TRAINING NEEDS OF TEACHERS IN ICT: TRAINING PROFILES AND ELEMENTS OF COMPLEXITY

[*Las necesidades formativas del profesorado en TIC: Perfiles formativos y elementos de complejidad*]

by/por

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Abstract

Teachers' training needs in Information and Communication Technologies (ICT) is one of the key aspects for the integration of ICT into daily educational practice, along with competencies in ICT and teachers' use of these technological resources. This paper aims to establish teacher training profiles to help relate them to their ICT competencies and use thereof, together with personal and contextual factors. To this end, a questionnaire design has been used with a sample of 868 primary and secondary education teachers in the Valencian Community (E. Spain) to collect information. The results obtained indicate that teachers demand higher-level training in the personal-professional area, and that they require more training with students in classrooms and to integrate ICT into classrooms. Furthermore, these needs can be arranged into four profiles: initial, initial-intermediate, intermediate and advanced. A clear relationship was also found between these training needs profiles with ICT competencies, especially technology; use of ICT, mainly in the personal-professional area. Teachers' age and frequency of computer use were seen to also influence these profiles. This implies that educational administrations should consider these results when developing teacher training plans to produce higher quality programmes in accordance with demand from various fields.

Resumen

Las necesidades formativas del profesorado en las Tecnologías de la Información y de la Comunicación (TIC) se constituyen como uno de los aspectos claves para la integración de las TIC en la práctica educativa diaria, junto con las competencias en TIC y el uso de estos recursos tecnológicos por parte del profesorado. El objetivo de este artículo es establecer perfiles formativos del profesorado y relacionarlos con sus competencias en TIC y el uso de las mismas, junto con factores personales y contextuales. Para ello, se ha utilizado un diseño de encuesta, con una muestra de 868 profesores y profesoras de Educación Primaria y Secundaria de la Comunidad Valenciana, siendo el instrumento de recogida de la información un cuestionario. Los resultados indican que el profesorado demanda formación de mayor nivel en el plano personal-profesional, necesitándose más formación en los planos con el alumnado en el aula y la integración de estos recursos en el aula. Además, estas necesidades se pueden estructurar en cuatro perfiles: inicial, inicial-medio, medio y avanzado. Asimismo, se ha hallado una relación clara entre estos perfiles de necesidades formativas con las competencias en TIC, esencialmente las tecnológicas; el uso de las TIC, principalmente el plano personal-profesional. También se encuentra una influencia en estos perfiles de la edad del profesorado y la frecuencia de uso del ordenador. Esto implica que las administraciones educativas han de considerar estos resultados en el desarrollo de los planes de formación del profesorado para producir programas de mayor calidad, tal y como se demanda desde diversos ámbitos.

Introduction

The introduction of the Information and Communication Technologies (ICT) in the last decade has brought about many changes in education, and has had a huge impact on the educational system (creation of infrastructures, teacher training, etc.). Nonetheless, integrating these resources into educational practices is not obtaining the expected results (Ertmer and Ottenbreit-Leftwich, 2010; Hixon and Buckenmeyer, 2009; Ramboll Management, 2006) despite the potential they amass. Given this situation, several countries are proposing new plans to incorporate ICT into education, such as the United States and the National Educational Technology Plan (2010), or Spain and the School 2.0 Plan (2009). When it comes to implementing these programmes, apart from supplying infrastructures, an essential part involves teachers and their training, which is a central theme of such programmes.

In this way, teachers become the main actor in ICT integration. Without this actor, the incorporation of these technologies into the teaching-learning process would not take place because, in the end, ICT are used by teachers (Cabero, 2004; Ertmer, 2005). In order to include ICT in their daily practices, teachers have to feel confident when using these new educational resources; in other words, teachers have to be competent in ICT. Nevertheless, this suggests that they still lack the required confidence to use these resources, despite any training they may have received (Daly, Pachler and Pelletier, 2009; Gray, Thomas and Lewis, 2010; IEAE, 2007; Ramboll Management, 2006; Sigalés, Mominó, Meneses and Badía, 2008). For instance, of the two thirds of the teachers who

participated in developing competencies, only one third feel confident to use them (Ramboll Management, 2006); or, as the report of Sigalés et al. (2008) points out, one fourth of the teachers who received training state that it proved of little use to them for their teaching activities.

The same teachers pointed out that lack of knowledge or skills is a barrier to integrate ICT into their educational practices (Banlankast and Blamire, 2007; Hew and Brush, 2007; Mueller, Wood, Willoughby, Ross and Specht, 2008; Sigalés et al., 2008). This means that they still demand training to integrate these new educational resources (Rudd et al., 2009) as a result of teachers self-assessing themselves as not being sufficiently competent to use ICT (Cabero, 2004). Therefore, knowledge about the structure of what teachers' training needs are is essential to implement training programmes in ICT and to, consequently, integrate them into their teaching practices.

Teacher training needs in Information and Communication Technologies

Apart from the introduction of ICT into the education domain, the last decade has witnessed the development of teacher training programmes for both teacher training and professional development purposes. Despite pursuing the same aim, that of integrating ICT into daily practices, the differences between both groups imply required training diversity (Condie and Munro, 2007; Ertmer and Ottenbreit-Leftwich, 2010), but without leaving to one side the required continuity between initial training and continuous training, as Marcelo (2007) pointed out . Moreover, given the compelling need to incorporate these resources into the classroom, most

of the literature about training needs or teachers' continuous training in ICT essentially addresses teachers who actively teach.

In this way, continuous professional development among teachers is based on a fundamental aspect to help achieve the genuine integration process for technological tools. Unlike other educational resources, these are characterised essentially by two interrelated components; technological and pedagogic; which implies that teachers must master these resources and must also know how to use them so that the educational practice is enriched (Tello and Aguaded, 2009). We should remember that, in Spain, teacher training in new technologies –with both the technological aspects and the methodological and social aspects that integrating these resources into their daily teaching practices entail– is a central theme of the School 2.0. Plan. Nonetheless, many studies indicate that teacher training in these new resources has not proved all that suitable (Balanskat, Blamire and Kefala, 2006; Becta, 2004; Cabero, 2004; Condie et al, 2005; Galanouli, Murphy and Gardner, 2004; Llorente, 2008; Waite, 2004). So, in principle, teacher training has focused more on mastering technological resources which, in turn, had led to a good number of criticisms being made in former studies, which can be broken down into three main aspects:

a) Lack of training in pedagogical aspects owing to focus on technology,

b) Poor adaptation of training programmes to teachers' knowledge and skills,

c) Lack of time to carry out innovations using ICT, along with an inadequate follow-up of their use in the classroom.

This has led to question continuous professional development and the need to reconsider these programmes in order to bring about improvements in terms of their quality and efficacy (Daly, Pachler and Pelletier, 2009; Davis, Preston and Sahin, 2009; Ertmer and Ottenbreit-Leftwich, 2010; Hew and Brush, 2007; Hixon and Buckenmeyer, 2009; Lawless and Pellegrino, 2007).

From our viewpoint, one of the key features of these programmes lies in adequately planning contents, as also put forward by Hew and Brush (2007) or Ertmer and Ottenbreit-Leftwich (2010). In our view, there are two key factors that enhance the efficacy and quality expected of these programmes: a) suitable development of ICT knowledge and skills, and b) adapting them to teachers' requirements. The former is a key element (Daly, Pachler and Pelletier, 2009; Ertmer and Ottenbreit-Leftwich, 2010; Hew and Brush, 2007; Lawless and Pellegrino, 2008) in implementing training programmes by considering both the technological and pedagogic aspects that integrating these resources entails. The latter is a less covered aspect because, as Valcke, Rots, Verbeke, and Van Braak (2007) pointed out, teachers' professional development programmes have been based on excellent national standards or on training experts' minds; yet teachers' opinions are scarcely considered when it comes to designing such programmes or carrying out follow-ups of them.

