to the process of receiving and interaction. This dimension includes the ability to revise and self-assess the own "diet" on media, in accordance with conscience and reasonable criteria, the ability to recognize and appreciate messages with emotional content, the ability to recognize values attached to media contents, the ability to interact in a team on the network…
- Competence in reference to the process of production and diffusion, including the skills to identify the type of media production, knowledge of production procedures, programming and dissemination of media content, knowledge and use of legal

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protection rights of media consumers, the responsible attitude towards protection of copyright and intellectual property rights.

- Axiological and ideological dimension. This dimension incorporates the ability to read and receive media messages autonomously, the ability to discover the sources of information, trusting their reliability, and the ability to interpret media contents in an ethical and democratic way, the ability to discover the interest and intentions that are indirectly transmitting on any information, the ability to use the media in a sustainable manner, the ability to elaborate and receive messages without falling into the social stereotypes.
- Aesthetic dimension in media competence. The last dimension includes the development of the sense of good taste, attention to the formal aspects, the ability to be sensitive with respect to the aesthetics quality of media production and the ability to produce creative messages.

Procedure

The participants completed the questionnaire online simultaneously in all the provinces. The link of the questionnaire was sent to the different school via email. The second step was to clean the database of all the data collected online and elaborate its corresponding list of codes. Afterwards, the responses were recoded using the statistical program SPSS (v.18) in accordance with an assessment rubric previously elaborated during the design of the questionnaire in order to measure the different levels of competence of those who took part in the study.

Results

The results are shown in the same order in which the objective were presented in this article.

The validity of this questionnaire implies two procedures: calculation of its validity and a calculation of its reliability. To determine its validity, e.g. the level in which the tool measures the variable that it intends to measure,

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was used, firstly, the validity of content. This makes reference to the items used on the questionnaire which is a sample representation of their content or contents of what is intended to be evaluated. To demonstrate its validity in terms of contents, we sought the advice of experts on the subject of evaluation applied to questionnaires Delphi Technique (Barroso & Cabero, 2010). Fifteen experts were consulted and we followed up on their proposals by Bravo & Arreita (2005), obtaining a final draft of the questionnaire with 43 items, in contrast to the 47 we initially began with keeping the 6 dimensions proposed by Ferrés & Piscitelli (2012).

To calculate the reliability, in thus that the level in which two different applications on the same questionnaire gives similar results, we sought Cronbach's *alpha*. An exploratory analysis in an overall proposal of items, permitted to recognize that it was preferable, given the nature of the difference in the items of those that are evaluated via a Likert scale and those that are evaluated according to a dichotomous scale. In order to obtain the psychometric calculations and analysis in a differentiated manner for both items respectively and with the aim of offering clear and justified arguments in favor of the results.

The levels of reliability obtained with the method Cronbach's *alpha* in each of the two group items, of self-assessment and dichotomous, were 0,812 and 0,625 respectively. We have decided to show the results of reliability separately because of the characteristics of tool's construction, in order to assure the internal consistency of the tests. We are convinced that both groups of items measure the same construct for which they were created, although we have verified that the reliability of the items in the dichotomous type is moderate according to Castañeda et ál. (2010), compared with the reliability obtained for the items in the self-assessment, which we consider to be of a higher or greater reliability.

The second objective mentioned was to find out the levels of media competencies of the non-university teachers. That is, whether the teachers cited appreciate their degree of media competence domain. With this in mind, the further objective is to establish the general guidelines of a future training program in media competence adapted to application context.

In this regard, we have established three levels of media literacy in the participating teachers according to the following distribution: In this way, the table II shows the relevance of one or other level of competence.

- Basic level: minimum value to percentile 33 (23.42).
- Middle: percentile 34 to percentile 66 (43.50).

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- High Advanced: percentile 67 to maximum value given (51.73).

We can appreciate in Table 2 the competence levels in comparison to each other.

TABLE II. Levels of teachers' media competence

LEVEL	F	%
Basic	303	33.5
Intermediate	308	34
Advanced	294	32.5
Total	905	100

Source: Own elaboration.

As it is shown, the distribution of the teachers studied among the three groups is significantly homogenous; it is remarkable a slightly higher percentage in the middle level, and lower percentage in the advanced group level.

The levels of media competence of the teachers are conditioned by aspects such as province, gender, level of training, and educational stage in which they teach. The type of school does not influence the achievement of one level or another by teachers (see Table III).

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TABLE III. Chi-square analysis between media competence level and independent

VARIABLES	X^2/p	Likelihood ratio/p	Contingency coefficient/p	Phi/p.	Cramèr's V /p
Province	87.285 0.000	89.255 0.000	0.297 0,000	0.311 0.000	0.220 0.000
Gender	19.815 0.000	19.825 0.000	0.146 0.000	0.148 0.000	0.148 0.000
Type of center	8.687 0.069	8.768 0.067	0.098 0.069	0.098 0.069	0.069 0.069
Level of training	103.132 0.000	101.37 0.000	0.320	0.338 0.000	0.239 0.000
Educational stage	35.687 0.000	36.220 0.000	0.195 0.000	0.199 0.000	0.140 0.000

Source: Own elaboration.

In concrete terms, Table IV shows that majority percentage of a certain competence level differ depending on teachers' provenance. So, Cantabria, Lugo, and Valencia are the provinces that receive a higher percentage at the advanced level. In contrast, Granada, Malaga and Murcia offer the highest percentages in the lower level of competence.

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TABLE IV. Contingency analysis between competence levels and province

		LEVELS			
		Basic	**Intermediate**	**Advanced**	**Total**
Cantabria	Count	25	47	60	132
	% Province	18.9%	35.6%	45.5%	100.0%
	% Levels	8.3%	15.3%	20.4%	14.6%
	% total	2.8%	5.2%	6.6%	14.6%
Córdoba	Count	35	48	30	113
	% Province	31.0%	42.5%	26.5%	100.0%
	% Levels	11.6%	15.6%	10.2%	12.5%
	% total	3.9%	5.3%	3.3%	12.5%
Granada	Count	48	26	26	100
	% Province	48.0%	26.0%	26.0%	100.0%
	% Levels	15.8%	8.4%	8.8%	11.0%
	% total	5.3%	2.9%	2.9%	11.0%
Huelva	Count	30	16	29	75
	% Province	40.0%	21.3%	38.7%	100.0%
	% Levels	9.9%	5.2%	9.9%	8.3%
	% total	3.3%	1.8%	3.2%	8.3%
La Rioja	Count	8	11	7	26
	% Province	30.8%	42.3%	26.9%	100.0%
	% Levels	2.6%	3.6%	2.4%	2.9%
	% total	.9%	1.2%	.8%	2.9%
Lugo	Count	32	36	36	104
	% Province	30.8%	34.6%	34.6%	100.0%
	% Levels	10.6%	11.7%	12.2%	11.5%
	% total	3.5%	4.0%	4.0%	11.5%
Málaga	Count	54	21	10	85
	% Province	63.5%	24.7%	11.8%	100.0%
	% Levels	17.8%	6.8%	3.4%	9.4%
	% total	6.0%	2.3%	1.1%	9.4%
Murcia	Count	36	35	30	101
	% Province	35.6%	34.7%	29.7%	100.0%
	% Levels	11.9%	11.4%	10.2%	11.2%
	% del total	4.0%	3.9%	3.3%	11.2%

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Sevilla	Count	9	31	28	68
	% Province	13.2%	45.6%	41.2%	100.0%
	% Levels	3.0%	10.1%	9.5%	7.5%
	% total	1.0%	3.4%	3.1%	7.5%
Valencia	Count	26	37	38	101
	% Province	25.7%	36.6%	37.6%	100.0%
	% Levels	8.6%	12.0%	12.9%	11.2%
	% total	2.9%	4.1%	4.2%	11.2%
Total	Count	303	308	294	905
	% Province	33.5%	34.0%	32.5%	100.0%
	% Levels	100.0%	100.0%	100.0%	100.0%
	% total	33.5%	34.0%	32.5%	100.0%

Source: own elaboration

In terms of gender, men have a higher percentage of advanced competence level, whereas in women this percentage is higher in the lower level of competence (see Table v).

TABLE V. Contingency analysis between levels of competence and gender

		LEVELS			
		BASIC	**INTERMEDIATE**	**ADVANCED**	**Total**
Male	Count	108	128	157	393
	% Gender	27.5%	32.6%	39.9%	100.0%
	% Levels	35.6%	41.6%	53.4%	43.4%
	% total	11.9%	14.1%	17.3%	43.4%
Female	Count	195	180	137	512
	% Gender	38.1%	35.2%	26.8%	100.0%
	% Levels	64.4%	58.4%	46.6%	56.6%
	% total	21.5%	19.9%	15.1%	56.6%
Total	Count	303	308	294	905
	% Gender	33.5%	34.0%	32.5%	100.0%
	% Levels	100.0%	100.0%	100.0%	100.0%
	% total	33.5%	34.0%	32.5%	100.0%

Source: Own elaboration.

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Regarding the level of training, we emphasize that a higher level of education corresponds to a higher level of competence (see Table VI).

