University teachers ICT competence: evaluation indicators based on a pedagogical model

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ABSTRACT: In this paper we explain the process of building a catalogue of indicators to analyse, evaluate and promote the competence of university teachers in ICT. We are going to include here the description of every phase of the process of building the catalogue, as well as the catalogue itself. Finally we want to highlight these phases in order to analyse them, as a prerequisite to using them in a study with teachers, with the objective of opening new means of debate about one of the crucial elements of developing ICT enhanced learning in higher education: teacher training.

RESUMEN: En el presente trabajo se explica el proceso de construcción de un catálogo de indicadores para analizar, evaluar y desarrollar la competencias TIC de profesores universitarios. Se incluye a continuación, la descripción de la metodología de trabajo que se ha seguido para la construcción del catálogo, el catálgo en sí mismo, así como el modelo pedagógico subyacente y la perspectiva desde la que se desarrolla. Consideramos que el interés en torno a esta lista de indicadores, así como a su análisis a la luz de un modelo pedagógico concreto, reside no sólo en el uso de dicho catálogo para la medición de la competencia TIC en docentes de un momento concreto, sino en la apertura de un debate acerca de los elementos críticos a las hora del desarrollo de estrategias de implementación de TIC en las Enseñanza Superior.

Key Words: Higher Education, ICT Competencies, Catalogue of Indicators

Palabras clave: Educación Superior, Competencias TIC, Catálogo de Indicadores.

INTRODUCTION

Some of the literature of recent years (GILSTER, 1997; PRADO, 2001; KOEHLER & MISHRA, 2008, among others) has reflected the concern about user's ICT competence. This general social concern is highlighted by an interest in knowing and reinforcing the levels of ICT competence amongst teachers at all levels of education as a key element in the implementation of technology enhanced learning strategies at university (UNESCO, 1998; SALINAS, 2003; BARTOLOMÉ, 2004; ESCUDERO, 2004; CABERO, 2002; and et al).

In this paper we present the process of building, developing and validating a catalogue of indicators to analyse, evaluate and promote the ICT competence of university teachers. This development is a part of the Research Project "ICT competences for teachers in Spanish public universities: indicators & proposals for good practices" with reference EA2009-0133 funded by the Ministry of Education of Spain and coordinated by Paz Prendes.

Our main objective is to propose a catalogue of indicators to analyze and measure the digital competencies of every university teacher and to configure this catalogue based on an integrated and comprehensive model.

Basically, we combine some quantitative and qualitative strategies in order to approach the topic, using a dynamic where all the procedures can interact to enrich each other. To implement these procedures we have take advantage of the knowledge of the crucial stakeholders in Higher Education and Educational Technology: national and international educational organizations, higher education institutions, experts and teachers.

We have completed this research in 4 phases (including a previous study), that we will attempt to describe below:

THE PROCESS

Phase 0. Based on previous research, The pre-Catalogue 0:

We start with a previous catalogue of indicators (from here "Catalogue 0") to measure digital competencies (PRENDES ET AL. 2010; PRENDES & CASTAÑEDA, 2010) which are the result of a previous research (Project A/018302/08 "Research on competencies & ICT training of teachers in Bolivian and Dominican universities") and which are based on widely used international literature (ALA, 1998, BECTA, 2005; 2006; 2007; CABERO & LLORENTE, 2006; EFAW, 2005; EUROPEAN COMISSION, 2008; ESCUDERO, 2009; ISTE, 2008; JISC, 2009; Ministerio de Educación de Chile; 2006). This list of indicators configures Catalogue 0 (Included in PRENDES & CASTAÑEDA, 2010).

Phase 1. Collecting ICT competencies indicators from official institutions

We need to review and adapt catalogue 0 for public institutions of Higher Education (HE) in Spain. Therefore we decided to firstly explore the indicators related to ICT competencies which we found already included in the official documents, regulations and evaluation catalogues in public HE Institutions, and official agencies of accreditation (regional and national) in Spain. To summarise, we have examined all the public institutions in Spain: 13 agencies of accreditation and 52 Universities.

At the same time, we explored the most important international organisations related to education: UNESCO, OECD and UNO. As well as examining some national agencies of accreditation in 15 countries of reference –cited by our national agency of accreditation ANECA- in Europe and America (Argentina, Austria, Chile, Colombia, Denmark, Deutschland, Finland, France, Germany, Ireland, Mexico, Norway, Portugal, Switzerland and the United Kingdom).

In total, we have collected the information from 65 national institutions and 18 international organizations from 83 different sources. The task has been developed by 20 researchers from 10 different institutions in Spain who have reviewed almost 140 documents and papers. We have called this list -with more than 180 indicators- pre-Catalogue 1.

Phase 2. Cleaning and Mixing, the pre-Catalogue 2

Once we had collected the entire list of indicators from the revision, as explained above (pre-catalogue 1), we started to mix both catalogues of indicators, from the theoretical model and from institutions.