If we begin with the training needs that the teachers themselves express , this study attempts to seek a response for the training needs model that best matches this group's genuine needs as regards training in and integration of ICT into teaching practices. The context of this study has to be framed within a much broader research work, the PROFORTIC project[1], whose objectives are to detect teachers' needs in terms of ICT, to determine an ICT curriculum that emerges from these requirements, and to study training-innovation models for for ICT with teachers. The analysis of teachers' needs was done using three information sources: in-depth interviews with those in charge of ICT training in various teacher training centres; a documental analysis of the various teacher training plans of actively working teachers,

which have been presented; the teachers' own views.

Competency and use of ICT. Personal and contextual factors

There are two basic elements involved when teachers integrate ICT: the competencies they possess and their use of technologies. Besides, these two components are very much interconnected as competency in ICT, from both the technological and the pedagogic aspects, implies that ICT use increases in teachers' educational practice (Almerich, Suárez, Belloch & Orellana, 2010; Suárez, Almerich, Gargallo & Aliaga, 2010). Moreover, the personal and contextual factors have a complex influence on the structure and relations of competencies and ICT use (Almerich, Suárez, Jornet & Orellana, 2011).

In relation to competencies, around a decade ago, several governmental and non-governmental institutions (ACCE, 2000; North Caroline Department of Public Instruction, 2000; ISTE, 2008; Chilean Ministry of Education, 2006; UNESCO, 2008) developed competency-based models for ICT with teachers. One of the difficulties lies in there not being an explicit consensus about the exact competencies that teachers have to master; implicitly however, two large groups of competencies may be indicated: technological and pedagogic (Law and Chow, 2008; Suárez et al., 2010; Almerich, Suárez, Orellana and Díaz, 2010).

ICT use among teachers is an aspect that is dealt with more frequently than other elements relating to ICT (Aguaded and Tirado, 2010; Area, 2010; Becker, Ravitz and Wong, 1999; Condie et al., 2005; Empirica, 2006; Eteokleous, 2008; García-Valcárcer and Tejedor, 2010; IEAE, 2007; O'Dwyer, Russell and Bebell, 2004; Sigalés et al., 2008; Suárez et al., 2010; Tejedor & García-Valcárcel, 2006; van Braak, Tondeur and Valcke, 2004). Based on these studies, two distinct usages of teachers' use of technological resources may be contemplated: personal-professional and with students in the classroom.

From our viewpoint, the link between both these components- competencies in ICT and their use on the one hand, and teachers' training needs in terms of technologies on the other- has been poorly covered by the literature; hence, it is necessary to study them in more depth. According to the ICT integration outline proposed by Tejedor and García-Valcárcel (2006), work begins by considering teachers' attitudes, followed by competencies and, finally, ICT use in the classroom. In this context, lack of training in the competencies-based component will imply reduced use with students, therefore teachers' integration of ICT into their daily teaching practices will be compromised.

Furthermore, integrating ICT into education is a complex process which many factors influence (Area, 2005; de Pablos, Colás and González, 2010). Consequently, several authors (Law and Chow, 2008; Tondeur, Valcke and van Braak, 2008; Suárez et al., 2010) have pointed out the need to address ICT studies from a multivariate position when implementing an integrating process given the intervention of these different factors. Various studies (Ertmer, 2005) have suggested that personal and contextual factors play a determining role in the integration of these education resources into the classroom. In this way, gender, age, frequency of using a computer by teachers, level of education and access to a computer classroom, are all factors that several studies have addressed. Nevertheless, one of the problems is that they have been mainly dealt with from a univariate perspective; that is to say, looking at how a factor influences any of the key dimensions (competencies, use, training needs, etc.); for example, the study into training needs by Hernández and Quintero (2009). Conversely, the multivariate perspective provides a much more suitable joint view of the different factors involved (Almerich et al., 2011) for the inherent com-

plexity of the phenomenon that is being dealt with. However, it is worth pointing out that there are very few contributions available as to how these factors influence teacher training, particularly when one of these teacher training premises in this domain is adaptation to their needs.

The purpose of the study

Its purpose is to attempt to identify the standards that will respond to teachers' training needs in order to implement training plans that better adapt to this group's knowledge, which means that their knowledge will become more efficient and of better quality. To go about this, it is firstly necessary to determine a model that identifies non-university teachers' training profiles in ICT through their own opinions. Next, the intention is to link the profiles identified with competencies in ICT and how teachers use technological resources to connect them with several important personal and contextual factors at the same time.

2. Method

This study was based on a *survey design*, whose population comprised teachers from both public and private primary and secondary education centres in the Valencian Community (E. Spain). The *sample*, containing 868 teachers, was selected by means of stratified random sampling in terms of level of education and province within the Valencian Community. The primary sampling unit was the educational centres, while teachers were the secondary sampling unit.

Sampling distribution, done by considering the key personal and contextual variables, can be summarised in the points set out below:

a) Ownership of the working centre: 70.3% belong to public centres, while 29.7% correspond to private or subsidised private schools.

b) Distribution in terms of gender: in the whole sample, the percentage of males was approximately 44%, with around 56% female teachers.

c) In relation to the learning stage they work at, and their gender distribution: 39% teach primary education –of whom 34.8% are males and 65.2% are females-; 38.7% of teachers belong to Compulsory Secondary Education -with 52% of males and 48% females-; 22.4% teach high school education –with 56.3% males and 43.7% females-.

d) Teachers' ages: their ages range between 20 and 65 years, with a mean age of 40.9 years.

e) Teachers' professional experience falls in a range of 1 year to 41 years, and their average teaching experience is 15.5 years.

f) Access to a computer classroom: 47.7% of the teachers do not have regular access to such classrooms, whereas 52.3% do.

g) Finally, and to contextualise the sample's characteristics, among the surveyed teachers, frequency of computer use at home: 25.9% use a computer at home once a month or less, 27.5% report using one several times each month or weekly, 28.7% state that they use a computer at home several times a week; finally, 17.9% indicate that they use a computer at home on a daily basis.

The *instrument* used to collect information was a questionnaire, which was designed for this very purpose and included nine sections: teacher characteristics, access to computer equipment, knowledge about ICT, use of ICT (personal-professional and with pupils), integration of ICT into educational practices, training needs in both technological resources and integrating ICT, attitudes towards ICT and obstacles perceived for their use in the classroom. To develop this questionnaire, difference references about ICT among teachers were firstly taken into account. Secondly, the questionnaire was sent to several specialists in educational technology so they could assess the items. Based on these experts' judgements, the definitive in-

strument was devised by bearing in mind coherence. One main aspect considered when devising the questionnaire was to establish a competencies-based model in ICT for teachers. This was based mainly on the following proposals: ISTE (2002), Department of Education of Victoria (1998) and the North Caroline Department of Public Instruction (2000).

This study also took into account four questionnaire sections which were closely linked to the competencies-based model: knowledge of technological resources; use of technological resources that are both personal-professional and with students; integration of technological resources into the classroom; and teachers' ICT training needs. Personal factors have also been considered (gender, age and frequency of using a computer at home), as have contextual factors (educational stage and access to a computer classroom in their educational centre).

The training needs section -see Table 1- has been divided into three areas: technological resources for personal-professional use, integration of technological resources into the classroom for teaching purposes, and an area to incorporate them into several pedagogic aspects that influence the integration of ICT into their daily work activities (organisation and educational planning, etc.). There was a total of 41 items and the total reliability of the section presented a Cronbach's α of = 0.98. The first two subsections included 15 items, with a Cronbach's α of = 0.95 for the first section and of = 0.96 for the second. The third section had 11 items and a Cronbach's α of = 0.97. In all the areas, teachers were requested to indicate their training needs, and whether the training requested was an initial, intermediate or advanced level.