TABLE VI. Contingency analysis between competence levels and training levels

		LEVELS			
		Basic	**Intermediate**	**Advanced**	**Total**
None	Count	81	43	26	150
	% Levels of training	54.0%	28.7%	17.3%	100.0%
	% Levels	26.7%	14.0%	8.8%	16.6%
	% total	9.0%	4.8%	2.9%	16.6%
Some	Count	200	218	163	581
	% Levels of training	34.4%	37.5%	28.1%	100.0%
	% Levels	66.0%	70.8%	55.4%	64.2%
	% total	22.1%	24.1%	18.0%	64.2%
Quite	Count	22	47	105	174
	% Levels of training	12.6%	27.0%	60.3%	100.0%
	% Levels	7.3%	15.3%	35.7%	19.2%
	% total	2.4%	5.2%	11.6%	19.2%
Total	Count	303	308	294	905
	% Levels of training	33.5%	34.0%	32.5%	100.0%
	% Levels	100.0%	100.0%	100.0%	100.0%
	% total	33.5%	34.0%	32.5%	100.0%

Source: Own elaboration.

Regarding educational level, Table VII shows that to teach at higher education levels, except in the case of Professional training, involves the acquisition of higher competence levels.

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TABLE VII. Contingency analysis between level of competence and educational stage

		LEVELS			
		Basic	**Intermediate**	**Advanced**	**Total**
Pre-school	Count	39	47	25	111
	% Educational stage	35.1%	42.3%	22.5%	100.0%
	% Levels	12.9%	15.3%	8.5%	12.3%
	% total	4.3%	5.2%	2.8%	12.3%
Primary	Count	139	95	92	326
	% Educational stage	42.6%	29.1%	28.2%	100.0%
	% Levels	46.0%	30.8%	31.3%	36.1%
	% total	15.4%	10.5%	10.2%	36.1%
Secundary/ Baccalauriate	Count	90	138	149	377
	% Educational stagea	23.9%	36.6%	39.5%	100.0%
	% Levels	29.8%	44.8%	50.7%	41.7%
	% total	10.0%	15.3%	16.5%	41.7%
Professional training	Count	34	28	28	90
	% Educational stage	37.8%	31.1%	31.1%	100.0%
	% Levels	11.3%	9.1%	9.5%	10.0%
	% total	3.8%	3.1%	3.1%	10.0%
Total	Count	302	308	294	904
	% Educational stage	33.4%	34.1%	32.5%	100.0%
	% Levels	100.0%	100.0%	100.0%	100.0%
	% total	33.4%	34.1%	32.5%	100.0%

Source: Own elaboration.

Table VIII shows that the average of the items measured with a Likert scale (from 1 to 4) (in bold) is around 2,15. The teachers surveyed did not openly declare their media competence domain, since the average does not extend to both extreme. This fact corroborates the three levels of media competence stated above.

It should also be noted that the average value of the standard deviation is 0.16, and the variation coefficient is17.5%. This value indicates that the mean responses of teachers surveyed are homogeneous.

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TABLE VIII. Mean and Standard Deviations

	N	Mean	SD
Item 11	905	2.92	.792
Item 12	905	1.76	.923
Item 13	905	**2.90**	.796
Item 14	905	1.97	.498
Item 15	905	1.38	.751
Item 16	905	**2.98**	.751
Item 18	905	1.70	.460
Item 19	905	1.70	.950
Item 20	905	**2.92**	.795
Item 22	905	2.50	.763
Item 23	905	**2.78**	.755
Item 24	905	1.08	**.353**
Item 25	**905**	2.73	.840
Item 26	905	1.68	.930
Item 28	905	1.88	.982
Item 29	905	1.62	.909
Item 30	905	1.21	.574
Item 31	905	**1.92**	.895
Item 32	905	2.28	.925
Item 35	905	**2.80**	.757
Item 36	905	1.79	.829
Item 37	905	**2.00**	.771
Item 38	905	**2.76**	.988
Item 39	**905**	**2.94**	**.736**
Item 40	905	**2.36**	.826
Item 41	905	**2.36**	.893
Item 42	904	1.52	.729
Item 43	904	1.78	.452

Source: Own elaboration.

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Then we proceed to cluster a synthesis of our mean and percentages results in two blocks, keeping the division of items valued according with the likert scale (1 to 4) (see Table IX) and those items valued on a dichotomous scale (1 to 3) (see Table X).

Despite the general data of the averages shown in table 8, we would like to note in particular the higher average scores obtained by the teachers studied in some distinctive aspects of media competence expressed in Table IX. Among them, the "capacity to conveniently use the media in order to improve educational process" with an average of 2.98: a 77.5% of the teachers recognized that they are concerned about using these media as appropriately as possible. On the other hand, 73% of the studied teachers say to be able to "recognize when a media product does not meet the minimal standards of aesthetics required (presentation, writing style, quality of the images, creativity)" at an average of 2.94. Regarding its capacity to distinguish between different codes and registers used in the media and "its capacity to distinguish the sociopolitical tendencies among the media most often used" with an average of 2.92 respectively, more than 71% of teachers recognized that they can discriminate sufficiently or much the registers and tendencies of the media. Finally, 71% of teachers confirm that have the capacity to "communicate using a different language depending on the context, the receiver or the purpose of the message", with an average of 2.90. In a smaller percentage, we would want to point out the fact that 68% considered to know "differentiate between stereotypes or prejudices of racial, sexual, religious or ideological type on the media" with an average of 2.80.

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TABLE IX. Frequency distribution and degree of agreement on media competence acquired, expressed as percentage (items rated with Likert scale 1-4)

ITEMS	NO		VERY LITTLE		GREAT AMOUNT		VERY MUCH	
	F	%	F	%	F	%	F	%
Q11	33	3.6%	226	25%	**430**	**47.5%**	**216**	**23.9%**
Q13	38	4.2%	221	24.4%	**437**	**48.3%**	**209**	**23.1%**
Q16	30	3.3%	174	19.2%	**485**	**53.6%**	**216**	**23.9%**
Q20	33	3.6%	227	25.1%	**426**	**47.1%**	**219**	**24.2%**
Q23	43	4.8%	247	27.3%	477	52.7%	138	15.2%
Q25	47	5.2%	324	35.8%	352	38.9%	181	20%
Q31	345	38.1%	337	37.2%	169	18.7%	53	5.9%
Q35	25	2.8%	284	31.4%	**435**	**48.1%**	**160**	**17.7%**
Q37	249	27.5%	421	46.5%	217	24%	17	1.9%
Q38	134	14.8%	170	18.8%	379	41.9%	221	24.4%
Q39	19	2.1%	218	24.1%	**469**	**51.8%**	**199**	**22%**
Q40	119	13.1%	425	47%	276	30.5%	85	9.4%
Q41	143	15.8%	405	44.8%	244	27%	12.5%	113

Source: Own elaboration.

Regarding the general knowledge about media of studied teachers (see table 10), it must be stated their level of expertise in relation to their abilities to use Internet. In this case, a high percentage recognizes the Internet potential in solidarity activities (95.2%), a 77.6% in resolving day-to-day situations (e.g. locating names of streets or places). Similarly, an 87.6% is aware of the laws concerning protection of minors from some contents of the media. Finally, 67% of the teachers are aware of some organization to contact as user of the Internet when he/she perceives something insulting, abusive or criminal in the media.

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TABLE X. Distribution of the frequencies and levels of general knowledge concerning the media (items valued with a dichotonomous scale 1-3)

ITEMS	YES		NO		I DO NOT KNOW	
	F	%	F	%	F	%
Q12	517	57.1%	85	9.4%	303	33.5%
Q14	128	14.1%	**680**	**75.1%**	97	10.7%
Q15	**702**	**77.6%**	55	6.1%	147	16.2%
Q18	269	29.7%	**633**	**69.9%**	0	0%
Q19	**578**	**63.9%**	13	1.4%	313	34.6%
Q22	150	16.6%	153	16.9%	**602**	**66.5%**
Q24	**862**	**95.2%**	19	2%	24	2.8%
Q26	**579**	**64%**	33	3.6%	293	32.4%
Q28	**498**	**55%**	19	2.1%	388	42.9%
Q29	**612**	**67.6%**	26	2.9%	267	29.5%
Q30	**793**	**87.6%**	37	4.1%	75	8.3
Q32	292	32.3%	61	6.7%	551	60.9%
Q36	**428**	**47.3%**	242	26.7%	235	26%
Q42	**557**	**61.5%**	220	24.3%	127	14%
Q43	216	23.9%	**674**	**74.5%**	14	1.5%

Source: Independent study.

The third objective raised consisted of detecting training needs related to media literacy among respondent professionals.

The descriptive analysis shows that 66.5% of teachers ignores or doubt about the existence of an Audiovisual Council in Spain. They do not know (42.9%) if the media companies are governed by an ethical code, and 60.95% do not know what a license to protect author data is, e.g. Creative Commons. In turn, almost 70% are unaware of tools to control Internet content and 75% do not know what Internet searchers are free of commercial advertising. Finally, 74.5% said they had no participated in an

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innovation or research project, nor elaboration processes of teaching materials regarding digital competence in the last 5 years.

