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Competencies for knowledge management: development and validation of a scale

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Abstract

Purpose – *The purpose of the current paper is to develop and validate a scale for measuring and managing the acquisition of competences provided by higher education studies.*

Design/methodology/approach – *A representative sample of Spanish graduates was obtained in the framework of the REFLEX project. In this questionnaire, a battery of 19 self-assessed items was used to measure the contribution of universities to the acquisition of generic competences. Exploratory and confirmatory factor analyses were performed.*

Findings – *The main competences acquired in higher education according to Spanish graduates can be grouped as follows: innovation, interpersonal, knowledge management, communication, organisational and professional development. Results indicated excellent fit indexes of this six-factor model to data.*

Research limitations/implications – *This scale may be particularly useful to understand the process of transition of higher education systems according to Bologna principles. It also represents a significant contribution to the existing research in competency-based education.*

Practical implications – *This paper may help higher education institutions to identify improvement areas in their study programmes. Besides, the proposed scale may offer crucial information in the determination of which Bologna principles have been successfully implemented.*

Social implications – *Organisations may use these findings to design formal or informal training for new graduates hired by the organisation.*

Originality/value – *Despite the recent increasing research in the field of competency-based learning and competences required in graduates' workplaces, this is the first paper that aims to present a validated scale designed to measure graduate self-assessed competences.*

Keywords Competences, Statistics, Higher education

Paper type Research paper

1. Introduction

Measuring competences in higher education has become a major issue due to their relevance to ensure that organisations can create and manage the knowledge that is needed for their successful performance. Their relevance to sustainable development and the achievement of social cohesion was emphasised during the conferences of European higher education ministers in Berlin Communiqué (2003) and Bergen Communiqué (2005). In addition, it was also stated that competences had to include knowledge and abilities as well as attitudes and values (Organisation for Economic Co-operation and Development, 2005). Generally speaking, universities are now demanding greater research into the definition and selection of key competences (Rychen and Tiana, 2004). Likewise, higher education institutions are offering new study programmes, more specialised and focused on the latest advances in the field, with the aim of improving quality of education and ensuring that students have the relevant labor market skills needed to effectively compete for domestic, regional and international employment. Policymakers, practitioners and academic researchers, all have roles to play in assisting people at an early stage of their career (Pinnington, 2011). To this end, most of existing study programmes at different

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faculties and departments have been upgraded or reformed over the past decade. In this context, the education system faces the challenge to produce graduates who possess competences that are sound and flexible enough to close the so-called mismatch between job opportunities and higher education institutions (Dekker *et al.*, 1980), which is usually linked to lower levels of satisfaction with the job occupation (Allen and De Weert, 2007).

The introduction of the competency-based education has represented an interesting turning point in the Spanish Higher Education system. At the beginning of this decade, Bricall (2000) pointed out that the Spanish universities should be more oriented to the labour market to favour the recent changes in organisations and the production processes. This socio-economic challenge has required a profound change in the organisational structure of the universities. The following year, the 2001 Organic Act on Universities included some detailed information regarding the structure of the studies, the European supplement and credits and the mobility of students. In 2007, it was published in Spain, the Royal Decree 1393/2007, by which the organisation of official university degrees is established, following the guidelines of the Bologna process. The Ministry of Education and Science proposed a system based on a structure of "four years bachelor plus one year master", clearly different from the previous system (three years for a Diploma degree or five years for a Bachelor degree). This three-cycle structure (Diplomado/Licenciado) had been used since the 1983 University Reform Act (LRU), but the new structure (Bachelor/Master/Doctor) was quite different. Since this moment, the redesign of the academic titles and curricula has represented a key point in the Spanish Bologna process and, nowadays, is still in its implementation phase. This reform has been considered as an opportunity to restructure also the study programmes for the improvement of the quality in higher education. (Krüger *et al.*, 2007).

In fact, the introduction of pedagogical innovations according to the paradigm shift from teaching to learning has been perceived in Spain as an opportunity to reform the system and adequate it to the requirements of the knowledge society [Agencia Nacional de la Calidad y Acreditación (ANECA), 2003]. These innovations have emphasised the need for new didactical methods and the modernisation of the objectives, methods, contents and instruments to evaluate teaching and learning processes (Pagani and González, 2002). In a sense, this new education model has the aim to improve the employability of the students, based on the principles of the transmission of scientific knowledge and their practical application (Mora, 2004). New concepts, such as learning outcomes and competences were introduced at this point in the redefinition of degree structures (Kennedy, 2007) and the identification of job requirements and skills.

However, it is difficult to determine, in a broad sense, the competences employers demand to graduates, due to different reasons (Allen and Van der Velden, 2007). First, the expansion of the participation of students in higher education, as well as the development of knowledge-intensive or high-technology economy sectors, indicate that a change is being produced towards a knowledge society, where abilities and skills become rapidly outdated (Teichler, 1999). Hayes and Allinson (2000) remarked that different employees, and specifically managers, might need to develop different sets of idiosyncratic competences, while there may be some competences that have universal relevance. In addition, the demarcation lines between work, leisure time, education and care have been

blurred for graduates, leading to increased mobility and flexibility patterns and the destandardisation of the professional careers (Schmid, 2000), especially in the present international and globalised labour market. On the other hand, organisational heterogeneity involves a challenge in the identification of a standard profile of graduate, able to satisfy all needs of training and knowledge in the workplaces.