Table 1. - Basic dimensions of the teachers' training needs

Personal-Professional		Use with students	
Handling	Handling and use of the computer	Handling and use of the computer	**Handling**
Basic applications	Basic computer applications	Basic computer applications	**Basic applications**
Mulpres	Multimedia and presentations	Multimedia and presentations	**Mulpres**
ICT	Information and Communication Technologies	Information and Communication Technologies	**ICT**

Integration of ICT	
Planning	Planning teaching
Environment	Designing environments to integrate ICT
Inno-Com	Innovation and communication
Ethics	Ethical and legal problems

The ICT competencies section has been arranged into two areas: technological (ICT knowledge and skills) and pedagogic (integration of ICT into educational practice). As far as technologies are concerned – see Table 2- there were 32 items (Cronbach's α = 0.98), grouped into four basic dimensions: handling and use of a computer, basic computer applications, multimedia applications and presentations and, finally, the ICT dimension. In each dimension, items indicated the knowledge and skills teachers had of certain operations, which took a progressive structure. Therefore, the first items corresponded to the most basic knowledge, whereas the last ones related to advanced knowledge of technological tools. A 5-point (from nothing to a great deal) Likert-type evaluation scale was used.

Regarding pedagogic competencies –see Table 2-, teachers were asked about how they integrated ICT into the curricular design and development, and into educational planning and organisation. This section was made up of 11 items (Cronbach's α = 0.92)

covering four basic dimensions: planning education, creation of environments where ICT were integrated, innovation and communication with the school community, and ethical aspects. A 5-point (from never to always) Likert-type evaluation scale was used.

Table 2.- Basic dimensions of teachers' ICT competencies

Technological competencies		Pedagogic competencies	
Handling	Handling and use of the computer	Planning teaching	**Planning**
Basic applications	Basic computer applications	Designing environments to integrate ICT	**Environment**
Mulpres	Multimedia and presentations	Innovation and communication	**Inno-Com**
ICT	Information and Communication Technologies	Ethical and legal problems	**Ethics**

Within the use of technological resources, personal-professional use and use with students have been distinguished. In both sections, teachers were asked about the resources they used (text processor, spreadsheet, etc.) and about the frequency these were employed with. Each section comprised

12 items valued using a 5-point (from nothing to a great deal) Likert-type evaluation scale. In this case, the two sections were divided into three basic dimensions; see Table 3. The Cronbach's α for personal-professional use was = 0.92 and it was = 0.89 for use with students.

Table 3.- Basic dimensions of teachers' use of ICT

Personal-professional use		Use with students in the classroom	
BA_UP	Basic computer applications	**BA_AU**	Basic computer applications
MP_UP	Multimedia and presentations	**MP_AU**	Multimedia and presentations
ICT_UP	Information and Communication Technologies	**ICT_AU**	Information and Communication Technologies

To structure these indicators into dimensions, sets of items were used, known as item parcels, as a working tool given this situation's characteristics –see Tables 1, 2 and 3. Therefore, both the scales in which these questions were measured –a 3- and a 5-point Likert-type scale- (Schau et al., 1995), and the existence of clear "difficulty" associations among the elements (Rushton, Brainerd, & Pressley, 1983), constituted a complex structure which, as we understand it, did not help to clearly structure this field. Thus, we assumed the definition of Kishton and Widaman (1994): "the simple sum of the several items that evaluate the same construct. Several parcels are developed using the items making up a scale; no item is assigned to more than one parcel and all the

scale items are employed to construct the parcels" (p. 757).

The statistical analyses were a basic descriptive statistics, a cluster analysis by the k-means procedure, and a discriminant analysis. All these analyses were done using the SPSS 17.0 software.

The data from the questionnaires were basically collected by means of online questionnaires. However, when this system was not feasible, that is in those educational centres without the appropriate installations for such means or due to teachers' lack of knowledge, printed questionnaires were supplied.

3. Results

This section presents the results obtained. Firstly, training needs, competencies in ICT and use of technological resources were described. Secondly, the profiles based on teachers' requested training needs were presented. Finally, models were proposed showing the relation between the training needs profiles obtained, teachers' ICT competencies and use, and the influence of the personal and contextual factors was also included in each case.

Teachers' training needs

The teachers on the whole showed that their training needs did not reach the intermediate level, as Graph 1 illustrates. Specifically, the level of training needs requested by teachers was of an intermediate level as regards personal-professional training needs, whereas it was of an initiation level for the other two areas: use in the classroom and ICT integration.

The various dimensions contemplated among the needs indicated a heterogeneity in the training requested since the presented variability was high. This means that teachers requested different training needs in the three considered areas. In the personal-professional area, they required training ranging from the initiation level to the advanced level, whereas they needed an initiation to an intermediate level for the other two areas (with students and ICT integration).
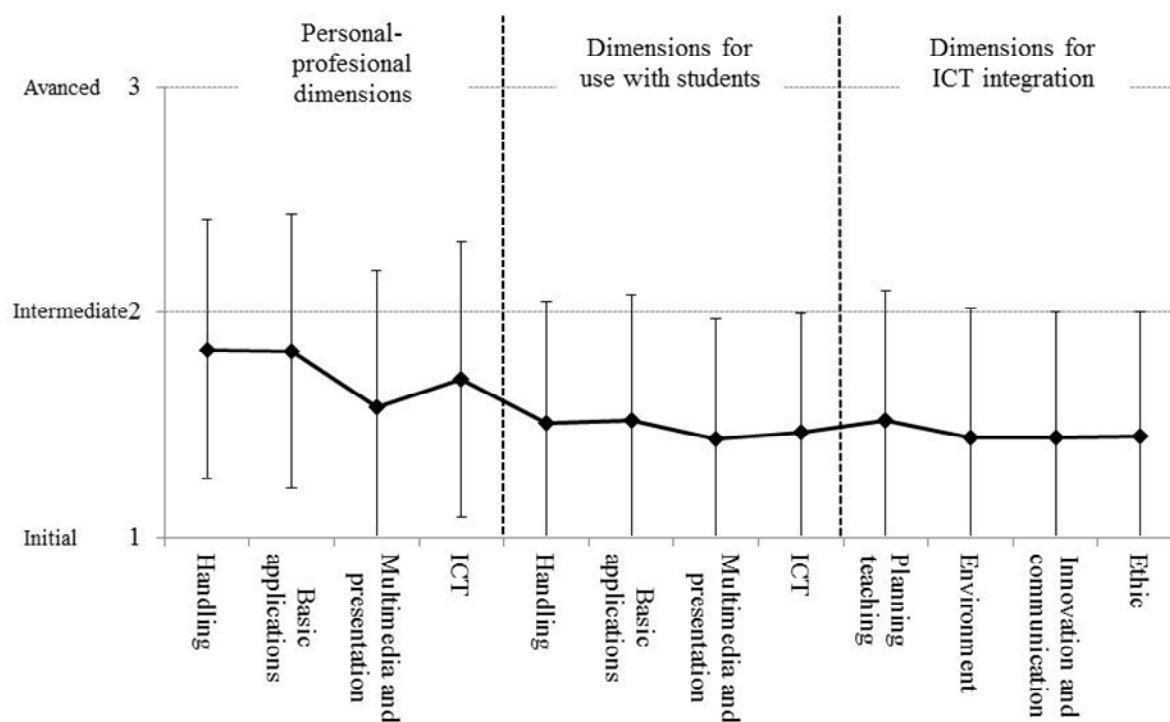
Graph 1.- Personal-professional training needs, with students in the classrom and ICT integration

In the personal-professional area, the computer handling and use, basic applications and the Information and Communication Technologies dimensions were those for which teachers requested a higher level of training, which basically addressed handling the more advanced functions of those resources being integrated. In contrast, the training needs for the multimedia and presen- tations dimension related more with the use of minimum functions in relation to the resources in this dimension.