We united both catalogues after integrating the two lists of indicators, matching indicators with the same meaning from both parts, deleting repeated items and finally configuring a new list. 79 indicators divided into 5 areas configured this new list (pre-Catalogue 2). Educational; management; ethical, social and legal aspects; professional development and technical aspects (this division of areas was based on the definition of the Chilean Ministry of Education in 2006).

Phase 3. Redefining the catalogue of indicators in a model of ICT competence.

When we completed pre-Catalogue 2, we started to analyse the lists of indicators in order to understand how they could shape the perspective of the whole of ICT competence for teachers at university.

In order to achieve this we used the reflections of 20 experts at 8 different universities. All of these were selected because of their specific expertise in education, competencies and/or educational technology.

Firstly: they carried out an individual analysis based on three criteria: 1) character of the indicator: objective-subjective; 2) preferable system of evaluation of the indicator: self-evaluation or external evaluation and, 3) level of priority of the indicator within the concept of ICT competence. In addition they could make proposals about grammar, organization, model, semantics and whatever else they wanted to change in the list or about the model.

Secondly: they had to discuss their first analysis and obtain a consensus in a panel of experts (brainstorming sessions). We organised this process at three different meetings (Tarragona, Murcia and Madrid). The final idea was to triangulate the data from the three meetings.

Thirdly: after these three meetings the coordinator finally produced a document containing the conclusions of each of the three meetings. Using this document the main research group proceeded to:

- Compare the lists of indicators from each meeting.
- Eliminate indicators that appeared only in one of the three lists.
- Remix and reformulate common indicators.

- Compare the level of priority, the character (objective or subjective) and the preferable method of evaluation (self-evaluation or external).

After finishing the entire process, we successfully achieved the catalogue we aimed for in addition to a model which supports it. This is the model and catalogue we present below.

THE UNIVERSITY TEACHERS ICT COMPETENCE MODEL UNDERLYING:

After considering every reflection during the different meetings that we have described, we are going to explain the proposal of this model with this first consideration: *a **competence**, being competent, includes **not only knowing how to do** things, but knowing **why you are doing these things in this way***. In addition to this, from our point of view, the original division used in the scientific literature (pre-catalogue 0 and conserved in pre-catalogue 2) which divide the ICT competence into areas has an evident bias towards institutional interest.

To achieve this objective (reordering the catalogue), we propose a model of organization about the digital competence of university teachers which has indicators classified by the three basic areas the university teacher usually works in: teaching (T), research (R) and management (M).

For each of these areas, we understand ICT teachers' competence at three levels of expertise which are progressive (to reach level 2 it is imperative to have level 1), and which constitute the ideal of university teacher competence in ICT. These levels of expertise are:

- **Level of expertise 1**: skills related to base knowledge of the common use of ICT in university work
- **Level of expertise 2**: skills related to:
  a. Design
  b. Implementation
  c. Evaluating activities using ICT
- **Level of expertise 3**:skills related to the reflection and critical analysis of the actions and activities carried out using ICT
  a. Individually
  b. Collectively (with other teachers)

In order to fully expose the mechanism of this model and how the relationships between basic areas and level of expertise work, we represent it in the follow diagrams:

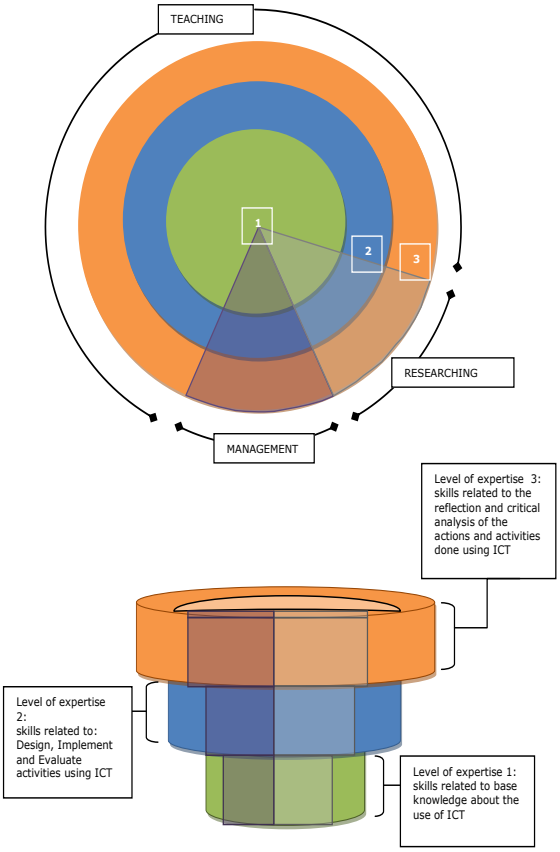

Fig. 1. University teachers ICT competence model, top view and front view

More than a real model (in the technical sense of this word), we want to propose a pedagogical framework which supports our catalogue of indicators in a global concept of the digital competence of university teachers. For this reason, each indicator we decided to include in the catalogue must also be situated in relation to a basic area of work and level of expertise.

Catalogue of indicators

In accordance with this approach we present following the catalogue of indicators related to ICT competence for university teachers, organized by area (identified by their initial), level of expertise (number) and sublevel, if it has (letter).