This paper refers to this definition of competences in the context of universities and labour markets, understood as those talents, skills and capabilities of higher education graduates that contribute to multi-factor productivity gains (Hartog, 1992). This research has specifically focused on generic competences, defined as a combination of competences providing a strong basis for further learning, including not only learning abilities in a strict sense but also problem-solving or analytical competences (Heijke et al., 2003a, 2003b).

Although a common understanding of the competence construct has been achieved, the issue of properly measuring competences brings up additional problems, such as the existence of multiple components that entails the impossibility of measuring them by means of traditional procedures, which are mostly used in knowledge assessment (Heijke et al., 2010). To overcome this handicap, new measurement instruments for competence assessment, such as rubric and portfolio, have been proposed and are nowadays widely accepted. However, their application in transversal surveys aimed at higher education graduates in different fields of study does not seem appropriate. Conversely, both instruments could be better applied to longitudinal surveys specifically aimed at higher education students in each specific field of study, and even within each study programme. Nevertheless, these methodologies do not provide a standardised solution to the cross-sectional evaluation of the effects of teaching innovations introduced by institutions and professors. In that sense, a common instrument is required to assess student acquisition of competences, regardless of the study programme or the specific subjects they are enrolled on. In this context, self-assessment emerges as a suitable method to obtain information about people's perception of themselves, and is especially valid in the case of competences (Allen and Van der Velden, 2005). Individual self-assessment often provides more accurate data than information from external observers (Mischel, 1968). Spenner (1990) points out that self-reports offer relatively good prospects for skills measurement, as there is no systematic evidence that people distort reporting of their job characteristics. This method is relatively cheap, easy to administer and flexible, making it well suited to large-scale application in a range of situations. On the contrary, the only disadvantage of self-assessment revolves around the greater chance of measurement error (Allen and Van der Velden, 2005), which may be handled through methodologies such as structural equation modelling and confirmatory factor analysis.

The international CHEERS Project "Careers After higher education – A European Research Study" survey and its follow – up the REFLEX Project "The Flexible Professional in the Knowledge Society: New Demands on Higher Education in Europe" (Allen and Van der Velden, 2011; Allen et al., 2007; Schomburg and Teichler, 2007) focused on the determinants of professional success as well as the skills level held at the moment of graduation and the presently possessed skills level. Both of them used self-assessment as a valid method for measuring the acquired level of skills. Similar research projects were developed in the following decade, facing the challenge of implementing these strategies

"**The six-factor model suggested in this paper structures competences that can be developed in universities and integrates knowledge management in the definition of skills.**"

"Employers can use these findings to design formal or informal training courses or mentoring programs for new graduates hired by the organization."

and tools in other countries, such as the project PROFLEX in Latin America (Mora *et al.*, 2010); the project HEGESCO in several Eastern Europe countries (Pavlin, 2009); and the project CONGRAD in Serbia, Montenegro and Bosnia and Herzegovina (Lazetic *et al.*, 2014). All of them used similar instruments for measuring self-assessed competences.

In the REFLEX questionnaire, graduates were asked to name a maximum of three competences as strong and weak points to analyze the contribution of higher education to the development of competences. Generally speaking, results showed that some competences were much more considered strong points of higher education studies, such as analytical thinking; the mastery of graduates' own field or discipline; the ability to write reports, memos or documents; the ability to rapidly acquire new knowledge; the ability to work productively with others; and the ability to perform well under pressure. On the contrary, other competences are much more regarded as weak points: the ability to write and speak in a foreign language; to present products, ideas or reports to an audience; to assert authority; to negotiate effectively; to mobilise the capacities of others; the knowledge of other fields of disciplines; and the alertness to new opportunities (Allen *et al.*, 2007). Regarding the competences organisations want for graduates, Kivinen and Nurmi (2007) pointed out that, graduates are expected to possess high levels of professional expertise, functional flexibility, innovation and knowledge management, mobilisation of human resources and foreign language skills, regardless of the country. These authors also refer to the influence of study programmes on the development of competences that were surprisingly modest. However, it was found that traditional, teacher-centred methods were less conducive to competence development than active and student-centred study modes of teaching and learning. In a sense, graduates perceived that university professors tend to focus on the theoretical basis of the subjects. This conclusion was also supported by Vila *et al.* (2012), who stated that proactive methods and problem-based learning were the most effective modes for teaching and learning competences of innovation, by analyzing the Spanish dataset of the REFLEX project. This emphasis on the level of generic competences graduates should possess in their workplaces has been widely studied in the literature (Angeles *et al.*, 2004; Ley *et al.*, 2008; Male *et al.*, 2010; Nair *et al.*, 2009; Passow, 2012; Reio and Sutton, 2006; Tong, 2003). Even the results a survey of 3,158 engineers conducted in 2011 in the Russian Federation, using the same item – battery for measuring competences, showed that generic competences such as social, innovation, communication and management skills are more required than specific or technical knowledge to promote the products they create at foreign markets (Shmatko, 2014). Other researches derived from the REFLEX project and related to competences focus on the effects of over-education and over-skilling on wages and job satisfaction (McGuinness and Sloane, 2011; Sánchez-Sánchez and McGuinness, 2011).