As regards the training domain for use in the classroom, in the handling/use of computers and the basic computer applications dimensions, teachers requested a slightly higher training level so they could use the

various resources in different educational situations, and only on certain occasions. For the other two dimensions, the training required was of an even lower level. No cases were seen in which the needs requested related with innovation, creation of new materials, or to research and reflecting on one's own practice.

In the area to integrate the technological resources into curricular design and development, and into educational organisation and planning, the training needs requested were, on the whole, to occasionally help perform certain educational activities. They did not refer to acting in situations entailing a

certain level of complexity, rather to simple educational activities undertaken at specific times. The teaching planning dimension presented the higher mean score as far as training needs were concerned.

Teachers' competencies in ICT

As Graph 2 indicates, the teachers' level of technological and pedagogic competencies in ICT was low. In general terms, the technological component level was higher than the pedagogic competency level. Furthermore, a substantial level of heterogeneity was found, indicating several levels of knowledge and ICT integration among the teachers.
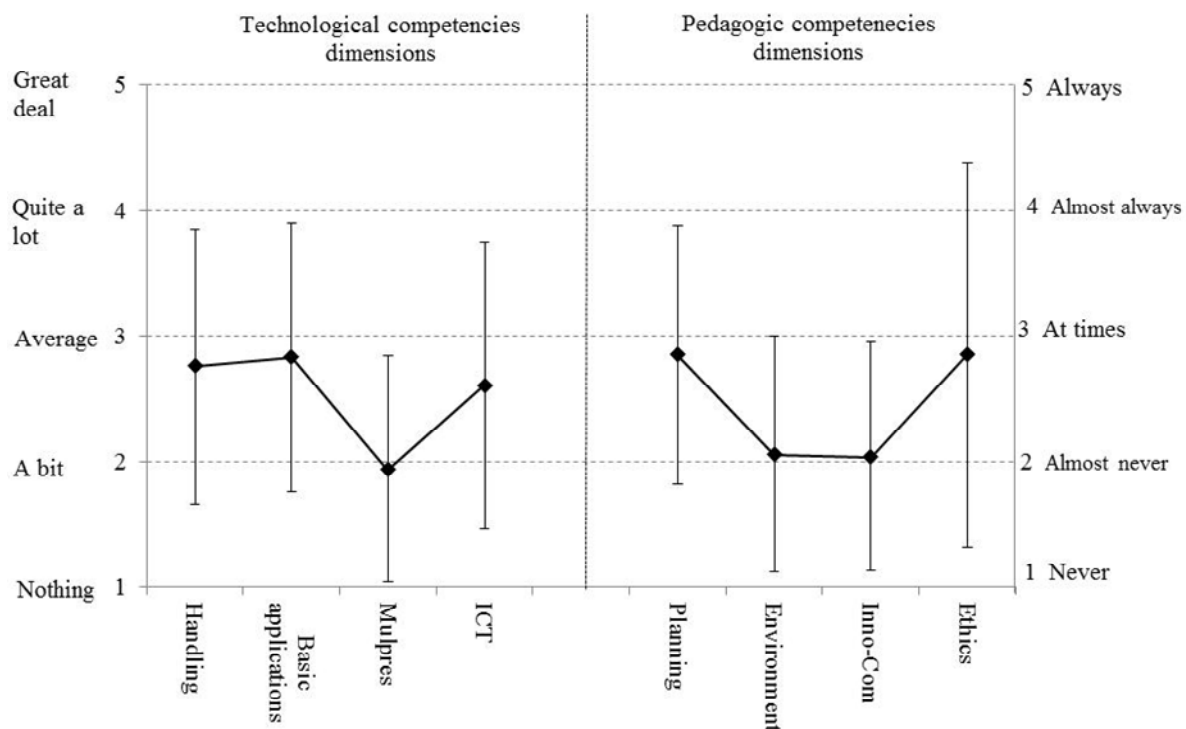
Graph 2.- Basic dimensions of the technological and pedagogic competencies

The teachers' technological competency in handling the computer, basic computer applications and resources relating to ICT dimensions may be considered the equivalent to that of a normal user; that is, a user who masters the usual basic technological resources (text processor, basic Internet browsing, spreadsheet), but no advanced functions. The multimedia and presentations dimension reveals the largest gaps and shortfalls, and

the teachers on the whole reported that they poorly mastered this area.

Pedagogic competencies were better for the planning and ethics dimension which teachers took into account at least on certain occasions. Conversely, teachers stated paying less attention to both the creating learning environments, where ICT are integrated, and the innovation and communication dimensions,

as they only considered them on specific occasions and sporadically. Heteoregeneity, as far as ethical matters relating to technology were concerned, was better than it was for other aspects.

Use of personal-professional technological resources and in the classroom

Teachers' use of technological resources was poor for both the personal-professional and use with students in the classroom areas -see Graph 3. Levels of use with students in the classroom were seen to be particularly sporadic. For both types of use, a certain level of heterogeneity was noted, which was higher for personal-professional use, suggesting broader usages among the teachers. As regards their use with students, a low level of heterogeneity was obtained, basically owing to the ground effect given the particularly low levels observed.

Teachers stated using basic applications more frequently in the personal-professional domain, and reported doing so habitually for administrative and teaching planning tasks. Conversely for the other two dimensions – multimedia and presentations, and ICT- this use was restricted to certain activities (doing an exam, making a list, etc.) and was more sporadic.

The results for the use with students in the classroom dimension were generally very poor. However, they were slightly more consistent for the multimedia and presentations dimension and, strangely enough, the lowest level of use was observed for ICT. Generally in all the dimensions, teachers' use was to basically carry out sporadic activities with students and for a given situation; therefore, such use was not habitual.
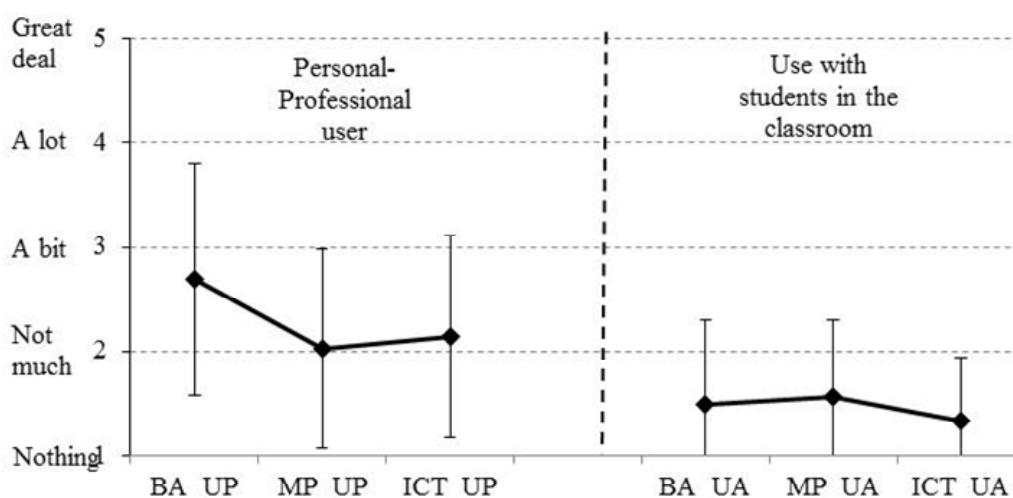
Graph 3.- Basic dimensions of personal-professional use and use with students in the classroom

Teachers' profiles based on their ICT training needs

This section presents the teachers' profiles based on their training needs in the three areas considered: personal-professional, use in the classroom and ICT integration. For this purpose, an analysis of conglomerates was done by means of the k-means procedure by exploring group models from 3 to 8

groups. We opted for a 4-group model as we considered it allowed us to describe the teachers' profile in terms of their grouping in a parsimonious and consistent manner, thus avoiding solutions of a residual type.