	Indicators	Objective	Subjective
T1	Knows the role of ICT in future profession of students he teaches.	X	
	Understands relationships between the curriculum of his area of knowledge, and the way to implement ICT in his teaching practice		X
	Knows a variety of didactic strategies to implement ICT in his teaching	X	
	Knows good educational practices in his area of specialization, using ICT at university	X	
	Knows good educational practices in his area of specialization, using ICT in general	X	X
	Knows possibilities and limitations of ICT as learning tools	X	X
	Knows implications of educational politics in his teaching practice, especially the politics related to ICT	X	X
T2a	Selects and chooses appropriate ICT tools and resources in order to enhance the students' learning	X	X
	Selects and uses didactic strategies using ICT	X	
	Uses ICT tools to produce educational resources	X	
	Uses ICT to publish educational resources	X	
	Uses pedagogical criteria to select educational resources based on ICT		X
	Designs activities where his include educational resources based on ICT	X	
	Uses university technology enhanced learning support services	X	
T2b	Uses a diversity of didactic strategy using ICT	X	X
	Solves learning needs using educational resources based on ICT		X
	Uses educational resources based on ICT to take into account the diversity of students		X
	Implements learning activities that include educational resources based on ICT	X	
	Uses communication skills to improve the participation of students in ICT environments	X	X
	Uses ICT for tutoring	X	X
	Uses ICT for learning assessment	X	X
	Uses ICT to evaluate complex cognitive processes		X
T3a	Favors equal access to ICT resources for all students	X	X
	Analyzes the effect of teaching practices using ICT, in order to improve it, using the conclusions in further experiences	X	
T3b	Continually updates his knowledge of ICT development and uses of ICT	X	
	Participates in educational innovation projects to promote or improve the use of ICT in teaching	X	
	Co-ordinates and/or promotes, ICT supported activities in their department or institution	X	X
	Creates and enriches a list of relevant sites (web resources) to improve teaching practices and professional learning	X	
	Uses diverse information sources related to actualization in teaching and in ICT	X	
	Uses digital resources in order to improve teaching practices	X	
	Participates in learning activities related to ICT as a student	X	
	Participates in learning activities related to ICT as a teacher	X	X
	Participates in spaces of reflection and interchange (face to face or online) about experiences of design and implementing teaching experiences using ICT	X	X
	Takes part in professional networks of teachers who use ICT for teaching	X	
	Spreads awareness of teaching experiences using ICT in different places	X	
	Takes part in and/or promotes innovation groups and research	X	X

	in the use of ICT for teaching		
R2 **R3**	Knows and applies legal and ethical principles associated with digital information and ICT use	X	
	Uses and promotes the use of open format to publish digital resources	X	
	Publishes their scientific production in open (free) environments	X	
M2 **TR M1**	Uses the ICT resources the institution gives him, to carry out management tasks	X	
	Knows basic terms and components related to ICT	X	
	Correctly uses necessary information to select and buy digital resources and ICT tools	X	
TR M3	Uses health and safety measures in the use of ICT	X	
	Is able to face and solve technical problems	X	X

Table 1. Catalogue of indicators of ICT competence for university teachers

Discussion and next steps

In the end, we have built a strong proposal for a catalogue of indicators of ICT competence, and we have based the proposal of the catalogue on a model of understanding relationships between skills, levels of expertise and basic areas of work.

Due to this, we understand than in an ideal situation, a university teacher has to have the skills of each level of expertise in order to reach the next level.

As is evident in the table we present in the previous part, based on this model, and indicators included on this, and with the hard work a cohort of experts we have analyzed who we can measure this indicators in a real study. We were aware that the huge majority of these indicators have very subjective aspects –as well as objective ones-, and would be quite difficult to measure them, specially because of the ways to do it would be habitually affected by "interested views" (university government, national government, too technical approaches, etc.); consequently find a good way to measure them would imply very different instruments and a potentially impossible wide open process of assessment.

Nevertheless, the approach to an assessment process of this ICT competence, especially in order to improve the qualification and training of teachers, is an ineluctable goal of our system, and from our point of view the first evident approach to start it must be the teachers self-evaluation.

From this progressive point of view of the components of ICT competence, this approach is especially interesting in proposing and promoting enhanced self-evaluation processes. Enhanced, because the results of a self-evaluation related to this model of understanding can give the teacher not only an overview of the state of their ICT competence, but can give them, at the same time, a coherent recommended method of training (specifically related to levels of expertise).

Consequently, now is the time to proceed with the use of this model in a real world environment. To obtain this, we have carried out a study of the ICT competencies in all the universities of Spain, and –at the moment of this editing- we have just finished the recovering of the data (available at http://www.um.es/competenciastic/), as well as we have developed an short online questionnaire, based on this catalogue and model, for the self-evaluation of ICT competence for teachers.

The outlook is exciting. The ICT competence of university teachers is one of the crucial elements that can help us enter new era for our Institutions of Higher Education.

Let's continue exploring.

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