Likewise, a high number of different classifications of competences can be found in literature. The theoretical approach mentioned by Bunk (1994) divided professional competences into four groups: technical, methodological, participative and personal. Nevertheless, in the context of higher education, competences are usually divided into generic and specific competences, as suggested by Becker (1964). Generic competences are defined as a combination of competences providing a strong basis for further learning, including not only learning abilities in the strict sense but also problem-solving and analytical competences, as opposed to specific competences, namely, vocational or

field-specific (Heijke *et al.*, 2003a, 2003b). This general classification was refined by Nordhaug (1993) and extended by distinguishing between competences that are specific to firms (firm-specificity), tasks (task-specificity) and economic sectors (industry-specificity). Additionally, the Tuning Project distinguished between subject-specific and generic competences and divided generic competences into three categories: instrumental, interpersonal and systemic competences (González and Wagenaar, 2005). The main report of this project suggested that time and attention should also be devoted to the development of generic competences or transferable skills, whereas subject-specific knowledge and skills are the basis for university degree programmes. Following this classification in generic and specific competences, Heijke *et al.* (2003a, 2003b) mentioned that vocational competences positively influence the chance of being matched to an occupation inside the own domain, using data on the labour market situation of Dutch higher education graduates. Similarly, Biesma *et al.* (2008) recognised the value of generic competences despite specific knowledge provide a useful starting point for entry-level public health professionals through a comparative study among Poland, the UK and The Netherlands. Also, Semeijn *et al.* (2006) examined to what extent indications of specific and generic competence during the educational programme predict labour market outcomes, with a research population that consists of graduates in Health Sciences (Masters) from Maastricht University who started their studies in the years 1991-1993. Other studies using this basic classification refer to the effect of the learning environment on competences. Vaatstra and De Vries (2007) stressed that graduates from activating learning environments attribute more generic and reflective competences to themselves than graduates from conventional learning environments, after analyzing data from the CHEERS project (Billing, 2007). Likewise, Meng and Heijke (2005) stated that activating learning methods are effective in both, the acquisition of generic competences and the acquisition of discipline-specific competences, through the analysis of a similar dataset. According to the employers' perspective Hernández-March *et al.* (2009) identified the competences Spanish graduates are expected to possess in their workplaces. The competences under study were divided into two large groups: vocational and generic. At the same time, this latter group was subdivided into three categories: knowledge-related, methodological and interpersonal competences. Also based on this classification, Smits (2007) examines in depth conflicting interests of firms and apprentices with respect to the training level for industry-specific and generic skills.

On the contrary, new classifications of competences, based on a quantitative perspective, were discussed by Heijke *et al.* (2003a, 2003b) who differentiated between discipline-specific, general – academic and management competences. These authors suggested this structure within the context of the European Union's Targeted Socio-Economic Research (TSER) programme that analysed the responses of a sample of higher education graduates from universities located in Northern Italy. On the other hand, in the framework of the CHEERS Project "Careers After higher education –A European Research Study", García-Aracil *et al.* (2004) identified eight groups of competences, namely, participative, methodological, specialised, organisational, rule-application, physical, generic and socio-emotional competences by using factor analysis. However, four years later, García-Aracil and Van der Velden (2008) suggested a related classification based on six groups of competences (organisational, specialised, methodological, generic, participative and socio-emotional competences). As a result of the same project, Kellerman (2007) came to the conclusion that graduate jobs could be characterised by four dimensions of competences: general-cognitive, professionally knowledgeable, social-reflexive and physiologically/manually skilled, also with the help of factor analysis and using further theoretical considerations. Similarly, in the application of the Tuning Project in Latin America, competences were grouped into four main factors by using factor analysis: learning process, social values, technological and international context and interpersonal skills (Beneitone *et al.*, 2007). Finally, in the framework of the REFLEX Project, the four main competences demanded in graduate jobs were identified: professional

expertise, functional flexibility, innovation and knowledge management and mobilisation of human resources (Allen and Van der Velden, 2011).

In the Spanish higher education context, De Miguel et al. (2005) disaggregated the components of competences according to the following three criteria:

1. Knowledge (General for learning, academic, specific and linked to the professional context).

2. Skills (intellectual, communication, interpersonal and personal organisation/management).

3. Attitudes (professional development and personal commitment).

Using a quantitative approach, Rodriguez and Vieira (2009) found four groups of competences: theoretical, practical, informational and generic, by applying factor analysis to a sample of graduates from the University of Leon. Clemente-Ricolfe and Escribá-Pérez (2013) also suggested a factorial structure of four groups, namely, methodological, social, participative and specialised competences, by using exploratory and confirmatory factor analyses on a sample of higher education graduates at the Universitat Politècnica de València.

Given the heterogeneity of outcomes in previous research, there appears to be little agreement on a common classification of competences as shown in Table I. Consequently, most studies end up working with ad hoc classifications, depending on the availability of data and previous background (Allen and Van der Velden, 2001). In that sense, a common instrument is required to assess student acquisition of competences, regardless of the country, the study programme or the specific subjects they are enrolled on.