The four groups making up the model (see Table 4) are, in terms of teachers' training needs at different levels, as follows: initia-

tion, initiation-intermediate, intermediate and advanced. Before describing each group's characteristics, we point out some initiation matters. Firstly, there were two main groups: the training at initiation level group and the initiation-intermediate training level group which, together, represented 72.1% of the whole teachers' sample. What this indicates is that the majority of teachers consider they still felt poorly confident about the training received. Secondly, the intermediate training level group represented almost 20.1% of the complete sample, a substantial group in relation to the whole sample. Finally, there was a group with around 8% of all the participating teachers who requested advanced training in the three areas considered.

Table 4.- Number of cases and percentage of each conglomerate

Group	Number of teachers	Percentage
Initiation	335	38.6%
Initiation-intermediate	291	33.5%
Intermediate	174	20.1%
Advanced	68	7.8%
Total	868	

According to Graph 4, the group profiles are the following:

Group I.- Training at Initiation level. This group of teachers was characterised by their demand for training at initiation level in the three training needs areas considered, of which the use with students and integration of ICT into their educational practice areas proved the most striking. This means that the training was requested for using the minimum functions of the various resources in the personal-professional area, except for the handling and computer use and the basic computer applications dimensions, where the level of training requested was somewhat higher than the initiation level. In the same vein, teachers demanded basic training to apply the various resources when working with students in a minimum of situations and in their educational practice to help them carry out simple activities on an occasional

basis. More than one third of all the teachers showed this basic needs profile.

Group II.- Training at Initiation-intermediate level. This particular group of teachers was characterised by requesting training somewhere between the initiation and the intermediate levels, and basically in the personal-professional area, where a higher level was needed than for the other two areas. The level requested for the other two areas was similar, although somewhat higher for use with students.

In the personal-professional area, the training requested appoached the intermediate level, implying that training was required to master the tasks that went beyond the basic tasks available in the various resources, but without the knowledge used in the most advanced type of functions. Here the level was higher for handling a computer and basic computer applications, which approached an intermediate training level. The training requested for the other two dimensions was at a lower level, especially in the multimedia and presentations dimension, which was somewhere between the initiation and intermediate levels.

In the use with students area, the training that teachers required was slightly higher than for the initiation level, and for using different resources in educational situations on a regular basis. In this case, it is noteworthy that this needs profile was similar to the pattern described in the personal-professional area. Teachers approached an intermediate level in the use of computer and basic computer applications dimensions, somewhere between the initiation and intermediate training levels, whereas their level of training approached the initiation training level for the other two dimensions, particularly the multimedia and presentations dimension.

In the ICT integration area, the training that teachers required was of a slightly higher level than for the initiation training level in all the dimensions, which implies being

able to apply ICT to their different teaching activities, although they were undertaken occasionally. In the teaching planning dimension, the training required was of a slightly higher level, somewhere between the initiation and intermediate levels. The training needs profile of one third of all the teachers was of this kind.

Group III.- Intermediate training level. This group was characterised by demand for at intermediate training level in the three areas, of which the personal-professional area required a higher level of training. A similar situation was noted for the use with students and ICT integration area with intermediate scores, but with slightly higher ones for the latter.

In the personal-professional area, this group of teachers required a higher level of training than the intermediate level in all the dimensions, implying that they needed training to handle the more advanced functions of the different technological resources. In the basic computer applications and ICT dimensions, the level requested was higher than for the other dimensions.

In the use with students area, the mean score for any dimension did not reach the intermediate training level, which suggests being able to use the different resources in a wide range of educational situations. Although this group's mean scores were similar, a slight tendency to increase training needs for basic computer applications and ICT was observed, while a slightly lower score was obtained in the multimedia and presentations dimension. The training level that obtained a lower score was handling and using a computer with students.

In the ICT integration area, an intermediate training level was not requested for the dimensions, except teaching planning, indicating the need to integrate different resources into varied and somewhat complex activities. In the teaching planning dimension, the training required was of a higher level, but

was slightly lower for the other three dimensions. Only the profile of one in five teachers could guarantee genuine ICT integration.

Group IV.- Advanced training level. This group of teachers was characterised by requesting advanced training in all three areas. The level required was slightly higher in the personal-professional area, while similar and slightly lower scores were obtained for the other two areas.

In the personal-professional area, the training level requested was similar in all the dimensions and came close to the advanced training level; this implies the need to perform advanced functions of the various technological resources in the personal-professional area.

In the use with students area, the scores of all four dimensions came close to the advanced level, suggesting the desire to receive training to innovate and produce new curricular materials, as well as to research and reflect about experiences gained when using technological resources.

In the ICT integration area, the level also approached the advanced level, indicating the need to be able to develop knowledge to be able to apply these activities in any situation and with all the complexity that this entails. Creation of learning environments where ICT were fully integrated, along with the innovation-comunication dimensions, was the level at which the highest training was requested. Less than 10% of the teachers had a profile that enabled ICT integration to a considerable extent.
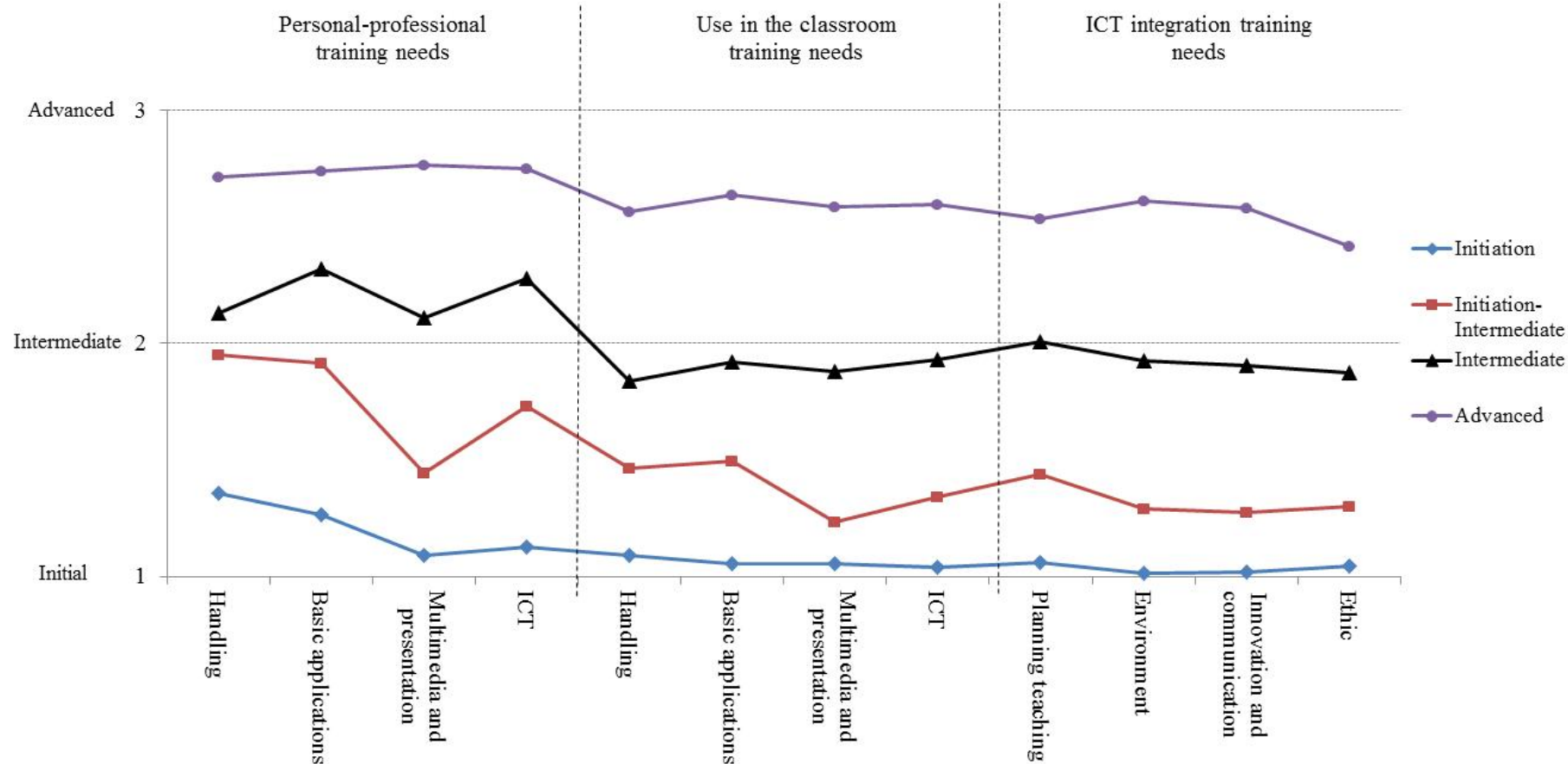
Graph 4.- Teachers' profiles based on their training needs using the dimensions within the areas: personal-professional, use in the classroom and ICT integration. The average scores in each dimension are shown of the selected 4-group solution

