Digital divide in ICT competences in primary and secondary education: a complex relation with other key dimensions.

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This paper, which is a part of PROFORTIC project, is oriented to analyze the competences on ICT of the teachers of non-university educational level in relation to gender, educational level and type of educational institution. From a model of competences, in the Comunidad Valenciana (Spain), it has been collected data on 32 indicators related to the ICT competences of teachers by means of a questionnaire in a representative sample stratified by educational level, province and type of educational institution. The results, obtained by means of ANOVA model, indicate that the variable gender has greater influence on the teacher's knowledge. Likewise, it will be noted that male teachers have a greater level of competence than the female ones, the teachers from private educational institutions show greater knowledge than the ones from public educational institutions, and primary school teachers show smaller level of competence than the other levels. Finally, we point out a complex relation between gender and educational level.

Keywords Teacher; technological competences in ICT; gender; educational institution; educational level.

1. Introduction

The introduction of Information and Communication Technologies (ICT) in the education system has supposed and supposes continuing changes. In the ICT integration process in the classroom, teacher becomes in a key figure of this process. For this reason, teacher must have a range of competencies which let him/her implement ICT in the teaching process, and from several institutions, as government as non-government ones[1, 2], it can be established two wide sets: pedagogical competencies and technological competencies . The knowledge of the latter competencies is a necessary requirement, although not enough, for the integration process.

Researches in which it can be noted how several factors have an influence on ICT use by teachers, have been developed from different areas. In that way, it can be noted how teacher's gender and type of educational institution have an influence on Internet use [4], teacher's attitudes towards ICT [5,6] and ICT use according to educational level by teachers [6].

From technical competency area, it can be pointed out that technical knowledge about ICT, which teachers have, is a limited knowledge, with some gaps [3]. This fact involves the necessity of researching about which factors, as personal as context ones, have an impact on that knowledge, in order to adopt the necessary training activities adapted to teacher's needs.

This current work, which is a part of PROFORTIC[2] project, focuses on a study of teacher training needs in ICT integration in the non- university levels, establishing a teacher competency model towards ICT to determine teacher needs and subsequent ICT training for teachers. In this paper, it is analyzed how gender, educational level and type of educational institution impact on teacher's knowledge about different technological resources.

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2. Method

The study is based on a survey design, whose population is made up of teachers from Primary and Secondary educational institutions in the Comunidad Valenciana, both public as private ones. The sample was extracted by means of a random sampling stratified depending on educational level and province in the Comunidad Valenciana. The primary unit is composed of the educational institutions and the secondary unit consists of teachers who answer the questionnaire.

The sample is composed of 868 teachers, with an average age of 40,9 years, and 15,5 professional experience years of average. As for the distribution by gender, the percentage of male teachers is around 44% and that of female teachers around 56%. In relation to the type of educational institution, the teachers belonging to public educational institutions represent 70,3% and the teachers from private ones are 29,7%. Finally, as regards educational level, 50,3% are Primary school teachers, 37% are Compulsory Secondary school teachers and 12,7% are non-Compulsory Secondary school ones.

Collecting data instrument is a questionnaire, designed for such purpose, and structured in nine sections of which three ones represent teacher's ICT competences: knowledge, use and ICT integration. In this study we will focus on the first section: knowledge about technological tools, which is comprised of 32 items, divided into four dimensions (management and use of the computer, basic data processing applications, presentations and multimedia applications and information and communication technology), though the items have been grouped in 14 sections corresponding to: management of operating system (windows, file management, etc.), setup of software and hardware and computer maintenance, networks knowledge, word processor, spreadsheets, databases, documentary bases, audiovisual media, presentations programs, educational software, author applications, Internet as source of information, Internet as a way of communication and web page design.

The data of the questionnaires, collected between the months of April-July and September-November of 2003, have been met mainly through questionnaires on-line (http://cfv.uv.es/profortic), and questionnaires in paper for educational institutions with a lack of resources or teacher's knowledge to fill in it through Internet.

3. Results

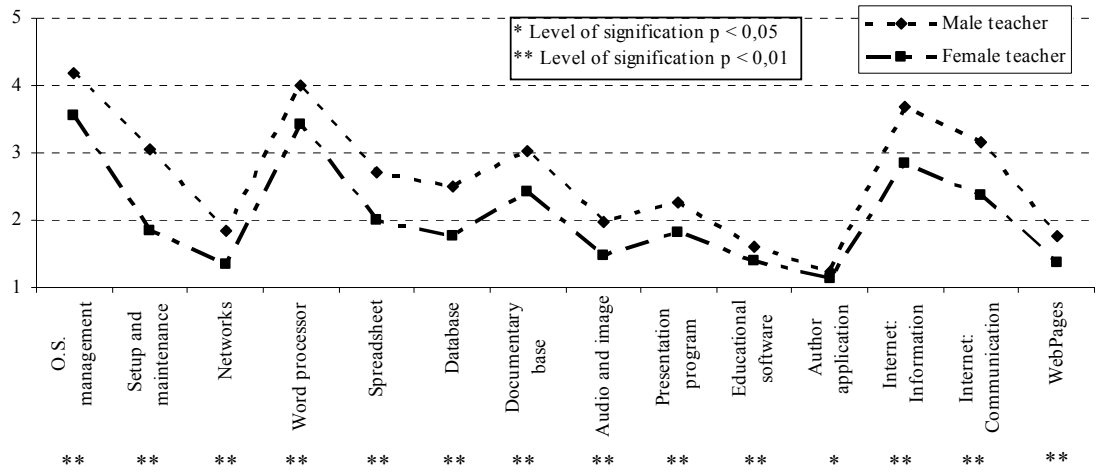
In this section we will present the results obtained by means of the ANOVA model. Thus, firstly we will refer to the effect of the main factors (gender, type of educational institution and educational level) in the knowledge of technological resources, and, secondly, how the interaction of these three factors has an influence on these knowledges.