To further clarification on the results, a process of correlation between all the items shown in Tables IX and X was carried out. Although the correlation shows that the influence is significant, but small, we have proposed a contingency analysis between those items with higher correlation. Thus, we attempt to establish what influence can be attributed to the current level of training in the domain of media competence. The results of the contingency analysis are shown in table VI.

We understand that, once acquired "some training" in media competence, it has influenced a lot on skills learned, internalized and implemented by teachers, since around 60% of them recognized that training was quite an useful tool to distinguish current codes used in media messages, to communicate through the media, to use different media in education, and to know programs like Moviemaker or image edition.

What strikes us is that in cases where teachers have acquired "enough training" in media competence, this is not reflected in higher percentages of domain and use capability, since only 23.5% of teachers recognize that the current training has been very useful to distinguish the codes used in media messages, communicate through the media, use different media in education, to know tools like MovieMaker or to edit image.

Therefore, we must focus on a training which is closer to the needs and interests of teachers in those skills and abilities they need to improve.

Discussion and conclusions

The recently published OECD report (2013, p.10), on the assessment of the adult population competences, has assessed, among other issues, problems solving in computer environments, defined as "the ability to use ICT to acquire and evaluate information, communicate with others and solve problems". The aim is not to develop a "computer literacy" but the cognitive skills needed in the current information age.

This report shows that nearly 80% of adults in the OECD often use ICT in their daily lives. In Spain, the percentage falls to 75% of the adult population. However, ICT's use is not an indicator of their level of

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competence. The report also concludes that "the results highlight how relevant lifelong and continuous learning is in different professional, personal and social environments, in addition to classroom learning, adding experience and skills that are obtained through the cycle life" (p. 234).

In the case of teachers, the study by the European Commission, *Key topics in education in Europe. Volume 3, the teaching profession in Europe: profile, trends and Concerns (Eurydice, 2002),* stated that teacher-training systems were not giving the right answers to the required needs. Therefore, on August 6th, 2007, the Commission in Brussels presented a series of proposals aimed at improving the quality of teacher training in all Member States of the European Union (EU) including the following statement about continuous training:

> A better teaching and learning are crucial to the competitiveness of the EU in long term as a highly qualified staff is much more effective. I think we should work in order to provide the EU with high-quality teachers if we want the educational reforms in the Member States to be successful (IP / 07/1210, 2007).

These proposals reveal that in some Member States there is little systematic coordination between the various components of teacher education, which leads to a lack of coherence and formative continuity. Similarly, it is also stated that investment in ongoing training and development of teachers is low.

After our research, we conclude that, in general terms, media competence of non-university teachers is medium-high level (two-thirds of the subjects), with differences to be considered as city or region, gender, and above all, the presence of previous learning. Thus, updating training in media literacy acquired by respondent teachers has shown to be quite useful. However, they need to improve their knowledge, use and media relations in specific areas. Therefore, agreeing with Gray & Lewis, 2009; Valverde, Garrido & Fernández, 2010; Shot & Aguaded, 2014, it seems necessary to implement continuous training programs under the supervision of an expert, so that the teacher practices skills related to media competence in order to improve learning skills acquired. A non-systematic training is not enough.

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The general guidelines for a future training program in media literacy aimed at non-university teachers we propose are:

- The verification of the need to conduct a detailed investigation at educational levels before any intervention.
- The need to contextualize all the training based on the interests and needs of teachers to whom the program is implemented.
- The premise of the need of teacher training from their interests, introducing informal learning in formal settings (Cross, 2006) to enhance their motivation, involvement and safe handling of media skills, allowing teachers to develop their own creative learning zone and be autonomous.
- Consistency in the internal design of the training program: objectives, responsibilities, activities, groupings, resources, timing and formative assessment.
- Foundation of activities on real cases, based on mechanisms and game techniques (gamification) in order to involve and motivate through experience in learning (McGonigal, 2011).
- The flexibility to allow changes in the process of development in training programs.
- The need to work with the teachers of those levels, resilience to be able to overcome mistakes and difficulties as part of the learning process.
- The aims for the training program should be centered on:
- Identifying the different languages used in the transmission of any type of message independently of the media used.
- Updating knowledge and uses of new technologies for media education.
- Knowing internal uses of media, as well as the new process of communication that they generate.
- Knowing the Spanish and European guidelines regarding the media
- Analyzing the contents of the media in its use and creative expression.
- Awakening a sense of critical judgment towards mass media.
- Developing an aesthetic capacity to select media products.
- Applying knowledge to media in an educational setting.
- Enabling the realization of research on and with media.

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In accordance with Bautista (2000), it is necessary that training programs for teachers exceed didactics and technological aspects about media. In this sense, Gutiérrez Martin (2007) makes a proposal linked to the use of ICT, which can be adapted to the media competence.

Keeping in mind these proposals and stemming from our investigation, we understand that the contents of training programs, apart from the traditional didactic and technical aspects, should concentrate on the scope of economics, sociopolitical, cultural and civic aspects of media.

This broad vision on media competence would not only improve teachers training as professionals in education but also as citizens of a changing, global and media society like ours.

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Difficulties and challenges in the implementation of Degrees in Spanish Universities[1]

Dificultades y retos en la implantación de los títulos de grado en las universidades españolas

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Abstract

The purpose of this research is to determine the monitoring procedure of new Degree implantation in Spanish universities through assessments carried out by quality managers during the monitoring phase of the study plans. The information was gathered from interviews in which experts adopted the role of "key informants", by participating in an ad hoc interview. The sample also included 125 members of the Quality Assurance Commission (selected at random and structured in the five branches of knowledge) who completed an online survey. After content analysis of the interviews, the most important problems faced by the participants in their jobs were coordination between stakeholders, bureaucratization, and lack of adequate technological resources, as well as of qualified and specialized staff. Their ratings indicate that the measures that universities should undertake to improve the new Degree functioning should resolve these issues, while counting on the contribution of external professionals. This study includes a screening of the Quality Assurance Commissions' satisfaction with the Degrees. This paper is a comparative analysis of the characteristics of the Spanish University System at the

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beginning of the European Higher Education Area (EHEA) and the situation it is currently undergoing. Ultimately, the limitations of Spanish universities at the beginning of the convergence process are currently being perceived. Considering that first cohort of degrees adapted to the EHEA is about to be accredited, it is essential for the academic heads to rethink the processes associated with the new qualifications, set up improvements which favor its development and thereby, produce a positive impact on the progress of the Spanish University System as a whole.

Keywords: Higher Education; Quality Assurance; Continuous Improvement; Degree; Stakeholders.

Resumen

El propósito de este estudio es conocer el proceso de implantación de los nuevos títulos de grado en las universidades españolas a través de las valoraciones realizadas por los responsables en calidad durante la fase de seguimiento de los planes de estudio. La información fue recabada a partir de entrevistas en la que los expertos adoptaron el rol de "informantes clave", mediante su participación en una entrevista *ad hoc.* La muestra también estaba compuesta por 125 miembros de comisiones de garantía de calidad de grados (seleccionadas al azar y estructuradas en las cinco ramas de conocimiento) que cumplimentaron una encuesta *online*. Tras el análisis de contenido de los discursos, las dificultades más notables a las que se enfrentan los participantes en su trabajo fueron la coordinación entre los agentes implicados, la burocratización, la carencia de recursos tecnológicos adecuados así como de personal especializado y formado. Sus valoraciones indican que las medidas que las universidades deben adoptar para mejorar el funcionamiento de los nuevos títulos tendrían que dar respuesta a estas áreas contando, paralelamente, con las aportaciones de profesionales externos. Este estudio incluye igualmente un *screening* de la satisfacción de las comisiones de garantía de calidad con los títulos de grado. Este estudio constituye un análisis comparativo entre las características del sistema universitario Español en los inicios del Espacio Europeo de Educación Superior (EEES) y la situación que éste experimenta actualmente. En definitiva, las limitaciones que preveían las universidades españolas al comienzo del proceso de convergencia están siendo percibidas actualmente. Considerando que la primera cohorte de titulaciones adaptadas al EEES está próxima a acreditarse, es esencial que los responsables académicos replanteen los procesos vinculados a los nuevos títulos, instauren mejoras que favorezcan su evolución y que, como consecuencia, repercutan positivamente en la marcha del sistema universitario español en su conjunto.

Palabras clave: Educación Superior; aseguramiento de la calidad; mejora continua; título de grado; *stakeholders*.

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Introduction

Within the Spanish university context, the process of implementation of the new Study Plans have led to the first a cohort of students who would achieve the Degree according to the European Higher Education Area (EHEA). The next step is the accreditation of the Degrees, understood as the determination of the measure by which university teachings either meet or fail to meet the minimum or excellence standards according to pre-established criteria (Michavila & Zamorano, 2007).