Table I	Classifications of competences		
Data source	*Reference*	*Framework/scope*	*Types of competences*
Theoretical	Becker (1964)	–	Generic and specific
	Nordhaug (1993)	–	Firm, tasks and industry–specificity
	Bunk (1994)	–	Technical, methodological, participative and personal
	De Miguel et al. (2005)	Spanish context	Structured on knowledge, skills and attitudes
International research projects	García-Aracil et al. (2004)	CHEERS project	Participative, methodological, specialised, organisational, rule-application, physical, generic, and socio-emotional
	González and Wagenaar (2005)	Tuning project (Europe)	Specific and generic (the latter group divided in instrumental, interpersonal and systemic)
	Beneitone et al. (2007)	Tuning project (Latin America)	Learning process, social values, technological and international context, and interpersonal skills
	Kellerman (2007)	CHEERS project	General-cognitive, professionally knowledgeable, social-reflexive, and physiologically/manually skilled
	García-Aracil and Van der Velden (2008)	CHEERS project	Organizational, specialized, methodological, generic, participative and socio-emotional competences
	Allen and Van der Velden (2011)	REFLEX project	Professional expertise, functional flexibility, innovation and knowledge management and mobilisation of human resources
Regional or national surveys	Heijke et al. (2003)	Dutch higher education graduates	Generic and specific
	Heijke et al. (2003)	TSER Project (Italy)	General academic- and discipline-specific
	Rodriguez and Vieira (2009)	Spanish regional survey	Theoretical, practical, informational and generic competences
	Clemente-Ricolfe and Escribá-Pérez (2013)	Spanish regional survey	Methodological, social, participative and specialized

In the light of the above, most of Spanish universities are now in the process of evaluating degree proposals according to European Higher Education Area (EHEA) criteria. In this context, confusion may be generated when trying to determine which Bologna principles have been successfully implemented, if any previous reference is available to compare. Besides, there is still a generalised need to develop validated instruments for measuring generic competences so that they can be used for common evaluation purposes in cross-sectional studies (Tigelaar *et al.*, 2004). In this paper, the study of self-assessed competences from higher education graduates in "pre-Bologna" degrees may offer crucial conclusions, especially as regards the comprehension of teaching and learning processes and its evolution in the past decade. Thus, the purpose of the current paper is to develop and validate a scale for measuring and managing the acquisition of competences, understood as the knowledge, abilities and attitudes provided by higher education studies.

2. Methods

2.1 Participants

Data were obtained from the REFLEX international research project "The Flexible Professional in the Knowledge Society: New Demands on Higher Education in Europe". In this project, a survey was conducted to examine the experience of higher education graduates during their studies, the process of transition to the labour market and the acquisition of competences in this academic period (Allen *et al.*, 2007). The REFLEX project aimed to make a contribution to assessing the demands that the modern knowledge society places on higher education graduates and the degree to which higher education institutions in Europe are up to the task of equipping graduates with the competences needed to meet these demands. The REFLEX project has been carried out in 16 different countries: Austria, Belgium-Flanders, The Czech Republic, Estonia, Finland, France, Germany, Italy, Japan, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the UK. The major part of the project consisted of a large-scale survey held among some 40,000 graduates from higher education in these countries.

Comparison of graduates' responses from different countries may be challenging due to the potential confusion of cross-cultural and language differences. Heine *et al.* (2002) pointed out that cross-cultural comparisons using subjective Likert scales might be misleading because of different reference groups. Additionally, the translation of educational tests for its use in other languages and cultures has limited value unless they are adapted with a high degree of concern for issues of usability, reliability and validity (Hambleton and Patsula, 1999). Results from REFLEX project compared graduates' self-assessment of competences between different countries by using descriptive analysis (means and percentages). Besides, it was remarked in the reports that assessments came from self-reports of graduates, which is a subjective method for skills measurement (Allen *et al.*, 2007). Nevertheless, even in other programmes that have been specifically designed for international assessment of competences, such as the International Association for the Evaluation of Educational Achievement (IEA) Trends in Mathematics and Science Study (TIMMS) (Mullis *et al.*, 2012; Martin *et al.*, 2012) and the Organisation for Economic Co-operation and Development Programme of International Students Assessment, questions have been raised about the possible cultural bias (Emin, 2003). As this paper has focused on the Spanish dataset, methodological considerations for comparing data from different sources were not appropriate.

A representative sample of 5,474 graduates from ISCED 5A programmes who got their degree in the academic year 1999/2000 was obtained. However, after list-wise deletion of missing data, the sample size was 4,814. The percentage of female graduates was 65.7, and the average age was 30.5 years (SD = 3.3), as questionnaires were sent to graduates who had finished their studies five years before the interviews took place. Graduates from 33 public and private universities participated in the survey. Before starting to answer, all

participants were informed of the aims of the research, and some specific guidelines were given to avoid any misunderstanding while filling in the questionnaire.

2.2 Measurements

An initial 28-item self-report scale was suggested, based on an exhaustive literature review and the adaptation of existing instruments, such as the DESECO Report (Rychen and Salganik, 2001) and the competences questionnaire used in the CHEERS research project (Schomburg and Teichler, 2007). Some of the items were also written by research participants, taking into consideration the guidelines established by the American Educational Research Association, the American Psychological Association and the National Council on Measurement in Education (1999). Participants were required to rate the level of competences acquired at university by means of a 19-item battery, as well as their own level of competences and the required level in their work. Responses to the items were made on a seven-point Likert scale anchored with "Very low" and "Very high" (Table II).

Content validity was established by:

■   reviewing the theoretical models and methods used to develop the items; and

■   submitting this initial version to an expert's evaluation, where the adequacy of items was analyzed and inter-rater agreement was used to examine each item.

As a result, nine items were dropped by consensus because they were considered redundant; the content was too general or their meaning was difficult to understand. This procedure resulted in the retention of 19 competence items.

