

## COMMUNITY OF ANDALUSIA'S ICT CENTRES IMPLEMENTATION PROCESS OUTCOMES: A TRANSFERABLE MODEL

By

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### ABSTRACT

*This paper contributes significant data to the report of the project Observation and the implementation of free software in ICT schools in Andalusia. The researchers main goal is to analyse its effects in the teaching-learning process. This project is backed and financed by the National Research Plan (R&D&I) 2004-2007 of Spain's Ministry of Education. This research analyses the centres' Information and Communication Technology (ICT) plan, implemented by the Regional Autonomous Government of Andalusia, to focus on the progressive implementation of computers in Andalusian Primary and Secondary schools, so that pupils can use them daily and thus contribute to their own learning process. In general, the authors try to gauge the range of use of computers in schools, the models of computers use and the influence of factors associated to second-level obstacles, such as the teachers' professional situation. The most outstanding data are those which refer to the increasing use of computers and the training process in which teachers are involved. Other significant factors are the educational stage and teachers' professional characteristics (age, teaching experience, years in the school, job stability, etc.) as well as the presence of computers at home; all these have some influence on the use and curricular integration of ICTs.*

*Keywords: ICT, Training, Teacher, Secondary, Primary, Education, Curriculum, Technology.*

### INTRODUCTION

This study, framed within the National Research Plan (R&D&I) 2004-2007 of the Spanish Ministry of Education (SEC-2004-01421-EDUC), aims principally to describe the impact of ICT on the Andalusian education system within a new environment, the new ICT centres, characterized by their high level of technology in Primary and Secondary Education.

The political, social and educational impact that this policy has had on our educational innovation policy has been established (that is, the general implementation of ICT and its possible effects on teaching-learning processes), it is necessary to promote rigorous and systematic studies that evaluate this implementation in real contexts, first by fixing the main guidelines for future didactic programmes, as well as for our institutional educational policies.

In this work, which analyses a significant sample from the first year of ICT centres in Andalusia, the authors have

described the impact of technological resources, not only at institutional level (for example, regarding school management and general organization), but also at classroom level and, therefore, the direct impact on the teaching-learning process.

The research starts from the rigorous analysis of a new educational reality that is progressively being implemented in Spain, and in all countries of the developed world. This reality is the presence of computers in classrooms and their integration as a common resource for the teaching-learning process. Up to their implementation, computers had only been part of the process in specific subjects or classrooms. The enormous investment by the national/regional government (regarding financial support and equipment maintenance) requires the analysis of scientific studies, which are relevant because of:

Their innovation, since ICT centres are innovative regarding the new real virtual quality of life they lead,

and in which the school and the educational institution are developed, (which is evident in countries within our social environment). Specifically in Andalusia, a new ICT Centres Plan started in 2003/04, and has grown progressively over the years, as we will indicate in this study.

Their importance for public investment, the high number of centres which have joined this programme this number increases year on year and the trend in the rest of the regional autonomous communities is to implement this type of resource and equipment in their schools.

Nevertheless, they lack information to allow them to know more fully the advance that such human, resource, and economic effort means for classrooms, teaching institutions and for the education system in general.

## Review of bibliography

There are a lot of theoretical views about the use of ICT in education. Squires & McDougall (1994) establish three types:

Those which differentiate several categories of use in the software.

Those based on the instructional role of the software,

Those which associate the software to a specific methodology.

These authors criticize the isolation created by the use of software, emphasizing the importance of interaction and the consideration of other important didactic aspects, such as the context of the classroom, and the role of the teacher.

Similarly, Lim (2002) also reflects on the integrated nature of the use of computers in education through the definition of a concentric model to demonstrate the mechanisms associated to its didactic use. In this sense, the 2<sup>nd</sup> Module of the Second Technology in Education Study (SITES) specifies some factors and interactions (Kozma, 2003) that matched the use of the computer to the promotion of pedagogically innovative practices.

Apart from this the authors agree with Baron and Bruillard

(2003), on that any evaluation of the use of Computer Science depends on the educational uses defined by society. In this context, the analyses of national and international plans reveal two main objectives (e.g. Qualification and Curriculum Authority/Department for Education and Employment 1999; European Union Commission 2002). One of them starts from the fact that pupils must be digitally trained to be ready for the knowledge society (Information Age). The second objective comes from the belief in the value of Computer Sciences to facilitate the learning process.