Upon retrospectively analyzing the initial panorama of the EHEA in Spanish universities, this implied a radical change in the academic processes. According to Martínez and Viader (2008), in order for the new degrees to adapt to the European parameters, a series of conditions had to be met: among them, greater coherence between the design and subsequent implementation of the teachings, as well as the incorporation of a System of Quality Assurance that would have an impact on the training programs, promote the assessment of the achievement goals, and direct its efforts towards the management of mobility, the study of occupational insertion, and the learning-teaching methodology.

The implementation of these challenges demanded cultural and organizational changes, as noted more than a decade ago by the United Nations (1998), when indicating the importance of promoting a university culture that would prioritize autonomy, responsibility, and accountability. However, at the European level, although the countries have progressively introduced significant changes, diverse studies (Comunicado de Bergen, 2005; Eurydice, 2005) have shown the distance between the different states in the ground covered until the EHEA was operationalized.

At the initial stages of implementation of the conversion measures, the analysis of the Spanish System of Higher Education revealed a series of obstacles that the new EHEA framework has had to face. Below, we shall describe some of them.

Resistance to change

University training in the new Study Plans requires the students to acquire a concrete competential profile. Thus, successfully completing the studies

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requires the mastery of skills such as reflection and self-learning, the acquisition of strategies to resolve conflicts, and the establishment of a foundation to promote life-long learning (Pozo, Bretones, Martos & Alonso, 2011).

Likewise, the new functions expected from the teachers requires the development of innovative materials, the design of teaching guidelines, tutorship of the students, and the transformation of teaching methodologies and assessment systems, among other issues. Therefore, this paradigm requires new pedagogical and didactic knowledge, and therefore, attending to the formative needs of the teachers becomes a priority (Pozo et ál., 2011).

The EHEA has also affected the Administration and Services Personnel (in Spanish, PAS) because it has been necessary to adapt the management tasks to the new demands generated (Pérez, Segura & Tomás, 2007).

The need of integrating convergence versus autonomy

The constitution of the EHEA is grounded in the pro-European definition of unification, convergence, and mobility, with the goal of competing in the market with the North American universities (Armengol & Castro, 2004; Comas, 2013). Accordingly, the European Commission (2003) claimed that:

> "The European Union therefore needs a healthy and flourishing university world. Europe needs excellence in its universities, to optimise the processes which underpin the knowledge society and meet the target, set out by the European Council in Lisbon, of becoming the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion" (p. 2).

The consolidation of the European Union within the educational setting would not only produce economic gains, but would also meet the expressed need of collaboration in I+D+i, as suggested by the results of prior reports (Dearing, 1997, in the UK; Attali, 1998, in France; University Report, 2000).

This sense of cohesion and university autonomy was reflected in the proposal of a globalized offer of programs to generate more heterogeneity in the European university panorama (Lebrero, 2007). The success of the

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reform will depend on the capacity of each university to define its institutional strategy, to adopt structures that promote change, and to develop its competitive capacity (Haug, 2008).

However, according to Armengol and Castro (2004), this scenario of convergence is not exempt from basic discrepancies:

- The view of threat to the individual competences of the European States and the possible loss of autonomy.
- The lack of prior experience in terms of conjoint institutional collaboration.
- Economic reasons as the generator of transformations in Higher Education.
- The fear of segregation of university students.

The necessary participation of all the stakeholders

According to Vázquez (2008), the success of the EHEA depended on diffusing the contents, the scope, and the opportunities of the reform to the university community in a clear, simple, and efficacious way. Only when knowing the processes that accompany the restructuring of the teachings will it be possible for the teachers and the administration personnel of the universities to take an active part in the improvement of the educational quality without its being perceived as an emotional overload (Pérez-Gracia, Codinas, López, García, Buenestado et ál., 2011).

From the start, the reality of the implementation of the new Degrees has become a debate among experts, in which the university community and society are in the background (Valle, 2007). In fact, the main criticism of the implementation of Bologna has been the lack of consideration of the opinions of its principal protagonists (De Juanas, 2010). Years ago, the National University Network of Students' Affairs (2005) noted that the convergence process was being carried out *"without sufficient presence of the students"*.

Sánchez and Zubillaga (2005) conducted a study that includes the measures carried out by 16 Spanish universities to guarantee the incorporation of the Spanish University System within the EHEA. Thus, before the year 2005, 75% of the participant universities held seminars and meetings to divulge the convergence process, but only 3 carried out activities targeting the PAS and the students. With regard to formative

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actions, although they were designed in 94% of the cases, they were never carried out.

Subsequently (González, Muñoz, & Muñoz, 2008; Pozo, Martos, Bretones, Cid, Alonso, Romero et ál., 2012), the information available on the Websites (referring to EHEA) of the Spanish public universities was examined. The conclusions indicate that this information is irregular, asystematic, and heterogeneous.

On the other hand, although there are many publications referring to the changes involved in the implementation of the new university Degrees for teachers and students (Cifuentes, 2006; Pozo, Alonso, Bretones & Martos, 2011; Rodríguez, López, Zambrano & Guerrero, 2012), the same cannot be said about the administrative personnel, in spite of the fact that, since the Declaration of Bologna (European Conference of Ministers of Higher Education, 1999), the tasks of this collective extend to issues related to the management of the European credit, the Quality paradigm, Diploma Supplement, and the monitoring of the diplomas, among other issues.

Excessive bureaucratization of the processes

As a consequence of the concern of the universities to develop competent systems to ensure the internal quality of their processes (Martínez & Viader, 2008), an exaggerated production of protocols, reports, and documentation has been generated, leading to an excess of bureaucracy, and leaving little room for critical analysis and the implementation of measures of improvement.

Some years before, the Declaration of Graz (2003) was especially unequivocal about this aspect. Specifically, it pointed out that: *"The procedures to ensure quality in Europe should:…., minimize bureaucracy and avoid excess regimentation"* (p.5).

Perhaps, in spite of the ground covered by the countries involved in the convergence process, the model of organizational functioning, in which regimentation and bureaucracy are a constant, is still rigid and vertical (Riesco, 2007).

The bureaucratization that is typical of the universities belonging to the EHEA is, if anything, increased by the diversity of the stakeholders involved, as well as the multitude of signatory countries and institutions that participated in the birth of the EHEA (the European Union, the European Commission, UNESCO, the autonomous communities, and the commissions

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of the universities, etc.). In parallel, the diverse countries started out with notable differences among them with regard to university tradition or the degrees they offered, among other issues.

Resources (human, material, and infrastructures) and institutional recognition

According to Freire (2006), the universities must be prepared for their real adaptation to the EHEA.

In spite of this, the results obtained in the study of Florido, Jiménez and Perdiguero (2012) indicate that, in the Spanish universities, the necessary resources for the university to change have not been assigned. In the context of the 144 cases analyzed, a worsening of the professional situation of the university teachers had been observed, due to the absence of recognition and the notable increase of the workload.

Regarding the PAS, having a staff specialized in the new qualification demands has become a priority issue. This collective has encountered an occupational problem that needs, for example, to adapt structures and procedures of a work philosophy based on integrated management, new documentation and concepts, as well as platforms designed to centralize and speed up the processes (Carpio, 2006).

Proposal and goals of the study

The general purpose of this investigation is to analyze the process of implementation and monitoring of the Degrees in Spanish universities by means of the assessments carried out by the managers and Quality Technicians, as well as by members of the Degree Quality Assurance Commissions (stakeholders). We present below the specific goals we expect to achieve:

- To analyze the perceived barriers to the development of the functions of the people involved in tasks related to the teachings.
- To identify the improvements that must be incorporated into the management of the new Degrees.
- To examine the participants' level of satisfaction with the functioning of the Degrees.

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Method

Participants

As selection criteria of the participants, the following aspects were taken into account. Firstly, they had to be collectives with sufficient knowledge about the internal functioning of the Degrees and, on the other hand, people with a significant role within the university quality management.

The sample is made up of two differentiated groups; one with ten people managersor Quality Technicians who carry out their work in Vice-Rectorates, Services or Units in charge of the management of the Degrees in different Spanish universities[2].

A total of 125 members of the Quality Assurance Commissions from 11 Spanish public universities participated[3]. Of them, 100 are Teaching and Research Staff (in Spanish, PDI), 12 are PAS, and 46 hold posts of academic responsibility.

Most of the participants proceed from teachings associated with Social and Juridical Sciences (32), followed by Sciences (26), Health Sciences (20), and Arts and Humanities (15); another 20 participants did not provide information about this aspect.

Instruments

In order to examine the implementation of the Degrees and the difficulties involved, we designed a semistructured interview (*ad hoc*) targeting the persons-in-charge and Quality Technicians. The participants expressed their opinion about 7 criteria (see Picture 1).

(2) University of Huelva, University of Jaén, University of Salamanca, University of Barcelona, Autonomous University of Madrid, University of Alicante, University of Santiago de Compostela, University of las Palmas de Gran Canaria, Universityof Oviedo andNational Open University.