Table II	Initial items for the generic competences acquired through a higher education scale
No.	*Name of competence*
1	Ability to comprehend complex problems as a whole
2	Ability to rapidly acquire new knowledge
3	Ability to rapidly diagnose new problems
4	Analytical thinking
5	General knowledge of other fields or disciplines
6	Knowledge of other fields or disciplines
7	Mastery of your own field or discipline
8	Self-reflection
9	Ability to come up with new ideas and solutions
10	Ability to find new ways to apply existing knowledge
11	Ability to use information and communication technology
12	Ability to use computers and the internet
13	Willingness to question prevailing ideas
14	Ability to make your meaning clear to others
15	Ability to present products, ideas or reports to an audience
16	Ability to write reports, memos or documents
17	Ability to write and speak in a foreign language
18	Ability to cope with changes
19	Ability to perform well under pressure
20	Ability to take decisive action in case of uncertainty
21	Organisation skills
22	Ability to use time efficiently
23	Ability to coordinate activities
24	Ability to mobilize the capacities of others
25	Ability to work productively with others
26	Ability to assert your authority
27	Ability to negotiate effectively
28	Alertness to new opportunities

Notes: Items: 1-8 (Knowledge management); 9-13 (Innovation); 14-17 (Communication); 18-23 (Organizational); 24-25 (Interpersonal); 26-28 (Professional development)

This version of the scale was initially written in English and it was subsequently translated and implemented in different European countries and Japan. In Spain, the method of blind back-translation was applied by professional translators so that the idiomatic equivalence between the English and the Spanish versions could be guaranteed (Nunnally and Bernstein, 1994). After the translation of the questionnaire, a pilot study was conducted to once again identify possible difficulties in the comprehension of translated items. Following the guidelines suggested by Anderson and Gerbing (1991), a group of 20 Spanish graduates was selected as representatives of the main reference population of interest for the pilot study. This number was considered appropriate as recommendations range from 12 to 30 (Hunt et al., 1982). Results from this pre-test sample provided significant support of substantive and content validity of the Spanish version of the scale (Holden and Jackson, 1979; Hambleton, 1984) (Table III).

2.3 Procedure

The questionnaire was sent by postal mail, phone calls and online from 2005 to 2006, and it was specifically aimed at higher education graduates who had finished their studies five years before the interview. This criterion was defined by the group of experts who participated in the REFLEX Project. The main reason was the widespread trend among graduates at this stage in their lives to think about their past experiences and their future prospects in the labour market.

Graduates were selected by means of random stratified sampling, according to the following strata: region of location of the university (North: 25 per cent; Centre: 41 per cent; and Southwest and islands: 25 per cent) and field of study (Education: 13 per cent; Humanities and Arts: 10 per cent; Social sciences: 12 per cent; Business and Management: 21 per cent; Law: 7 per cent; Engineering and Architecture: 21 per cent; Health and Welfare: 9 per cent; and Sciences: 7 per cent) (Agencia Nacional de Evaluación de la Calidad y Acreditación, 2007), in line with the classification of fields of study in higher education suggested by the United Nations Educational Scientific and Cultural Organisation (1988).

Table III	Final version of the scale for generic competences acquired through higher education
No.	*Name of competence*
1	Ability to rapidly acquire new knowledge
2	Analytical thinking
3	Knowledge of other fields or disciplines
4	Mastery of your own field or discipline
5	Ability to come up with new ideas and solutions
6	Ability to use computers and the internet
7	Willingness to question prevailing ideas
8	Ability to make your meaning clear to others
9	Ability to present products, ideas or reports to an audience
10	Ability to write reports, memos or documents
11	Ability to perform well under pressure
12	Ability to use time efficiently
13	Ability to coordinate activities
14	Ability to mobilize the capacities of others
15	Ability to work productively with others
16	Ability to assert your authority
17	Ability to negotiate effectively
18	Alertness to new opportunities
19*	Ability to write and speak in a foreign language

Notes: Items: 1-4 (Knowledge management); 5-7 (Innovation); 8-10 (Communication); 11-13 (Organizational); 14-15 (Interpersonal); 16-18 (Professional development); 19* removed

3. Analysis

The sample was randomly split into two halves so that cross-validation procedures could be applied, as two different analysis were performed in the paper: exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). The use of EFA is recommendable when strong assumptions cannot be made about the factor structure of the measured variables, whereas CFA can be used when there is a theoretical basis for the specification of the model. It is also useful to perform EFA and CFA in conjunction. If the sample is large enough, it can be split in half, and the EFA can be conducted on one half, providing a first basis for the CFA model (Fabrigar et al., 1999). Ideally, researchers would want to split their samples, using one half to identify the factor structure by using EFA and the other half to validate the solution obtained from the first half. However, this procedure is only possible when large samples are available, as the desirable asymptotic properties of full-information maximum likelihood (ML) or generalised least squares estimators must be attained (Anderson and Gerbing, 1988). This procedure has been widely used in researches that examine factor structures (Helfrich et al., 2007; Cassidy et al., 2005) and was considered appropriate for the analysis of the sample.

Half of the sample (2,392 graduates) was used to analyse items and scale dimensionality, through EFA. First, descriptive statistics and item-total correlations were obtained, taking into account the multidimensional definition of the construct. These indicators show the association between each item with the total battery of items (excluding the selected one); therefore, high item-total correlations are desirable (Scott and Mead, 2011). Bartlett's test of sphericity was used to analyse the possibility of performing factor analysis and the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was also evaluated. Six dimensions were identified through EFA using the ML method with an oblique rotation (oblimin) using PASW Statistics18.