Relation between teachers' profiles, based on their ICT training needs, uses of and competencies in ICT, and personal and contextual factors

This section presents the relation between teachers' profiles, obtained from their training needs, competencies in and use of ICT, and personal and contextual factors.

A discriminant analysis was done in which a complete model that included all the study variables was selected. The dependent variables were the teachers' profiles obtained by means of the analysis of conglomerates, while the independent variables were competencies in ICT (technological and pedagogic), teachers' use of the different technological resources (both the personal-professional and with students areas) and gender, age, frequency they use a computer at home, the level of education they teach and if they have access to a computer classroom.

To interpret the analysis, a graphical representation is provided and shows the unrotate discriminant loadings and centroids following the procedure of Dillon and Goldstein (1984).

The discriminant analysis enabled three functions to be obtained. Of the three, the first two were significant -see Table 5-. The first function, which explains 82.7% of variance, was the most relevant dimension for the four groups' discrimination. The second function, explaining 15.2% of variance, is a less relevant dimension and merely explains better the first function.

Table 5.- Self-assessed values and contrast of the discriminating functions according to competencies, use and the personal and contextual factors

Function	Eigenvalues	% of variance	Canonical Correlation	Contrast of functions	Wilks' Lambda	Chi-squared	df	Sig.
1	1.212	82.7	.740	1 to 2	.359	743.785	57	.000
2	.223	15.2	.427	2 to 3	.794	167.682	36	.000
3	.030	2.1	.171	3	.971	21.502	17	.205

The first function, showing a high discriminant value, clearly separated the four training needs groups -see Graph 5. In relation to this situation, the initiation and the initiation-intermediate training needs groups were found on the negative pole of the function, whereas the other two groups (intermediate and advanced) were located on the positive pole. Furthermore, the initiation and the advanced training needs groups separated from the other two groups, each one towards its respective pole. The other two groups (initiation-intermediate and intermediate) remained relatively close, as Graph 5 depicts. The second function generated less separation of groups given its lower discriminating power. As seen in Graph 5, this second function basically represented the separation between the intermediate groups' needs in relation to the extreme groups' ones (initiation and advanced, respectively).
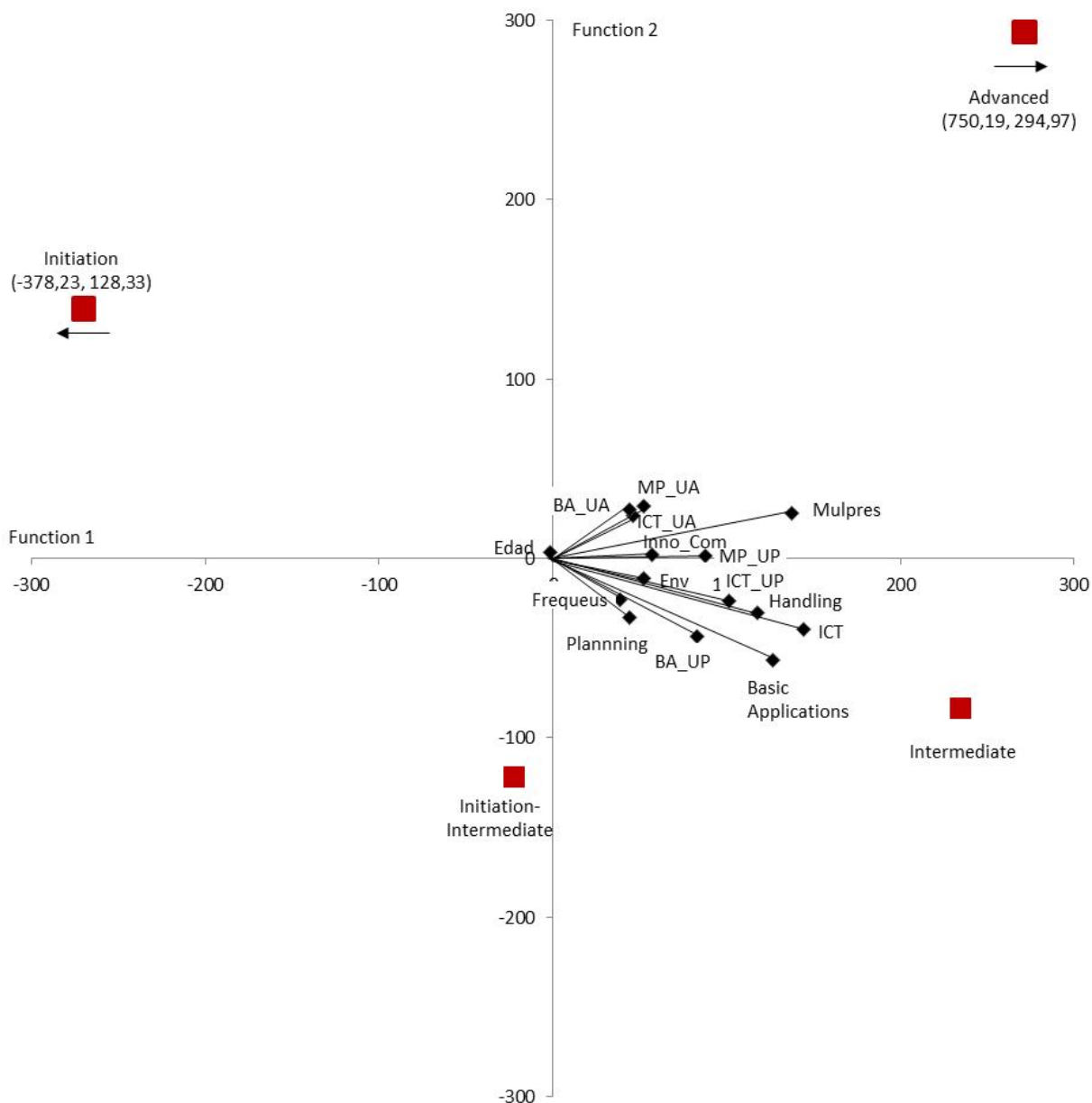
Graph 5.- A graphic representation of the unrotate discriminant loadings and centroids of teachers' training needs, competencies in ICT, use of ICT, and personal and contextual factors.