(3) University of Almería, University of Cádiz, University of Jaén, University Pablo Olavide, University of Huelva, University of Cantabria, University of Burgos, University of Valladolid, Polytechnic University of Cataluña, University of Lleida, Autonomous University of Madrid, University Rey Juan Carlos, Polytechnic University of Valencia, University of Santiago de Compostela, University of Navarra, University of Oviedo andUniversity of Murcia.

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PICTURE I. Criteria of the interview guideline

1. Level of involvement of the institutional individuals with maximum responsibility in the monitoring of the Degrees.
2. Main drawbacks detected in the Quality Assurance Systems (QAS).
3. Diffusion mechanisms of the Degrees targeting the university community.
4. Techniques and communication sources to interact with the collectives involved.
5. Protocols for the monitoring of the Degrees (action schedules, associated documentation).
6. Level of satisfaction with the monitoring of the Degrees.
7. Proposals of improvement resulting from the Monitoring Process.

In order to know the degree of satisfaction of the members of the Quality Assurance Commissions with the performance of their functions, an ad hoc online survey was administered (see Picture II).

The sociodemographic variables were: university of provenance, occupational collective (PDI, PAS, people with academic responsibility), and the Quality Assurance Commission in which the individuals carry out their functions. Then, 13 items were presented to be rated on a Likert-type response scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Lastly, by including an open item, we collected the participants' opinions of the improvements that should be included in the monitoring of the new university teachings.

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PICTURE II. Survey items

Express your level of satisfaction with:

1. The level of involvement of the institutional people with maximum responsibility in monitoring the Degrees.
2. The coordination among the different stakeholders involved in the Process of Monitoring the Degrees (Vice-Rectorates, Services/ Units, Deans and Directors of Centers, Degree Coordinators ...).
3. The degree of coordination among the Quality Assurance Commissions/Units and the people responsible for the Degree.
4. The internal functioning of your Unit/ Quality Assurance Commission.
5. Sufficiency and suitability of the resources of the Degree Quality Assurance Commission to which you belong.
6. Sufficiency and suitability of the human resources for the task involved in Monitoring the Degrees.
7. Level of suitability of the technological resources (computer applications) in your University for performing your work as a member of the Quality Assurance Commission /Unit.
8. Information and training provided by your University with regard to the functions to be performed in the Monitoring Process.
9. The communication system at the vertical (between Vice-Rectorates and Services/units) and the horizontal level (Coordinator and Degree Quality Assurance Commissions or Units).
10. The temporal cost involved in performing your functions.
11. The effort involved in belonging to the Commission.
12. Institutional recognition for belonging to the Quality Assurance Commission/Unit.
13. Degree of global satisfaction with the work performed by the Quality Commission you belong to.

Procedure

We collected the institutional e-mails corresponding to the diverse stakeholders involved that were published on the Websites of Spanish universities in different Autonomous Communities. On the one hand, those related to the people responsible and the Quality Technicians who managed the Degrees and their corresponding Quality Assurance Systems. On the other hand, the e-mails of the teachers, PAS, and people with academic responsibilities who belonged to the Degree Quality Assurance

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Commissions offered by 11 public Spanish universities (selected randomly and structured in the five knowledge s areas).

In the case of the people responsible and technicians, 10 of them agreed to participate in the study. Personal interviews were performed and the information collected was analyzed by means of the MAXQDA 10 software.

The on-line survey was administered to the members of the Quality Assurance Commissions by means of the *"Limesurvey"* (version 9.1) application. The statistical analyses were performed with SPSS (version 19.0 for Windows).

The qualitative information (the discourses of the people responsible/Quality Technicians and the Commissions) was submitted to content analysis. The quantitative data were treated by means of descriptive analysis.

Results

Firstly, we show the qualitative results of the interviews of the people responsible and the Quality Technicians, reflecting their views of the current panorama of the Spanish Educational System. Specifically, we identified the areas where specific deficits have been detected for the implementation of the teachings, including a series of proposals for improvement that, in view of the interviewees, are relevant.

Secondly, we present the quantitative information about the degree of general satisfaction experienced by the target collective with the implementation of the new university teachings carried out since the EHEA.

Qualitative study

Problem areas for the development of the Degrees

One of the main handicaps observed refers to the way the tasks of Degree Quality Management are performed. In general, coordination problems between the diverse stakeholders involved are perceived, leading to excessive bureaucratization of the procedures and changes in the appropriate meeting of predetermined deadlines:

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"Poor coordination among the different Vice Rectorates".
"Many emails must be sent and multiple phone calls must be made to clarify aspects that involve Degree Monitoring".

Furthermore, the participants' responses reveal the universities' lack of technical personnel with the function of articulating the implementation of the new Study Plans. Likewise, the availability of technological resources is an unresolved issue in the universities, especially when the monitoring of the Degrees requires the coordinated work of many university collectives (Vice-Rectorates, Services, Centers, etc.):

"The need for specific human resources. In general, the scarcity of Quality Technicians".
"The inexistence of a platform to manage data treatment and emit the monitoring reports".

Training represents another of the perceived limitations, a particularly relevant aspect when, in this case, novel procedures of some complexity –which vary as a function of unstable normative and assessment requirements– must be operationalized:

"The lack of training of the PAS in the centers".
"The inexistence of specific training of the Coordinators".

As a consequence of the above, the personnel who participated in the study perceive that they must put out "extra" effort for the technical actions involved in the performance of their work. As shown in many studies (Pozo, Alonso, Bretones & Martos, 2011; Herrero, Gracia & Musitu, 1996; Salanova & Schaufeli, 2009), repeated exposure to these working conditions can become a risk factor for health and well-being in the workplace (in the form of stress):

"The high temporal cost derived from the lack of an adequate computer application".
"Difficulty providing data in real time to all the users because the data collection system is not completely automated".

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After the Royal Decree 861/2010, the assessment agencies have worked on the design of specific models for the universities to present the results concerning the state of implementation of their teachings. In parallel, the universities have elaborated internal procedures to monitor their degrees, which match the minimum demanded requirements (*European Association for Quality Assurance in Higher Education* –ENQA– 2005); Ministry of Education, 2003; Royal Decree 1393/2007; Spanish Network of University Quality Agencies, 2010; National Agency of Assessment of Quality and Accreditation [ANECA], 2007), and the temporariness of the performance of the actions established in the Quality Assurance Systems,while taking into account the opinion of the diverse stakeholders involved (Pozo, 2010; Pozo, Bretones, Martos & Alonso, 2011). This fact has led to some divergences perceived by the interviewees, for example:

> *"…the temporal alignment or mismatch between the deadlines of the Autonomous Agency and System of Internal Quality Assurance of the University."*
> *"The deadline of the monitoring process has not been clarified in the Autonomous Agency, as it has undergone various modifications".*

Proposals for improvement of the new university teachings

In accordance with the second goal of this study, we now describe the issues indicated by the participants as being susceptible to improvement in the sphere of training provided by their universities of origin. Specifically, they underline as priorities: adequate supply of human and material resources to support the management of the processes, the existence of commitment, involvement, and institutional recognition, the availability of higher training and information about the implementation of the teachings, as well as better coordination and communication at the vertical and horizontal levels between the different collectives that make up the university community. The simplification of the existing bureaucracy, the subsequent clarity of criteria and protocols, as well as adequate diffusion and transparency of the outcomes obtained are essential aspects to be taken into account. Moreover, they firmly indicate the benefits that may ensue, in terms of advice, from the contribution of external referents (from other universities and/or companies).

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One of the great challenges associated with the development of the convergence process depends on the active role of the staff –both PDI and PAS– in the analysis, assessment, and improvement of educational quality (Pérez-Gracia et ál., 2011). In spite of the above, the information gathered shows how the surveyees observe mismatches between the resources they have at their universities for the adequate management of the Degrees and those that should exist:

"Increase of material and human means in order to collect data by the Quality Assurance Commissions/Units".
"Humans resources exclusively dedicated to the Quality Assurance System".

However, the good performance of the Monitoring process and the implementation of a culture of quality shared by the members of the university community should reflect the commitment acquired by the people responsible for making decisions about the functioning of the university teachings. From the perspective of the stakeholders, it would be necessary to include the following measures:

"By request of the Rectorates, involvement in the quality assurance process".
"Greater institutional commitment in the process of accepting the proposals of improvement and the responsibilities".
"Involvement of the people with maximum responsibility and greater objectivity".

Ever since the incorporation of Spanish universities into the European convergence process, it was known that this would lead to rethinking the teaching methodology (Méndez, 2005; Torre&Gil, 2004), the use of new technologies (Area, 2005; Marqués, 2001), as well as the use of novel assessment strategies (Bordas & Cabrera, 2001; Pérez, Carretero, Palma & Rafael, 2000), among other aspects. It would not only change the role played by the teachers (García-Valcárcel, 2001; Rodríguez, 2000), but would also require notable adaptations in university management (Noguera, 2001; Torres, 2001).