On the other hand, the remaining sample (2,422 graduates) was used to perform CFA to validate the six-factor model using EQS (6.2). All models were tested using the robust ML estimator, which corrects for both non-normality and dependence due to the clustering of graduates within universities. Regarding the issue of the hierarchical structure of data, the authors were concerned about the risks of using a disaggregated approach for graduates belonging to different universities. According to Muthén and Satorra (1995), focusing on the individual level would lead to biased parameter estimates, standard errors and the associated tests for significance. However, intraclass correlations indicated that there was no rationale for conducting analysis at the higher level of the model (universities). As stated by Muthén (1997), coefficient values for intraclass correlations in survey data tend to range from 0.0 to 0.5, and multilevel structure of data should be modelled just when values of 0.1 or larger are combined with group sizes exceeding 15. Despite the second requirement about the size of the clusters was fulfilled in all samples, intraclass correlations were lower than 0.1. Therefore, the underlying assumption of independent responses of graduates from different universities was accomplished.

Evaluation of the tested models was based on multiple criteria that considered statistical, practical and substantive fit. Values for the (corrected) chi-square statistic were reported for comparison purposes but not used for hypothesis testing. This statistic is known to be an overly sensitive index of model fit under conditions with large numbers of constraints, especially with large samples. Thereby, rendering it an impractical and unrealistic criterion on which to base evidence of invariance (Cheung and Rensvold, 2002; Marsh et al., 1988; Little, 1997). Thus, because of our large sample sizes, differences on the chi-square scale have been examined in this paper, but conclusions have been mainly based on goodness-of-fit indices.

Following the recommendations of Hu and Bentler (1999), although other fit indices were reported in the paper such as the Normed and Non-normed indices (NFI, NNFI; Bentler and Bonett, 1980) the Comparative Fit Index (CFI; Bentler, 1990) and the Root-Mean-Square

Error of Approximation (RMSEA; Steiger, 1990) were used. The CFI ranges in value from 0 to 1; values greater than 0.90 and 0.95 typically reflect acceptable and good model fit, respectively, of a target model relative to the null model (Bentler and Bonett, 1980; Hu and Bentler, 1999). The RMSEA is a measure of a model's approximate fit in the population. Values less than 0.05 indicate good fit, and values as high as 0.08 represent acceptable errors of approximation in the population (Browne and Cudeck, 1993; Steiger, 1990).

Reliability and convergent validity of the scale were examined by using Cronbach's alpha values (Cronbach, 1951), which indicated high internal consistency in the general score of the instrument, as well as in each of the six factors. Reliability was also estimated by composite reliability and average variance extracted (AVE). The interpretation of the resulting coefficient is similar to that of Cronbach's alpha, except that it also takes into account the actual factor loadings, rather than assuming that each item is equally weighted in the composite load determination. For construct validity, we followed the recommendations of Hair et al. (2007) that individual standardised factor loadings (regression weights) should be at least 0.5. Variance-extracted measures should equal or exceed 50 per cent, whereas 70 per cent is considered the minimum threshold for construct reliability, except when conducting exploratory research.

4. Results

Most of graduates considered that their studies helped them develop competences related to professional expertise, analytical thinking and quickly acquire new knowledge. On the contrary, most of them perceived low contributions of the university for learning to mobilise the capacities of others, assert their authority and negotiate effectively, as shown in Table IV. In respect to their international orientation, the ability to write and speak in foreign languages obtained the lowest average score. Yet, languages are seen as a weak point of higher education studies in preparing them for tasks in their future workplaces. Moreover, Table IV showed that most items obtained high correlations, so high levels of homogeneity were expected in each construct. Only the 19th item "ability to write and speak in a foreign language" obtained an excessively low correlation with the rest of items, and consequently, it was removed from the scale.

Table IV	Descriptive statistics and item-total correlations				
Description	Mean	SD	Skewness	Kurtosis	Corrected item-total correlation
Ability to rapidly acquire new knowledge	4.43	1.62	−0.33	−0.59	0.58
Analytical thinking	4.12	1.63	−0.14	−0.68	0.55
Knowledge of other fields or disciplines	3.24	1.58	0.32	−0.67	0.49
Mastery of your own field or discipline	4.06	1.73	−0.06	−0.85	0.40
Ability to come up with new ideas and solutions	3.69	1.64	0.08	−0.78	0.73
Ability to use computers and the internet	3.19	1.83	0.46	−0.88	0.52
Willingness to question prevailing ideas	3.74	1.68	0.11	−0.78	0.68
Ability to make your meaning clear to others	3.93	1.66	0.00	−0.76	0.69
Ability to present products, ideas or reports to an audience	3.61	1.75	0.19	−0.94	0.64
Ability to write reports, memos or documents	4.09	1.74	−0.12	−0.90	0.60
Ability to perform well under pressure	3.61	1.81	0.19	−0.99	0.58
Ability to use time efficiently	3.89	1.70	0.00	−0.85	0.69
Ability to coordinate activities	3.64	1.66	0.13	−0.80	0.73
Ability to mobilize the capacities of others	3.22	1.62	0.36	−0.64	0.70
Ability to work productively with others	4.26	1.78	−0.20	−0.93	0.65
Ability to assert your authority	2.95	1.58	0.53	−0.42	0.67
Ability to negotiate effectively	2.79	1.58	0.67	−0.28	0.62
Alertness to new opportunities s	3.00	1.54	0.44	−0.53	0.70
Ability to write and speak in a foreign language*	2.22	1.55	1.38	1.27	0.36

Note: *Item removed

Subsequently, an EFA was conducted using the maximum likelihood extraction method. There was also a high degree of correlation competences, with correlations ranging from 0.30 to 0.60. A combination of the scree test and the eigenvalue greater than 1 rule was used to determine the number of factors to be extracted. This resulted in the expected six-factor structure which explained 72.7 per cent of the variance, as shown in Table V. Likewise, Cronbach's coefficient alpha was obtained to measure the reliability of each factor. This coefficient can have values ranging from 0 to 1, and the higher the value, the greater the internal consistency. Although reliability depends on the number of items in each factor, the alphas for these factors can be compared, as they have approximately similar lengths. The internal consistency of all the factors was good, with coefficients ranging from 0.742 to 0.809.