3.1. Effects of gender, type of educational institution and educational level.

In relation to the effect of the effects of the main factors, firstly we will consider the variable "gender", that as it can be observed in graph 1, both male and female teachers have a common standard in the knowledge of the different technological resources. The resources which are more known by teacher, at user's level: management of the operating system, word processor and Internet as obtaining.

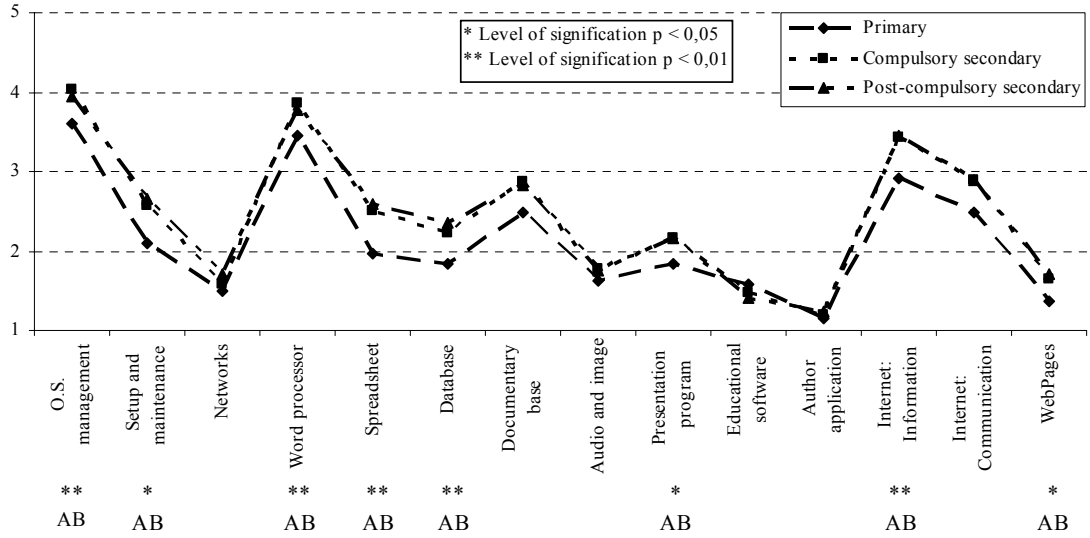
Teachers have a smaller degree of knowledge in networks, audio and image, presentation software, author applications and web pages design. As regards, male teachers they have an upper knowledge in all resources, being significant the differences of the averages, as we verify after ANOVA analysis carried out.

Graph 1. Knowledge about technological resources and level of signification according to teacher's gender.



Secondly, if we consider the educational level, the standard described by the different educational levels is similar in each one of the technological resources, as it can be observed in Graph 2. The technological resources, which are more known by teachers at user's level, are management of the operational system, word processor and Internet as search of information. The resources, which are less known, are networks, audio and video, presentations, educational software, author applications and web page design.

Graph 2. Knowledge about technological resources and level of signification according to educational level.



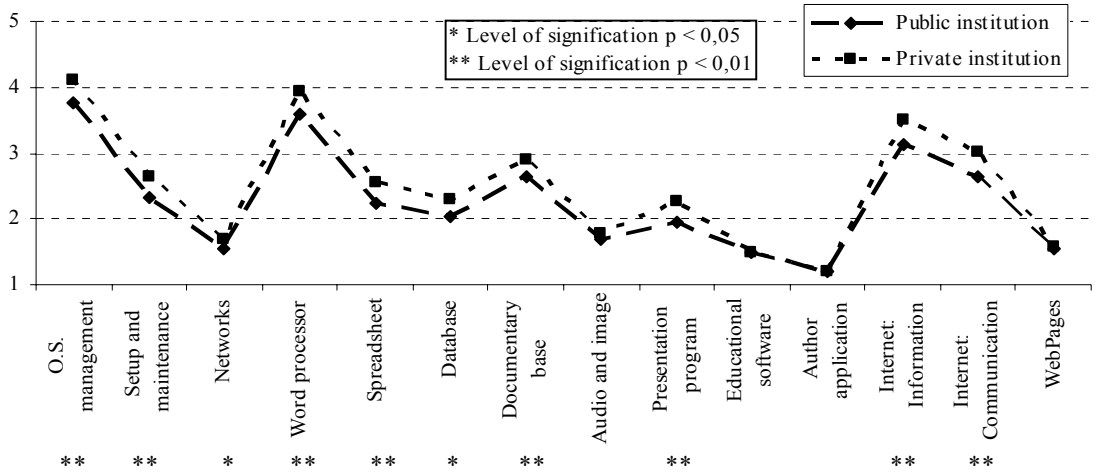
Multiple comparisons: A= Primay-Compulsory secondary, p < 0,01; B= Primay-Post-compulsory secondary p < 0,01