This "revolution" demanded considerable effort by the staff, which, as observed in the Quality Assurance Commissions, was not institutionally

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rewarded. The participants note that the time they spend on this should be translated into:

> *"Real recognition in credits matching the work we do, and economic recognition if the teacher's department has a high teaching load".*

In terms of training, if, during the first phase of the convergence process of the Spanish University System (1999-2005), it could be observed that there was still much to be done in this sphere (Valcárcel, 2006). The members of the Commissions currently demand actions like these, as well as the need to implement systems to speed up communication and information flows about the functioning of the teachings:

> *"…teachers' and students' total lack of information from the people responsible for the Degrees, both the Dean's team and the Degree Coordinator... A circumstance that hinders extraordinarily the development of teaching activity and the monitoring of Degree implementation…".*

The surveyees demand that such information be accompanied by simple explanations justifying the protocols to be followed and their utility. At the long term, this way of management will positively impact the degree of commitment concerning the monitoring of the Degrees.

Another of the interviewees' proposals for improvement coincides with the contributions made by Valle (2007) about the need to count on communication flows that resolve the processes linked to the EHEA. The current panorama in Spanish universities is significantly far from this "ideal", according to the interviewees. In fact, the improvements they propose have to do with:

> *"Optimizing the coordination among the different stakeholders involved in the Process of Monitoring of the Degrees (Vice-Rectorates, Services/ Units, Deans and Directors of Centers, Degree Coordinators…)".*

Likewise, from the participants' appraisals, we could conclude that another solution could be to increase the periods of membership in the

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Quality Assurance Commissions, so that its continuity would facilitate the interrelations among its members.

The emergence of new terminology and the adoption of different management criteria need not be associated with higher costs for the handling and performance of academic activities in the universities. However, according to the participants, this is what is occurring, so they consider it necessary to simplify the processes, eliminating the *"cumbersome and incomprehensible language of the hundreds of pages that must be disentangled to write a simple report".* No doubt, the three adjectives that best define the management model to be followed are: *"…clarity, simplicity,* and *agility* in the assessment processes*".*

The participants are dissatisfied with the many "steps" that are necessary to be carried out for routine academic transactions. Therefore, they propose the appropriateness of:

> *"Reducing the number –excessively high– of administrative formalities that must be carried out. They absorb a great amount of time and do not necessarily lead to better quality teaching".*

According to Roca (2012), the quality policies that are undertaken should be contextualized so they become projects with some credibility and validity. This is not actually the reality, the university community faces numerous requirements daily for which *"not even the university has solutions"*.

According to the level of implementation of the new Degrees in the Spanish University System, accreditation is the next challenge for which we should be "prepared". In spite of this, from the perspective of the surveyees:

> *"Monitoring is aimed at accreditation, but we have no guidelines for accreditation. This produces uncertainties … and we have doubts about whether we will subsequently have to undo things that the Centers consider definitive".*

According to Martínez, Gil and Tunnicliffe (2011), External Assessment is a mechanism that is useful to promote the improvement of the Degrees, as well as to comply with the provisions established in the Quality Assurance Systems. Specifically, the collaboration of stakeholders from

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other universities benefits the assessment process and facilitates obtaining a diagnosis of the situation, from which actions can be proposed to optimize the functioning of the teachings.

In this regard, the members of the commissions agree that the external assessments should be performed by different collectives, linked to the university setting or from other sectors:

"The Commission should not be made up of a majority of teachers from the center, but instead stakeholders from society and international teachers who imprint dynamism to the design of the studies".
"Participation of external stakeholders: graduates, companies and institutions".

Lastly, the public diffusion of the information generated as a consequence of the implementation of the new university Degrees and the principle of transparency represent an essential maximum that appears in a large part of the legal and evaluative ruling and in the documentation of many organisms, entities, and national and international workgroups established as a consequence of the EHEA (Conference of European Ministers of Higher Education – Berlín, 2003; Conference of European Ministers of Higher Education – Leuven, 2009; Royal Decree 1044/2003; Ministry of Education, 2003; Organic Law 6/2001; Royal Decree, 1939/2007; Spanish Network of University Quality Agencies [in Spanish, REACU], 2010; Royal Decree 861/2010).

In spite of the efforts made, the surveyees' experience in this aspect is that there is still "a long way to go" in their universities, and they consider it "favorable" for this kind of practices to become generalized in the management of their services and Vice-Rectorates. For this purpose, they consider it is necessary:

"To improve publicizing of the conclusions of the Commission and to better coordinate with Quality Commissions from other universities".
"To improve the transmission of procedures, indicators, and levels of reference of the indicators to the entire personnel (especially, the students), in order to extend their involvement in the monitoring process".

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"Publication and diffusion of experiences occurring in similar Degrees in order to take advantage of them".

Quantitative study

This investigation includes a screening of this collective's level of satisfaction with the characteristics that define the new Degrees.

The results obtained indicate that the participants do not express much agreement with the way in which the new teachings in Higher Education are being managed (the mean scores recorded in the 13 items that make up the survey range between 2.07 and 3.62; in a scale of five points).

The aspects that are better valued are those having to do with the internal functioning of Commission to which they belong (M=3.62, SD=1.18), the degree of current coordination with the people responsible for the Degrees (M=3.60, SD=1.07) and the involvement of the institutional responsible people, in terms of support for the Monitoring Process (M=3.44, SD=1.08).

In contrast, the areas reflecting the most discomfiture are those related to their universities' institutional recognition for their role in favoring the adequate development of the new teachings (M=2.07, SD=1.18), followed by the scarcity of human resources devoted to Monitoring (M=2.70, SD=1.13) and the insufficient resources they have in order to fulfill their obligations in this sphere (M=2.79, SD=1.11).

The survey includes one last item designed to determine the participants'satisfaction in general terms. The mean score was 3.17 (SD=1.06), so these results should be taken into account by the universities, in the sense of reviewing the processes carried out to date in the implementation of the Degree teachings in the Spanish university setting.

Conclusions

This study is a comparative review of the problems faced by the Spanish universities when they initiated their incorporation into the EHEA and the situation and circumstances they currently encounter.

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To carry out this analysis, we used a sample made up of 135 members of different university collectives. Specifically, 10 were people responsible and Quality Technicians, who participated as "key informants", as well as 125 members of Degree Quality Assurance Commissions.

We wished to detect the barriers perceived by the participants for the development of their functions in the management of the teachings, to identify their priority measures, in the sense of implementing actions to minimize the impact produced (if any) by such deficiencies, and to determine their degree of satisfaction with the functioning of the Degrees in which they are involved.

The results indicate that, currently, notable deficiencies are still perceived, which even characterized the Spanish University System when it first initiated its course towards European convergence.

The people responsible and Quality Technicians perceive a lack of involvement in the representatives of the highest institutional ranks. Furthermore, they consider that there are still coordination problems among the services, units and Vice-Rectorates that perform functions related to the development of the Degrees; this translates into not meeting the stipulated deadlines and the unnecessary bureaucratization of the processes.

The implementation of a shared culture of quality is a goal for any university (Pozo, 2010). However, according to the interviewees, their universities still do not have the necessary resources for an optimal adaptation of their teachings. This problem refers to the need of specifically trained personnel dedicated to Degree Monitoring. Another aspect to be taken into account is the insufficient technological means to manage data, information, and documentation.

Regarding the improvements they would incorporate in their universities with regard to Monitoring, they think that greater institutional commitment should be the first step for the universities to generate confidence. However, the functioning of Degree Monitoring depends on many stakeholders involved, so the introduction of efficacious communication and coordination channels also represents a need that should be met by the institutional persons responsible for this aspect.

Likewise, the participants demand clarity and precision in the protocols and procedures to be followed; therefore, they request the implementation of mechanisms to facilitate greater diffusion and transparency of the outcomes and the decisions adopted regarding the Study Plans.

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Like the persons responsible and the Quality Technicians, the members of the Commissions openly express the need for the universities to invest in resources in accordance with the requirements of the new Degrees. Having computer tools to speed up the management of Monitoring and to ensure the validity of the results is a priority. The same can be said about the human resources, that is, the institutional persons responsible should make urgent decisions to incorporate sufficient personnel for the assessment of the functioning of the new Degrees, providing specific training and, in turn, "rewarding" the work of the PDI and PAS collectives involved.

The Assessment and Quality Assurance Systems play an important role, as they allow determining whether the goals have been achieved, detecting needs for change, and guaranteeing the quality of the service provided (Michavila & Zamorano, 2008). The members of the commissions confer special relevance to the benefits for the Degrees of the perspective of external referents from other universities and experts in other professional spheres.

Lastly, after the members of the commissions had indicated their level of satisfaction with the way the new Degrees are being implemented, they expressed more disagreement about the scarce institutional recognition they receive for performing activities related to the Monitoring Process, as well as the lack of administrative personnel and of available material resources to work efficiently.

Upon performing a global analysis of the characteristics of the Spanish University System at the start of the process of European Convergence of Higher Education and the characteristics that currently define the Study Plans, we see that a large part of the difficulties perceived initially are still unresolved. These circumstances are evident when the first cohort of Degrees adapted to the EHEA in our country are about to undergo the process of Accreditation.