Confirmatory factor analysis was conducted with the remaining half of the sample. Although univariate descriptive statistics shown in Table IV revealed an acceptable level of skewness and kurtosis, the assumption of multivariate analysis could not be accepted given that the standardised parameter of Mardia's (1970) test was 102.6. Therefore, robust maximum likelihood was the selected method for estimation.

As a result, the Satorra and Bentler scaled test statistic was obtained (ST χ^2 = 1,523.2, gl = 120, $p < 0.000$), which is an adjustment to the goodness of fit for non-normal data in covariance structure analysis. However, due to its high sensitivity to small differences between models when the size of the sample increases, its use is not appropriate in this case. On the other hand, fit indexes are commonly considered indicators of goodness of fit when NFI, NNFI and CFI are > 0.90 (Bentler, 1990; Hu and Bentler, 1999) and RMSEA is ≤ 0.08 (Browne and Cudeck, 1993). Hence, the model is a reasonable description of the data (NFI = 0.926, NNFI = 0.912, CFI = 0.931 and RMSEA = 0.069).

Convergence validity was determined through the statistical significance of factor scores corresponding to each item, as shown in Table VI. As this table demonstrates, all factor loadings exceeded or approached the minimum recommended level of 0.50. Factor loadings indicated that all items were good indicators of each competence factor. Likewise, all the t-test statistic values exceeded the critical value 1.96 (α = 5 per cent) (Hair *et al.*,

Table V	Exploratory factor analysis						
Item	Factors	F1	F2	F3	F4	F5	F6
5	Ability to come up with new ideas and solutions	1.063					
6	Ability to use computers and the internet	0.460					
7	Willingness to question prevailing ideas	0.430					
14	Ability to mobilize the capacities of others		0.739				
15	Ability to work productively with others		0.542				
2	Analytical thinking			0.794			
1	Ability to rapidly acquire new knowledge			0.615			
4	Mastery of your own field or discipline			0.462			
3	Knowledge of other fields or disciplines			0.372			
10	Ability to write reports, memos or documents				0.759		
9	Ability to present products, ideas or reports to an audience				0.752		
8	Ability to make your meaning clear to others				0.380		
12	Ability to use time efficiently					−0.746	
13	Ability to coordinate activities					−0.450	
11	Ability to perform well under pressure					−0.438	
16	Ability to assert your authority						0.418
18	Alertness to new opportunities						0.593
17	Ability to negotiate effectively						0.526
% Explained variance		44.5	8.2	6.2	5.3	4.7	3.9
% Cumulative explained variance		44.5	52.7	58.9	64.1	68.8	72.7
Cronbach's alpha		0.772	0.784	0.742	0.809	0.808	0.804
KMO = 0.934		χ^2 = 219710.1		$p < 0.000$			

Notes: F1 = Innovation; F2 = Interpersonal; F3 = Knowledge management; F4 = Communication; F5 = Organizational; F6 = Professional development

Table VI	Factor scores (λ) and *t*-statistics, CFC and AVE, by factor					
Factor	Items	λ	t	CFC (%)	AVE (%)
F1 – Innovation	6	0.606	19.09**	72.9	47.8
	5	0.868	49.60**		
	7	0.789	–		
F2 – Interpersonal	10	0.772	45.00**	68.9	52.6
	11	0.841	–		
F3 – Knowledge management	4	0.478	–	69.2	36.9
	3	0.559	20.05**		
	2	0.765	21.25**		
	1	0.781	21.24**		
F4 – Communication	8	0.797	–	73.9	48.6
	9	0.792	46.08**		
	10	0.730	39.39**		
F5 – Organizational	11	0.667	–	73.9	48.8
	13	0.850	39.34**		
	12	0.792	37.65**		
F6 – Professional development	18	0.797	43.17**	73.4	47.9
	17	0.740	–		
	16	0.764	41.11**		

Note: **significant at 1% level

2007). Additionally, composite reliability coefficient (CFC) and AVE were obtained to analyze internal consistency. The values of these coefficients are not influenced by the number of items in each factor, as is usually assumed in Cronbach's alpha. All values for both indicators either exceeded or came very close to the minimum recommended values: 70 per cent for the composite reliability coefficient (Nunnally and Bernstein, 1994) and 50 per cent for AVE (Bagozzi and Yi, 1988). Therefore, it was concluded that convergent validity existed between constructs.