With reference to the degree of knowledge, it can be indicated that primary school teachers are the ones who have smaller degree of knowledge in almost all resources, except for the educational software in which they have a slightly upper value. On the other hand, both compulsory and non-compulsory school teachers have some similar medium values, though in those resources with greater degree of knowledge compulsory secondary school teachers show an upper value, while in almost all the other ones, non-

compulsory secondary school teachers have an upper value. Finally, and after the ANOVA analysis, it can be found significant differences in some resources, although it is important to know that after the post-hoc tests such differences are due to the differential value between primary school teachers and the ones of the other educational levels, as it is appreciated in graph 2.

Thirdly, in relation to the type of educational institutions, both public as private ones show the same standard in all resources, as it can be observed in graph 3. The technological resources which present a greater degree of knowledge, at user's level, are the management of operating system, word processor and Internet as source of information. The resources in which both types of educational institutions show a smaller knowledge are networks, audio and image, presentations, educational software, author applications and web page design. The competence level of teachers from private educational institutions is greater than that of teachers from public educational institution, except for the educational software, being significant that difference, after the ANOVA analysis carried out, in almost all resources.

Graph 3. Knowledge about technological resources and level of signification according to type of educational institution



Finally, as regards the size of the effect, the variable gender is the one which shows an upper value, more than the sum of the size of the effect of the other two variables, as well as such value represents the half of the variation produced in each resource, setting overall variation in around 6%. As for the other two variables, according to the different technological resources, the value is higher in a variable or another, being set overall the size of the effect around 0,9% in the educational level and 1,1% the type of educational institution.

3.2. Effect of interaction of the gender, type of educational institution and educational level

Only the interaction regarding to educational level and gender is outstanding, while the other interactions do not show significant levels, except for two: the type of educational institution interaction and gender and the interaction of the three factors although in an only resource in both cases.

The interaction of educational level and gender is produced in those resources that show greater competence level in teachers: management of the operating system, setup and maintenance, word processor, documentary bases and Internet as source of information. In general it refers to the existence of a clear separation between male and female teachers, with an upper value of the male teachers compared to female ones in all resources. Also it can be noted that male teachers´ values are quite similar in all levels, while female teachers show an increment of knowledge from primary school to non-compulsory secondary school, emphasizing a significant difference between primary school and compulsory secondary school. The size of the effect of the interaction is situated around 1%.

Chart 1. - Signification degree of interactions and size of the effect for each interaction

	Institution x level		Institution x gender		Level x gender		Institution x level x gender	
	Sig.	Eta	Sig.	Eta	Sig.	Eta	Sig.	Eta
O. S. management	0,658	0,001	0,634	0,000	**0,001**	0,015	0,901	0,000
Setup and maintenance	0,781	0,001	0,273	0,001	**0,046**	0,006	0,393	0,002
Word Processor	0,756	0,001	0,836	0,000	**0,003**	0,012	0,845	0,000
Documentary base	0,629	0,001	**0,013**	0,006	**0,003**	0,012	0,680	0,001
Educational software	0,204	0,003	0,254	0,001	0,863	0,000	**0,024**	0,008
Internet: Information	0,498	0,001	0,269	0,001	**0,016**	0,008	0,631	0,001

4. Conclusion

The results obtained, by means of ANOVA model, point out that the main effects (gender, educational level and type of educational institution) are more important than the effect of the interaction of the factors, since only the interaction between gender and educational level is significant, what suggests a complex relation among both factors.

From the three variables studied, teacher's gender becomes the variable with the most significant influence on the knowledge of technological resources, as it is noted from the size of the effect, providing the other two variables smaller explanation to the variation. In this way, the competence profile of female teachers is similar to that of male ones with a smaller level of mastery in all technological resources, being likewise notable the fact that female teachers from primary school show a level of competence lower than the expected one. In relation to the other variables, we point out that teachers from private educational institutions show a higher profile of competences than that of the public ones, and primary teachers, in general, show a smaller knowledge that the other two levels, compulsory and non-compulsory secondary education school.

Finally, the model of competences proposed is sound, therefore, independently of the variable studied the competence standard remains essentially the same one. This fact lets detect teacher's needs in technological competences and to adapt training plans to the lacks detected. Thus, it is shown lacks in the most of the resources, above all in those that require production by the teacher (educational software, presentations …), and different needs depending on the different personal and context factors, as we have verified.

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