Hence, the urgent need to rethink the goals pursued with the development of the new teachings, to review the academic offer, to provide the universities with the necessary means for the correct implementation of the processes, as well as to install flexible and coordinated management models that are shared by the university community and by other external stakeholders. All these improvements would have a favorable impact on the evolution of the Degrees and on the University as a whole.

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Reviews and books received

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Reviews

González Pérez, I., García De La Torre Gómez, M. & Rodrigues Espínola, C. (Coords.) (2013). *Guía de Cooperación Educativa Internacional y Educación para el Desarrollo.* Madrid: Biblioteca Nueva. 209 pp. ISBN: 978-84-9940-723-4. (María Jesús Martínez Usarralde).

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At a time when Fukuyama's notion of 'the end of history' was surpassed, we encounter abrupt changes established in the international agendas that operate by force of stakes of an increasingly ambiguous power, a geography of hunger that is terribly growing, with poverty as a cruel companion. Consequently, the map of cooperation at international level shows a patent debility with extremely alarming signs of weakness. Indeed, these agendas seem to be each time further from composing a scene of effective and efficient political strategy against the evils increasingly entrenched in postmodern societies. When faced with a couple of decades of unwavering defense of the Human Rights, social justice and the fight against hunger, in addition to a sustained environment, today almost nobody denies the failure of the overall compliance of policies that were not trying to eradicate but to alleviate and lessen their impacts, and normally end up giving up due to their lack of capacity to do so.

When confronted with the evidence of more and more limitations to contribute in the search for models of development that walk facing the orthodoxy of the *establishment,* the crisis in these moments is multi-pronged: it is political (governance), it is human (the barbarity of poverty and the social vulnerability it causes progresses in leaps and bounds); therefore, it is also educational, ethical and moral.

Faced with such unfavourable scenario, it is necessary to keep trying. As a result, at the moment many universities that have shown their militant engagement with this issue, of course the NGOs, the social movements or the local municipalities whose policies were comfortable in congruence with the parameters open by the Spanish Cooperation, are trying to find in our days new reference points from which to continue generating fair, equitable and cohesive changes, in addition to legitimately sustainable.

The pedagogical proposal of the teacher Inmaculada González must be conceived and understood in this direction. She has already demonstrated a strong integrity in her commitment to cooperation through her book 'La Cooperación ante la Rebeldía entre culturas' (Cooperation before Rebellion among cultures), which can be seen in the book that occupies our attention. In effect, through the vital and academic experience of its

authors, the book is, as the title indicates, a guide, a manual that tries to clarify the precise moment in which we find ourselves, from a university gaze that does not forget its commitment to serve as a well-founded exegete of the global framework that surrounds us on the issue of policies of cooperation in the field of education.

For this reason, the text is skilfully and adequately divided in three parts: while the first provides the fundamental terminology databases of cosmology in development cooperation, the second part is about the more operational and strategic side of the same, through the instruments needed for its development. Finally, the third part will undertake in its uniqueness the Education for Development, for Human Rights, Gender Equality and Sustainable Development.

From the beginning of the book until its end, the reader will be unveiling a speech that travels through the effects of globalization and neoliberalism vis-à-vis the right for education, the signs of identity of the International Cooperation for Development and the International Educational Cooperation, the history of its development and the EPD (Education for Development), its planning and the importance of the human rights approach, a necessary tool nowadays, leading to that last part, more thematic, about the conceptual quartet mentioned above.

In sum, I strongly recommend this book to any reader that, either a graduate, post graduate or doctoral student, regardless of the chosen degree, wants to become a part of this global community that, knowing the details and problematizing the edges of the current situation, wants to continue to influence with words and with a concerted, responsible and conscious action, in order to consider again the development cooperation from the recognition that, historically and the ones that work on it so firmly believe, it deserves.

María Jesús Martínez Usarralde

Vázquez Cano, E. & Martín Monje, E. (2014). *Nuevas tendencias en la elaboración de materiales digitales para la enseñanza de lenguas*. Madrid: McGraw-Hill. 184 pp. ISBN: 8448191293.

Technologies for language learning have become a daily issue for many foreign and first language teachers in the world. Most language schools now include a subject on technology, internet or digital resources in their classrooms. However, after some 30 years of computer based language learning still remains the same: how to choose the adequate materials? This matter has a number of implications and issues that need to be resolved even before the curriculum is created. This excellent volume certainly contains some of the clues to orientate both the teacher's instruction in Languages and the student's class- oriented and autonomous learning. This valuable book begins by stating the most significant changes in the teachers and the students' roles in current language didactics. As they mention, one of the best features is the student's capacity of self-regulation. Although Computer Assisted Language Learning has served for a long time, its use has only become popular in the last 10 to 15 years. However, for the authors, the current challenge is making ICT invisible so that both teachers and students can stimulate the human capacity to generate, connect and reproduce new knowledge continuously (p. x). However, support is necessary and students need to rely on an ample variety of educational resources. These are reflected in the pages of Vazquez Cano and Martín Monje's book. To provide a perspective of this good range of resources, the book is divided into four chapters. Their focus is mostly practical. The first chapter, virtual space for instruction and learning, is an introductory chapter which presents current and emerging technologies and serves to justify and introduce the resources and proposals of the following chapters. Chapter two deals with the role of IC in schools and language learning. This chapter stresses the importance and way to work of teachers for both professional and curricular development in language teaching. It also analyzes the language skills and competences and also shows the types of IC based activities that can play a significant role in regular education. Chapter three, foundations and resources in the design of audiovisual environments and materials, deals with larger projects oriented towards the design and content of contents. Chapter four addresses the teachability of digital materials. The chapters shows how to use the materials that have been shown on the previous two chapters.

Nuevas tendencias en la elaboración y utilización de materiales digitales para la enseñanza de lenguas is a rather interesting volume mostly aimed at either pre-service or in-service teachers. Secondarily, some school administrators can also find the volume of interest. Its practical approach has led the authors to include one of the most ample ranges of educational ICT based materials. All of them include their descriptions and also provide ideas to implement them in the classroom. An additional asset is that most of these applications are freely available online which is usually an criticisable aspect in similar books (García Laborda, 2011). Activities include all four skills, testing, cultural issues and else. The book is ahead of its natural competitors due to the extended information and the outstanding interest in providing a practical approach to all the suggestions. In the negative sense, I personally missed a strong framework of general inclusion and application. Nevertheless, this book will benefit those who are new in the use of IC as well as experienced teachers for who IC is an intrinsic part of the daily work. All in all, a piece worth having in someone's night table.

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José Manuel Touriñán López has been professor at the University of Santiago de Compostela since 1988. I had the good fortune to meet him and to get to know his works when I began as a lecturer at the Madrid Complutense University. He was at the time the youngest Professor of

Pedagogy in Spain. His academic and professional career has been recognised, rewarded and recorded in European and American publications and he holds several awards and prizes for the academic and research work he has performed over the last 41 years.

In this book Touriñán reflects that everybody, in one way or another, takes a role in educating, even if they are unaware why they do; by doing what they do they educate, although they may not be able to justify their action. The underlying argument is that in Education we have to transform information into knowledge, and knowledge into education. On the one hand, knowing in its widest sense is required (I know what, I know how and I can); on the other, we must teach (which implies another type of knowing). Were that not enough, we must also educate, which implies not only knowing and teaching but also mastering the very character and sense of the meaning of 'education' in order to apply it to each area of cultural experience.

This is relevant in terms of real definition and enables one to understand that *the activity becomes the mainstay of education* and reflects the real meaning of education as an activity directed towards the use and construction of valuable experience to generate the activity educated. That is precisely why the question "*Where is education*" is directly answered in this book: it is where the common internal activity of people is and where the structural elements of intervention are.

According to Touriñán, all education depends on our internal activity, which has to be determined in line with the goal of education. With this intention we build fields of education and incorporate the temporary formative orientation for the individual, social, historical and species-being human condition. While it is true that in education there is always the underlying threat of indoctrination and the anti-pedagogical illusion of neutralism (which is critically analyzed in chapters 2 and 5), it is also true that, pedagogically, all education is education in values. Education without values is not education and so the relation between education and values is an unavoidable professional competence when building educational spheres and when training teachers.

The book comprises 10 chapters. The first deals with the basic definition, since from the outset it has to be understood that educating is not caring for, it is not coexisting, nor communicating, nor teaching, although these and many other aspects are all necessary within education. The last chapter looks at the pathway from method to model through the

program, because the specific pedagogical mentality and the specialized pedagogical approach are always disciplinary and are guided by focusses that can be justified on methodological and research principles. The 8 chapters in between are devoted to studying and understanding the structural elements in intervention: knowledge of education, pedagogical function, educational profession, educational relationship, education agents, processes, the product of education and the means. From these elements are born the principles of intervention that are linked to each of the structural elements and which bind together action and mentality.

In short, we have a very original book with new perspectives that are explained in the 83 charts which synthesize the most significant theoretical constructs of the work and summarize its underlying arguments. This book is, for me, a landmark in Spanish Pedagogy, and I believe that it will be a long time before another text as exhaustive as this one will appear that deals with the structural elements of intervention from the perspective of knowledge of education.