The use of ICT in the classroom must be understood as contextualized through the aims, activities, materials, pupils and teachers, these latter two with interactive and differentiated roles. These practices can be seen from a classroom-level perspective (minimum level); from a school or community level (medium level); and finally, from a national or international level (maximum level).

Other theoretical research adapted to the Spanish context (Tirado, 2002; 2003) has considered these three levels of differentiated analysis: the classroom level; that conditioned by the centre level (resources, work dynamics, teacher training, curricular projects); and the strategic level (regional, national or international plans, models on curricular national construction)

The conceptualization of the computer as either a content-knowledge item or as a resource has been the goal of some recent studies. For instance, Baylor & Ritchie (2002) define the use of the computer according to nine components, among which it is included as a subject-knowledge item. Other subcomponents refer to its use as a didactic tool, as a way of collaboration or as a resource for the development of higher skills. Niederhauser & Stoddart (2001) differentiated two types of applications: software for practice with exercises and skills (drills & practice), and software as a way of constructivist learning (simulation games, micro-worlds, etc.) The results of this study indicate that the majority of teachers use the computer to practice skills.

Among the studies dedicated to the validation of ICT classification, the authors find Hogarty *et al.* (2003), Kent

and Facer (2004), Pelgrum (2001), Ainley *et al.* (2002), Beker (2000) and Waite (2004). Hogarty *et al.* (2003), by making a factorial analysis and applying correlation methods, identified two factors; the first represents the use of instructional software, and the second represents the use of different computer applications, such as text processors, web searchers, presentation programs, and so on, as different learning resources. Regarding learning goals, Ainley *et al.* (2002) identified four categories, based on Rubin (1996), of the use of computers in education: as tools to access information, to create documents or presentations, to construct knowledge (interactive systems), and to reinforce knowledge (practice activities).

Many studies have approached the role that first-level obstacles have in the efficiency of technology integration processes (Owen, 2006; Fletcher, 2006). Technology access at schools and at home is losing influence as a barrier to the integration of technology due to the growth of schools with Internet access and the increase of the student-computer ratio. All Western governments are striving towards this in all stages of education (Fandos, 2007). This is so in the case of 'ICT Centres' in Andalusia, and is the impulse of this research.

Second-level barriers, mentioned in the literature, refer to teachers' beliefs regarding teaching processes, computers and their willingness to change didactic practices in the classroom. If overcoming second-level barriers is essential to the integration of technologies in pedagogical processes (Cuban, Kirkpatrick y Peck, 2001), administrators and politicians should examine the didactic practices implemented by teachers in the classroom and the associated circumstances (Ertmer *et al.*, 1999).

## Hypothesis

The study entitled "Uses of audio-visual mass media and new technologies in Andalusian centre" approved by the regional Andalusian government within the 1997 Evaluation Projects Call (Cabero, 2000) concludes with some special premises that are the starting point of this report: audio-visual mass media are exclusively curricular

elements which must neither be analyzed nor perceived alone or in isolation, but within a narrow relationship with the rest of the curricular elements. That is to say, that audio-visual mass media are not an isolated issue, so any attempt to approach them without considering this decisional, contextual, institutional and pluridimensional space will simply lead us to the introduction of new devices in the classroom, which will easily be forgotten by the teacher and relegated to playful and motivational functions. Thus, the starting hypothesis is that the teacher is the most significant element when specifying the audio-visual mass media within a certain teaching-learning context.

## Design of the research

### Objectives

The objectives of this research project aim to describe the current use of technological support in Andalusian schools, where computers have arrived *en masse* in the classrooms to transform the teaching-learning process and make their use by all pupils common and universal. They are called *Andalusian ICT Centres*, where technology plays a real part in the life of these centres, implementing new virtual resources (all with free software), and seeking to make an educational impact on all teaching-learning processes directly created in the classrooms.