In relation of what the variables contribute to the discriminant functions, they all enabled a discrimination to be made among the four training needs groups at the univariate level as the F value was significant in all the variables considered -see Table 6. However, when we contemplated the standardised co-efficients and the matrix structure, the gender, stage, computer classroom and ethics variables were not seen to be the relevant variables in the discriminant analysis.

Table 6.- Results of the first two functions of the discriminant analysis according to competencies, use and the personal and contextual factors

	Equality tests of the groups' means					Standardised coefficients of the discriminant functions		Matrix structure	
						Function		Function	
	Wilks' Lambda	F	df1	df2	Sig.	1	2	1	2
Gender	.942	15.050	3	734	.000	0.015	0.154	.218	.082
Age	.956	11.342	3	734	.000	-0.018	0.346	-.133	.333*
Frequency of use	.758	77.945	3	734	.000	0.105	-0.115	.497*	-.287
Stage	.954	11.926	3	734	.000	0.173	-0.038	.192	-.132
Computer classroom	.982	4.570	3	734	.004	-0.13	-0.129	.113	-.090
Handling	.603	161.172	3	734	.000	0.105	-0.184	.732*	-.185
Basic applications	.590	170.356	3	734	.000	0.212	-0.187	.744*	-.331
Mulpres	.579	178.141	3	734	.000	0.161	0.704	.771*	.143
ICT	.570	184.445	3	734	.000	0.294	-0.042	.783*	-.211
Planning	.740	85.904	3	734	.000	-0.132	-0.469	.512*	-.380
Environment	.723	93.906	3	734	.000	0.121	-0.25	.560*	-.116
Inno-Com	.712	98.978	3	734	.000	0.251	0.327	.577*	.025
Ethics	.921	20.918	3	734	.000	-0.085	-0.102	.248	-.186
BA_UP	.655	129.133	3	734	.000	0.031	-0.343	.644*	-.333
MP_UP	.650	131.895	3	734	.000	0.027	0.027	.667*	.013
ICT_UP	.627	145.664	3	734	.000	-0.045	-0.181	.696*	-.157
BA_UA	.742	84.966	3	734	.000	0.155	0.374	.516*	.328
MP_UA	.720	95.076	3	734	.000	0.161	0.296	.548*	.309
ICT_UA	.737	87.103	3	734	.000	0.067	0.09	.528*	.279

* Greater absolute correlation between each variable and any discriminant function

In relation to the first function of the discriminant analysis, other than age, all the other variables were clearly found on the positive part of this dimension. On the whole, the areas which discriminated more among the groups were the technological competencies dimension, followed by the personal-professional use of technological resources, pedagogic competencies, use of resources with students, plus the two personal factors: frequency of using a computer at home and age. Technological competencies related to multimedia and presentations and to ICT, which discriminated the most; to a lesser extent, we found basic computer applications and use/handling a computer. In the second group of variables, which belonged to the personal-professional use of technological resources, the dimensions presented are shown in the order of greater to

lesser influence: ICT, multimedia and presentations, and basic computer applications. The third group of variables comprised pedagogic competencies (innovation-communication, the creating environments for ICT integration and teaching planning) and the use of technological resources with students (ICT, multimedia and presentations, and basic applications) dimensions. This group of variables included frequency of using a computer at home. Finally, the personal age factor was located in the negative part of the function, meaning that younger teachers required a higher level of training than older teachers.

Regarding the second function, variables were separated more from each other, indicating this function's poor discriminating power. On the one hand, and in the positive part of the function, we saw how the multi-

media and presentations resources of the technological competencies, plus the three dimensions corresponding to use of technological resources with students, were the more discriminating variables. Yet in the negative part of the function, basic computer applications and ICT of the technological competencies could be found, along with basic computer applications for personal-professional use and teaching planning, which were the most discriminating variables. Age was located in the positive part of the function while frequency of use was negative, and there was a greater relation with age.

Consequently when using the most relevant dimensions and variables in both the discriminant functions, a relation was observed between teachers profiles based on their training needs and ICT competencies, use of these resources, and the personal and contextual factors. So we may state that there was a correspondence between the training needs profiles and the independent variables considered and, the higher the level of training needs requested by teachers, the higher the level of technological and pedagogic competencies, particularly technological competencies. The relation between needs and use of ICT offered a similar pattern; that is, the higher the needs demanded, the greater most teachers' use of technological resources was, with more influence at the personal-professional level than with students in the classroom. Finally, two personal factors related more to training needs terms. Firstly, the teachers who used a computer at home more frequently presented a higher level of training demands. Secondly, teachers' age, in turn, inversely conditioned their training needs because the younger teachers were, the higher their requested level of training became.

Thus, those teachers with an advanced level of training needs presented a high level of ICT competencies, both pedagogic and technological, frequently used technological re-

sources –regardless of them being for personal-professional use or with students in the classroom-, frequently used a computer at home and were generally younger. What mainly characterised this group of teachers was their knowledge and use at the personal-professional level of multimedia resources and presentations; use of technological resources with students in the classroom; ICT integration for innovation activities, regardless of them being for training purposes, research and innovation projects, or for communicating with the educational community. Teachers with an intermediate level of needs presented lower levels in all the areas if compared with the advanced training level group, they used a computer at home less frequently and were generally older. These teachers were characterised by having good knowledge of handling and using a computer, basic computer applications and ICT; good personal-professional use of basic computer applications and ICT; besides, this group stood out for teaching planning and for beginning to create learning environments where technological resources were present. Finally, both the initiation-intermediate and the initiation training level groups were characterised by presenting increasingly lower levels of technological and pedagogic competencies and ICT use in the two areas; that is, poor use of a computer at home– basically the initiation level group- and this group's age was higher than that of the other two groups. These two groups lacked individualised characterisation given the low levels found for all the considered variables.

Finally as Table 7 shows, we could obtain a score of 60.2% with this model (57.0% in the cross validation), which is well classified in its needs group according to competencies and use of ICT, and with the personal and contextual factors. Both the extreme groups –teachers with advanced and initiation training needs levels – classified well, by around 75%, which lowered slightly in the cross validation for the advanced group. The classification of the two intermediate groups

(initiation-intermediate and intermediate levels of training needs) was not so good, but around 50%. We indicate that the poorly classified subjects were mainly members of the group with the closest level of knowledge, implying certain coherence. It is also worth stressing that the poorly classified teachers in the initiation-intermediate and the intermediate training needs groups were mainly and reciprocally associated between

these two groups, just as Graph 5 illustrates by them being relatively close to each other. There was a low percentage of cases in which the mismatch between their situation and their profile predicted by the discriminant model presented greater discrepancy. Moreover, they all corresponded to extreme profiles and did not represent 5% of the considered cases.

Table 7.- Percentage of the teachers' classification after the discriminant analysis

Original		Group predicted to belong to			
		Initiation	Initiation-intermediate	Intermediate	Advanced
The cluster profiles group	Initiation	**77.0**	20.4	2.7	.0
	Initiation-intermediate	19.9	**52.9**	22.6	4.6
	Intermediate	13.8	21.8	**44.7**	19.7
	Advanced	.0	7.9	15.9	**76.2**
Percentage of perfectly classified cases: **60.2%**					

Cross validation		Group predicted to belong to			
		Initiation	Initiation-intermediate	Intermediate	Advanced
The cluster profiles group	Initiation	**75.2**	22.1	2.7	.0
	Initiation-intermediate	21.8	**49.0**	24.5	4.6
	Intermediate	15.4	22.3	**41.0**	21.3
	Advanced	.0	9.5	17.5	**73.0**
Percentage of perfectly classified cases: **57%**					

Conclusions

The results obtained with this study reveal that teachers require a level of training below the intermediate level for any of the three areas considered, even though the level of training required in the personal-professional area is higher. This finding coincides with other studies, which found that the level of training requested for use with students and ICT integration into teachers' teaching-learning activities was somewhat higher (Hernández and Quintero, 2009; IEAE, 2007), among the preliminary levels.