Mª Rosario Limón Mendizábal

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Rules

Rules for the submission of original manuscripts

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General Information

Experience, Coverage and Content

Revista de Educación is an arbitrated scientific journal published by the Spanish Ministry of Education, Culture and Sport, whose papers, both received and commissioned, are all subject to external assessment. Published every four months, *Revista de Educación* was founded in 1940 with the title Revista Nacional de Educación, and it has borne its current title since 1952. It publishes primarily original basic and applied research, essays and reviews of recent publications of educational interest. Its objective is to disseminate specialised knowledge for the improvement of education management, practice and research. Its target audience is the scientific community specialising in education, administrators and teachers. The journal has tree sections: a) Research Projects and Studies; b) Essays; c) Reviews; and it could have a Monographic section in one of the issues that are annually published. Original papers in Spanish and English are accepted.

General Rules for the Submission of Original Manuscripts

Published since 1941, the journal "Revista de Education" until now has accepted articles both in Spanish and English. As from 1st January 2014, the journal will continue to accept articles in both Spanish and English, but will be published in both languages: it will become a bilingual journal. This new model is in response to efforts to internationalize and disseminate its contents. The editorial team believes that this will provide a way for the quality research carried out in Spain to be known to a wider audience.

As with other periodicals, and given the importance of the English language as a scientific communication vehicle and additionally in this case the international importance of the Spanish language, this usually means an increase in the possible dissemination of its contents. As is the norm with most bilingual journals, once the process of peer review has finished and the article has been accepted for publication, authors are required to provide a professional translation within one month after the article's acceptance notice has been issued.

The final publication of the article is subject to the quality of the translation, which will be sent within one month so it can be assessed by a translation reviewer. If the first review is unfavourable, the author will have 20 days to submit a second professional translation.

I. Submission Channel

Articles, each accompanied by an introductory letter and transfer of intellectual property rights, must be submitted only over the Science and Technology Foundation's RECYT Journal Management Platform: (http://recyt.fecyt.es/index.php/index/login).

There is a tutorial for new users (authors and reviewers) on the *Revista de Educación* web page, which will help users register with the platform correctly. All articles must be sent in Microsoft Word format for PC. Authors may send their introductory letter and transfer of intellectual property rights in PDF format.

II. Presentation

To enable our editors to manage articles more efficiently, authors are to observe the following rules on original manuscript data, content, structure and style:

A. Letter of Authorship,[1] Introduction, Declaration of Conflicts of Interest and Transfer of Intellectual Property Rights

The author or authors are to send this letter in a file named 'cesion_submitter's first surname_submitter's second surname' (Example: cesion_ortega_jimenez). The letter form is provided in Appendix I.

B. Article

Authors are to adhere to the style guidelines given in the *Publication Manual of the American Psychological Association* (APA), 6th ed., Washington: APA, 2011 (www.apastyle.org) and Appendix II.

1. **File Name for Use with the Platform.** Articles are to be uploaded to the platform in a file named 'articulo_submitter's first surname_submitter's second surname' (Example: articulo_ortega_jimenez). Make sure this version of the article does not contain the name of the author or authors or any references to their credentials.

2. **Format.** The article must follow the format rules given in Appendix III.

3. **Título.** The title should be as illustrative and concise as possible, written first in Spanish and then in English. It is to be made up of eight to nine significant key words, drawn from the Education Resources Information Center's ERIC Thesaurus if possible.

4. **Abstract[2].** An abstract is to be provided in Spanish (300 words), followed by the English translation. The abstract is to be structured according to the IMRYD format: *Introduction*, stating the research's objective or purpose; *Methodology*, outlining the basic procedures used (design, sample or case selection, methods and techniques of experimentation/observation and analysis); *Results*, reporting the main findings (give specific data and their statistical significance when appropriate); and *Discussion or Conclusions*.

5. **Key Words.** After the abstract, include five to ten key words or descriptors, in Spanish and in English. Use key words or terms that are internationally accepted in the field of education to express concepts and contents.

6. **Length.** Between 5,000 and 8,000 words. The length stipulated here includes title, key words, abstract (Spanish and English), the body of the article, notes, bibliographic references and illustrations.

7. **Structure.** For papers reporting research projects and studies, it is recommended to include at least the following points: description of the problem or subject matter at issue, prior work and theoretical foundations, design and methodology, results, discussion of results, conclusions, limitations of the study and any further developments.

8. **Names, Symbols and Nomenclature.** Authors are to use each discipline's standard names, symbols and nomenclature.

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(1) Important notice for authors: To ensure that your article will be indexed correctly in international databases, we recommend you take a pen name. If your surnames are uncommon, use your one-word (non-compound) first name and one of your surnames; if your surnames are common, use your one-word first name and both surnames, joined in hyphenated form (Example: María Pérez-Acosta).

(2) An appropriate title and a well-written abstract are important, because potential readers base their decision to read the entire paper largely on what they find in the title and abstract (especially in web searches).

9. **Diagrams, Sketches, Charts, Tables, Equations, Etc.** Figures are to be numbered consecutively by type (table 1, table 2; chart 1, chart 2) and inserted in the appropriate place within the body of the article's text. Do not insert charts, diagrams and tables in image format; instead, use a format that will facilitate any changes that need to be made during the layout process.

10. **Footnotes.** Footnotes are to be numbered consecutively and placed at the foot of the page. They are to be restricted to the necessary minimum. Bibliographic references will not be accepted as footnotes.

11. **Bibliographic References.** A list entitled 'Bibliographic References' is to be included at the end of the paper. The author or authors of the article will be responsible for the accuracy of bibliographic citations. References are to be listed in alphabetical order and are to follow APA criteria (Appendix II). All bibliographic citations included in the article's text must refer to works included in the bibliographic references.

III. Editorial Process

1. **Reception of Papers.** All submissions are subjected to editorial review to ensure that articles meet the topicality guidelines, that they are of interest according to the journal's editorial criteria and that they meet the requirements of formal presentation set in the publication rules. Reception does not imply acceptance of an article.

2. **Peer Review System** Two or more external experts will be assigned in a double-blind arrangement to review the article confidentially and anonymously. To do so, the reviewers will use the assessment protocol included with these rules (Appendix IV). In order for a manuscript to be accepted definitively, the authors must include any and all changes and suggestions the reviewers propose and return the new version within 30 days. Authors will be able to check the assessment reports summary via the journal platform.

3. **Reviewer Selection Criteria.** Reviewers are selected by the journal's editors, who take account of candidates' academic and scientific merits and professional experience. Members of the Domestic and International Advisory Board may occasionally act as reviewers.

4. **Editorial Decisión.** The criteria used to accept or reject papers are: a) presentation: composition, organization (logical train of thought and presentation on the page); b) originality; c) relevance for solving specific problems; d) relevance to current events and new developments; e) significance: for progress in scientific knowledge; f) soundness and scientific validity: tested methodological quality. When the assessment process has ended, the primary author will be notified if the paper is accepted or rejected. If the author of an accepted article would like to review the initial printed drafts, they will have to do it within the timeline agreed with the journal. The article will not be published until the English version of the original manuscript has been positively assessed. The English translation should be submitted no later than one month after the Spanish version has been accepted for publication. The translation must be done by a professional translator, preferably specialized in the subject area of the accepted article.

5. **Review of the translated version:** Upon receipt of the translated version, the manuscript will be submitted to the translation reviewer, who will issue a value judgment (favourable or unfavourable) on the version sent to the journal.

   5.1. In the event that the assessment of the translation reviewer is favourable, the article will be published along with the original version in Spanish, in the corresponding issue of the journal *Revista de Educación.*

   5.2. In the event that the rating of the translation reviewer is unfavourable, the article will be sent to its main author, who will have to provide a new translated version of the manuscript within 20 calendar days after receiving the report of the translator reviewer on behalf of the *Revista de Educación.*

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1. Once the article has been accepted, the journal *Revista de Educación* will ask the author to cede its intellectual property and publishing rights.

2. Papers may be reprinted in full or partial form, in which case the paper's first printing will be credited and written authorisation must be secured from *Revista de Educación* before the reprinted material is published.

3. References to Papers Published in *Revista de Educación*. The following information is to be included always: *Revista de Educación*, issue number, page numbers and year of publication.

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3. The list of the paper's authors must include only those people who made an intellectual contribution to the work.

4. *Revista de Educación* expects authors to declare any commercial associations that might suppose a conflict of interests in connection with a submitted article.

5. In the section on methods, authors must state that informed consent was secured before the procedures used in sampling and controls were implemented.

Appendix I- LETTER OF AUTHORSHIP, INTRODUCTION, DECLARATION OF CONFLICTS OF INTEREST AND TRANSFER OF INTELLECTUAL PROPERTY RIGHTS

Appendix II- SHORT EXAMPLE OF APA RULES (6th edition)

Appendix III- ARTICLE FORMAT

Appendix IV.- ASSESSMENT PROTOCOL FOR REVIEWERS' USE

TUTORIAL TO REGISTER WITH RECYT JOURNAL MANAGEMENT PLATFORM

Compliance with these rules is mandatory.

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