These objectives are included in the National Research Plan (R&D&I) 2004-2007 of Spain's Ministry of Education and in the National Program of Social Sciences of the Department of Education and Science (Appendix 1). They refer especially to the 'didactic, methodological and technological components of teaching-learning programmes', as well as to 'lifelong ICT', 'learning in virtual contexts', 'open and distant teaching learning'. These are the specific aims of this research:

To describe the progress and the current situation of the use of technological mass media in ICT Centres in Andalusia (Spain).

To know the use of learning-teaching processes by teachers.

To know the influence on teachers' professional

situation of the use of technological resources in their teaching activity.

## Sample

The sample for this study is made up of students of the first year of all 56 Andalusian ICT Centres. This research uses a random sample through conglomerates and, since they have considered it important not to break up the unit of the centres, a representative sample for this study will be 16 sample centres and 800 teachers selected at random.

## Instruments for collecting information

Evaluative research uses descriptive methodologies to study a certain social phenomenon in all its complexity. The questionnaire will be used as the main research method, because our first objective is to describe rigorously the current situation of the use of technological media in ICT centres, as indicated above.

The questionnaire, as a research method, can answer specific problems not only in descriptive terms, but also regarding the list of variables, with the final aim of describing a reality; of identifying norms and patterns of condition; and finally, of establishing relationships among events (Buendía, 1997). The authors will complement this study with group interviews or discussion groups (Rincón *et al.* 1995), which will allow the qualitative and clarified expression of the information obtained from the first ones, using as a contrast, the confirmation and triangulation of the information.

In addition, the authors will use content analysis for documents, by interpreting the information regarding the organization of the centres in terms of the introduction of ICT. Finally, and in a complementary way, they will use observational methodology as a procedure to get to the meaning of specific types of behaviour in their natural context, with a rigorous process of recording. They will make the analysis of availability, use of computers and a telematic resource in ICT Centres through systematic observation of a non-participative nature through checklists and scales of estimation.

To sum up, a transversal research is described in this study, with different moments corresponding to different phases.

## Discussion of results

The first question put to the teachers was about the regular use of computers in the classroom. The majority of teachers declared having used the computer regularly in their classes (62.8%) as opposed to more than one third of teachers who indicated that they did not use them regularly (37.2%).

The following question was about the evolution that the teacher has undergone in the use of computers in the classroom from 2000 to 2005. The analysis of the information from this question allows us to say that there has been a constant and progressive increase in the use of the computer from 2000 to 2005.

Specifically speaking, if the researchers concentrate on the accumulated percentage of those who declare that they use ICT daily or some time per week, they verify that in 2000 the percentage was 9.3%; in 2002 it was 12.7%; in 2003, 33.5%; in 2004, 61.5%; and in 2005 it was 76.9%. As we can see, following the massive incorporation of computers in these centres in 2003, and after the impulse by the regional government of Andalusia, there is a significant growth in the regular use of computers in the classroom (Figure 1).

The next question deals with the academic year in which every teacher uses computer resources. In general, the study says that the higher the education stage, the greater the use of computer resources. The highest percentage of daily use is in the second year of High School (40.8%), followed by the first year of High School (26.3%). In

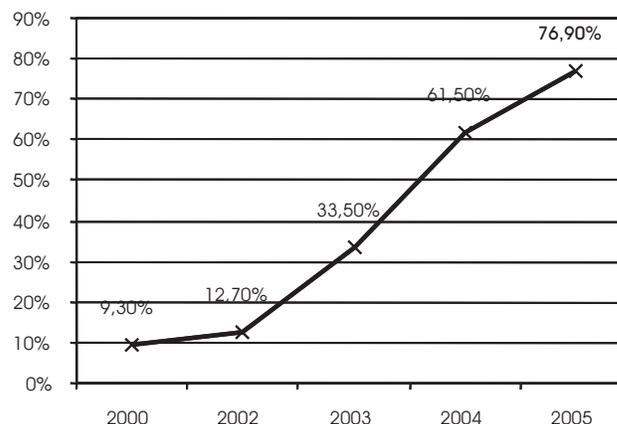


Figure 1. Personal evolution on the use of ICT

Secondary Education, the highest percentage is in the fourth year (4<sup>th</sup> of ESO) (21.5%) and the highest rise is in the second year of Secondary Education (16.7%). In Primary Education, the percentages range from 9.1% to 23.5% for the third and fourth years of Primary Education, respectively (Figure 2).