5. Discussion

The results of this study raise issues regarding the acquisition of generic competences in higher education. The paper shows that most graduates, in retrospect, considered themselves to be well qualified in mastery of their own field or discipline, five years after graduation. This also holds true for their competences for quick learning, which can be regarded as a key aspect of functional flexibility. However, one could have expected similar results in other related key competences, such as general or multidisciplinary skills, obtained as a result of quick learning abilities. But results show that graduates not considered themselves well equipped with knowledge of other fields or disciplines. These findings point out that graduates, on average, feel well prepared for their professional expertise and functional flexibility, competences they are expected to possess in organisations (Allen *et al.*, 2007). In contrast, they often note deficiencies concerning mobilisation of human resources and foreign language skills that are also considered important job requirements for graduates. Thus, as regards these competences, the detection of this gap between universities and organisations may help higher education institutions to identify improvement areas in their study programmes.

The analysis of ratings demonstrate that the competences graduates acquire in higher education can be grouped into six dimensions: "knowledge management", "innovation", "communication", "organisational", "interpersonal" and "professional development". However, the item "ability to write and speak in a foreign language" had to be removed due its low consistency with the scale. The proposed instrument for measuring generic competences in higher education is a reliable and valid measure of the level of competences. A large number of studies have already suggested the existence of cooperative competences, also known as social or interpersonal skills (Beneitone *et al.*, 2007; Clemente-Ricolfe and Escribá-Pérez, 2013; De Miguel *et al.*, 2005; García-Aracil

et al., 2004; González and Wagenaar, 2005; Kellerman, 2007). Likewise, the importance of competences related to knowledge management was also proposed by Allen and Van der Velden (2011), De Miguel *et al.* (2005). Particularly, Wong *et al.* (2013) emphasised in the use of qualitative techniques to examine the relationship of this competence and the performance of the organisation, whereas Manohar and Gupta (2014) developed a four-factor scale to analyze knowledge management practices in teams. In some cases, this competence was also named "general-cognitive" (Kellerman, 2007) or "learning process" (Beneitone *et al.*, 2007). These latter studies also confirmed the relevance of professional development. De Miguel *et al.* (2005) was the first to distinguish communication skills from the common core of generic competences. This conclusion was later confirmed by Rodríguez and Vieira (2009), whereas De Miguel *et al.* (2005) also emphasised the presence of organisational competences, as did other research papers (Clemente-Ricolfe and Escribá-Pérez, 2013; García-Aracil *et al.*, 2004). Finally, new proposals of items related to innovation competences were suggested by Allen and Van der Velden (2011).

This scale may be particularly useful to understand the process of transition of higher education systems towards the new Bachelor's and Master's degrees according to Bologna principles. Although a large number of university lecturers are nowadays involved in adapting their teaching activities to more active methodologies, there are not many instruments available to assess the efficacy of these experiences in the education of new knowledge and skills. Besides, from a methodological approach, the proposal of this validated instrument for measuring competences represents a significant contribution to the existing research in competency-based education that may help researchers to examine how competences are developed. From a practical perspective, this research may also help higher education institutions to identify improvement areas in their study programmes, through the identification of mismatches between universities and organisations. At the same time, the proposed scale may offer crucial information to universities in the determination of which Bologna principles have been successfully implemented in degree proposals according to EHEA criteria, especially as regards the comprehension of teaching and learning processes and its evolution in the past decade. As regards the implications for society, employers may use these findings to design formal or informal training courses or mentoring programmes for new graduates hired by the organisation. One survey limitation is that the data have been obtained from subjective opinions of respondents. Therefore, to avoid possible confusion in respondents and the subsequent misleading results, the wording of the items must be done in a clear and understandable way. Another limitation of the research is that results shown in this paper refer exclusively to the Spanish context.

For future research, the authors aim to identify the requirements of competences in workplaces occupied by graduates and, second, to check whether higher education institutions are helping graduates to acquire these competences, as exposed by Allen and Van der Velden (2007). Besides, the authors are considering the introduction of different sources of information (or methods of measurement) as regards to competences through multitrait-multimethods (MTMM) models, as used by Baig *et al.* (2010) with the aim of estimating construct validity of clinical competence measured through different assessment instruments. Three methods would be considered in our research: possessed competences, required competences in the workplace and contribution of higher education to the development of competences. In addition, there is also a need to evaluate the measurement invariance of the instrument across fields of study, as graduate attitudes towards competences may be influenced by differences in study programmes and the availability of learning activities. Using this methodology, the authors aim to confirm the factor structure identified in this paper in other countries that carried out the survey.

6. Conclusion

This paper describes the process of development and validation of a scale to measure the acquisition of competences in higher education. It represents a significant contribution to available knowledge about instruments for the assessment of competences from two different approaches. First, as higher educations institutions need objective and updated information about what competences students could develop through pre-Bologna higher education studies, this paper provides a reference point in assessing the advances reached in new study programmes with the three – cycle structure Bachelor/Master/Doctor, especially as regards the paradigm shift from teaching to learning. This change has involved new didactical methods and strong innovations in teaching and learning processes. Second, this research has an innovative approach into the topic of generic competences in higher education. While most of research focus on the level possessed by graduates and work requirements, this paper concentrates on the role of universities in providing training for the acquisition of competences. Despite employers putting emphasis on mobilisation of human resources and foreign languages, graduates perceive that universities are not necessarily helping them to develop these abilities. They mostly believe that universities are more concerned with professional expertise and quick learning.

The six-factor model suggested in this paper structures competences that can be developed in universities and integrates knowledge management in the definition of these skills. Universities may use the scale to diagnose improvement areas in the new study programmes, following Bologna principles, smoothing the transition from higher education to the labour market. Similarly, employers can use these findings to design formal or informal training courses or mentoring programmes for new graduates hired by the organisation.

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