The results obtained for the training required for ICT agree with that requested by teachers for competencies and use of resources. Thus, teachers present a low level of ICT competencies, but better master technological competencies than pedagogic ones.

Use of these technologies is generally low, despite the personal-professional area presenting a higher level if compared with use in the classroom. ICT use with students in the classroom is very limited and is more sporadic if anything (Aguaded and Tirado, 2010, Valcke et al., 2007).

These findings coincide with the stated levels of needs because the needs relating to knowledge of technological resources in the personal-professional area are higher. Conversely, everything relating to integrating ICT into their teaching presents a lower level of demand. Therefore, since teachers' pedagogic competencies are fewer and use of technological resources with students is also low, it is logical that the training needs expressed by teachers for use with students and to integrate ICT are also of a lower level;

consequently, this indicates that they require more training in all these aspects. These results agree with those reported by Valcke et al. (2007) in that the most demanded training related with skills in technological resources and with a more basic demand in educational use.

This model has obtained a considerably hierarchical model of teachers training needs profiles. Specifically, there are four profiles: initiation, initiation-intermediate, intermediate and advanced. Firstly, teachers are mainly grouped at the initiation and initiation-intermediate level (72.0%), implying little confidence in oneself to integrate ICT. Secondly, the training needs of all the groups for the personal-professional area are higher than for the other two areas, and they still act as a trampoline by teachers to make their way through the different levels. The coherence observed of these groups' profiles in terms of competencies and use of ICT allows us to deal more accurately with teachers' needs and their training framework so they head towards the professional development they require. It is worth stressing that more than two thirds of teachers have profiles that do not enable them to genuinely integrate these technologies into the classroom. In parallel, only 8% of the group is, and feels, capable of effectively carrying such integration into the classroom; however, these teachers state that their training needs relate more to complex matters to be used in the classroom.

Finally, there is evidence at the multivariate level for teachers' training needs, competencies and ICT use, and for the personal-contextual factors, which was also observed at the univariate level. The main finding is that training needs are closely linked with technological competencies, suggesting that teachers believe they must master technological resources before using them in the classroom. Likewise, personal-professional use has proved relevant as teachers firstly employ the various resources personally-

professionally to later apply them in the classroom. To go about this, it is necessary to master pedagogic competencies since planning the first scenario of action comes before moving on to creating learning and innovation-communication environments. This structuring adapts to the previously mentioned outline of ICT integration proposed by Tejedor and García-Valcárcel (2006). Moreover in relation to the personal-contextual factors, there are two factors that differentiate groups: age and frequency of using a computer at home. The other factors; education stage taught and access to a computer classroom; do not come over as being relevant for teachers' training needs.

By way of conclusion, a series of considerations may be drawn from this study. Firstly, we can stress that teachers' training needs for ICT imply a hierarchy structure. This means that training plans have to be arranged into different levels and stages, and that the possibility of flexibility needs to be added to them all. This allows teachers to select specific training based on their own level according to both their competencies in and use of technological resources. Furthermore, implementation of professional development programmes by teachers who do not bear ICT in mind entails a risk of returning to the problems set out in the literature (Balanskat, Blamire and Kefala, 2006; Becta, 2004; Cabero, 2004; Condie et al, 2005; Galanouli, Murphy and Gardner, 2004; Llorente, 2008; Waite, 2004).

Secondly, this study has verified that the level of training demanded in technological resources is higher than that requested for use of pedagogic resources. As pointed out by Condie and Munro (2007) or Angeli (2005), teachers need to master the first stages of their training in technological resources to be able to integrate them later into their teaching practice. In other words, teachers must first feel capable of using the technological resource to subsequently integrate it into their educational practice (Cabero, 2004;

Tello and Aguaded, 2009), the reason being that if teachers do not master a technological resource, they will simply not use it (Ramboll Management, 2006). Moreover, it is necessary to consider that both the technological and pedagogic components have to be present in various stages (Llorente, 2008), which leads us to what Hew and Brush (2007) and Lawless and Pellegrino (2007) stated; teachers' professional development in ICT has to contemplate several training areas, which are similar to those proposed herein: a) training in technological resources for teachers' personal-professional use; b) training for integrating technological resources into the classroom for teaching purposes; c) training for their incorporation into the various pedagogic aspects that will influence ICT integration into daily educational practice.

Thirdly, moving on to intermediate training levels, especially advanced training levels, relates with teachers' progress has been verified; it goes from a role of someone merely receiving technologies to another role involving an active producer using such technologies. In line with this, Area (2010) discovered that the actively working teacher is more a consumer of materials rather than a creator, which places this latter role into second place when teachers are faced with certain initiatives and, in part, may be explained by this poor mastering of the creative competencies which the future teacher could possess, as Prendes, Castañeda and Gutiérrez found (2010). Thus, it is necessary to contemplate how the development of multimedia contents or materials can become one of the final teacher training phases (Cabero, 2004; Tello and Aguaded, 2009; Rudd et al. 2009) in order to avoid a considerable decline in teachers' fully integrating ICT, regardless of them being actively working teachers or training to become teachers.

Fourthly, a gradation has been observed to integrate ICT into teachers' educational practice. This first key agent demands more training in teaching planning to gradually design enriched learning environments where ICT can integrate perfectly. Consequently, and in principle, training should, first and foremost, be guided to encourage teachers to consider the various technological resources in their teaching process. The aim here is to achieve an initiation level of confidence to help extend ICT integration into the learning-teaching process. This will be accomplished by providing educational centres with the required technological resources, and by establishing educational policies in educational centres (Area, 2005; Tello and Aguaded, 2009) to include plans that integrate ICT into classrooms.

Finally, this study reveals that teachers' training needs take a hierarchical structure and that these needs can guide us to plan this group's professional development for the purpose of designing better quality and more efficient plans. However, we need to study the exact structure that teachers' training needs take in detail by considering the three studied areas. Moreover, a relation has been obtained among training needs, competencies and use of technological resources. In line with this, indicators of competencies and use of technologies have proved to be a good guide for teachers' training needs. This leads to the importance of establishing good competencies-based frameworks which cover the technological and the pedagogic components. Therefore, it is unavoidable to back the structure among the training needs, competencies and ICT used by teachers which confirm these findings.

This work focuses on the content of training plans and their relation with other domains. However, other dimensions related with teachers' development also need to be considered, such as attitudes to ICT (Gargallo, Suárez and Almerich, 2006; Llorente, 2008; Mueller et al, 2008, Tejedor and García-Valcarcel, 2006; Tello and Aguaded, 2009), beliefs (Boza, Tirado and Guzmán-Franco, 2010; Hew and Brush, 2007) and

contemplating the integration of this training into educational centres which, as several authors have mentioned (Daly, Pachler and Pelletier, 2009; Davis, Preston and Sahin, 2009; García-Valcarcel and Tejedor, 2010; Valcke et al., 2007), is where teacher ICT training proves more efficacious. All of this will be reflected in a better understanding of teachers' professional development and will help us to put forwards training models that help not only progress towards integrating ICT into an educational scenario, but enhance the impacts that learning-teaching activities have (Lawless and Pellegrino, 2007). In this last aspect, the importance of institutional support in the centre is basic (management team, ICT coordinator) for ICT to be integrated in terms of the organisational changes entailed, particularly the ICT coordinator as an agent who detects training needs (Area, 2010), along with the insertion of teachers' professional development into ICT policy plans in schools (Valcke et al, 2007).

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