The following question asks about the didactic applications used most regularly, that is to say, some time per week or daily. Regarding this question, the highest range of regular use corresponds to exercises and practice; 51.6% of teachers declare they use them some time a week or daily. Presentations (21.7%) and educational games (18.7%) are less frequently used.

There are fewer teachers who regularly implement collaborative learning projects (16.3%), tutorial sessions (11.2%), simulators (11%), web quests (10.6%), imagine-creation programmes (7%) and web log (5.2%). A high percentage of teachers (68.8%) use other applications and technical resources of web search regularly, to find information on the Internet, texts processors, virtual models, educational platforms, e-mail programs, calculators on the web (Figure 3).

When they ask the teachers why they use ICT, they find

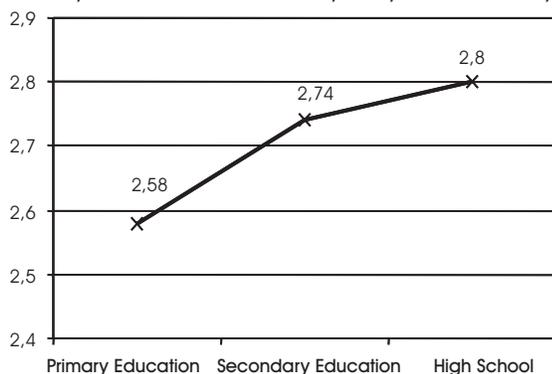


Figure 2. Media on the use of computer resources according to educational stage.

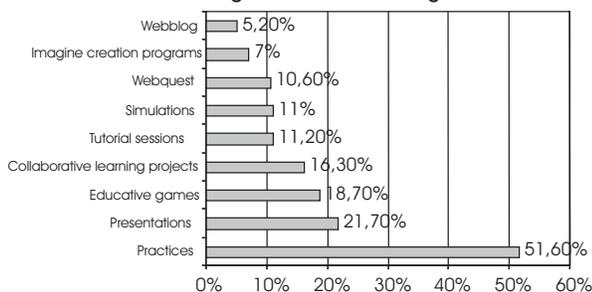


Figure 3. Weekly or Daily use of didactic material.

that the majority of them use new technologies to reinforce learning (77.3%) and to search for information (70.7%). By contrast, only a minority of teachers (4.4%) emphasizes ICT use for collaborative work with other centres. There are also many teachers (42.7%) who consider it either important or very important to use ICT to practise skills (Figure 4).

This research is interested in finding out if the presence of computers in the centre has meant an increase in teachers' activity in the creation of adapted materials for these new purposes. If they ask them about the development or design of some type of material, only 14.8% answer affirmatively. Among those who design some type of didactic material, 41.2% design web quests, 39.7% design web pages and 33.8% design presentations; it must take into account that this information refers to 14.8% of teachers, so it is a fairly small group of teachers who produce their own didactic materials (Figure 5).

The analysis of the relationships among the different variables will allow us to analyse the possible factors that can help to explain diverse phenomena, such as the frequency computer use, ICT teaching aims, the implication of teachers in their own training processes, the training methods and the changes at classroom and

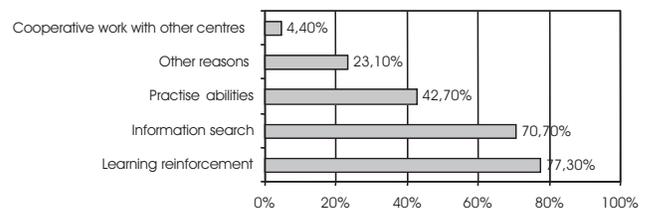


Figure 4. Reasons to use ICT

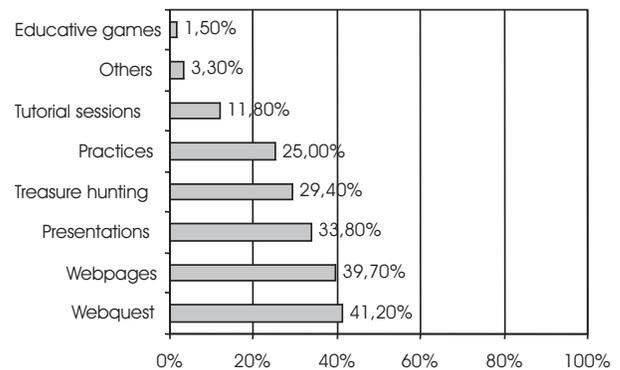


Figure 5. Material designed by teachers

centre level. The variables found associated to these aspects were: educational stage, administrative situation of the teachers, age, educational experience, seniority in the centre and having Internet at home. As a conclusion of this analysis the authors state the following: (Table 1)

The regular use of the computer in the classroom in the ICT Centres depends on the job stability of the teachers, both in the profession and in the centre. The researchers concentrate on permanent teachers; they are more numerous and they also use computers more regularly (even daily) than non-permanent teachers. So, it is the senior teachers who make more regular use of computers in the centre.

Nevertheless, regarding the daily computer use, the percentage is significantly higher among teachers of intermediate seniority (between 3 and 6 years). This fact shows us that there are intermediate periods that reveal high levels of activity in teachers. This period refers to when teachers are not new in their centre and/or have not been there for too long. This is repeated in their

Statistics: $\chi^2$ ; $p < 0.05$	Education stages		Administrative situation		Teaching experience		
	Secondary	Primary	Temporary teachers	Permanent teachers	Up to 5 years	Between 5 and 10 years	10 or More
ICT is regularly used in their Classes			40.9%	69.1%			
ICT is used in their classes daily			31%	40.3%			
ICT is used to reinforce learning in their classes					61.9%	75%	81.6%
ICT is used to practise skills	50.5%	23.4%			61.9%	56.5%	31.9%
Educative games are used in their classes	27.3%	66%					
Teachers who have participated in teacher training activities	90.6%	98.6%			68%	87%	94.2%
Teachers who are still enrolled in teacher training activities			75.9%	96.3%			
They are trained in the centre	39.1%	88.7%	36.2%	53.5%			
They are self-learners			31%	53.5%			

**Table 1. Analysis of the relationships among the different variables such as Education stages, Administrative situations and Teaching Experience.**

participation in training activities.

The final aim of using computers depends on several factors, one of them being the educational stage. Here they find that Primary teachers mainly use computers for educational games, whereas Secondary teachers use them to practise skills. Thus, the authors say that there are a few educational games designed to practise skills in ICT Centres. Skills practice, in most cases, consists of learning to use concrete software, there being fewer cases in which a simulator is used for the training of certain skills or principles, such as economic, physical and chemical.

Younger and less experienced teachers use computers more to practise skills. On the other hand, older teachers use computers to reinforce learning through programs such as JClíc (games programs mainly used to consolidate the learning of content). In fact, as they proceed in the age segment, the percentage of teachers who use computers to reinforce learning is higher.

The involvement of teachers in training activities is determined by three factors: their seniority in the teaching institution; age, and educational stage. As indicated in Table 2 the percentage of teachers of intermediate seniority at the centre (between 3 and 6 years) is higher than those who have spent less time (less than 3 years) there, though only slightly higher for those teachers who have been at the centre for more than six years.

Therefore, the study state that the intermediate period (between 3 and 6 years) is when teachers are very active in training tasks, and thus in ICT use. So, age is a definite factor that influences teacher involvement in training activities for computer use, the percentage of teachers over forty-five (92.3%) being higher than that of younger teachers; as we go down the age groups, the percentages also decrease. The authors think that this is due to the fact that older teachers need training in the technical and didactic use of ICT. Likewise, they found that younger teachers are the ones who use on-line training more as a training resource.

They have also found that the percentage of Primary

Statistics: $\chi^2; p < 0.05$	PC at home		Seniority at the centre			Age		
	No	YES	Up to 3 years	Between 3 and 6 Years	6 years or more	Up to 35 Years	Between 35 and 45 Years	45 or more
ICT is regularly used in their classes	28.6%	65%	51.5%	69.4%	70.2%			
ICT is used in their classes daily			41.8%	47.9%	32.3%			
ICT is used to reinforce learning in their classes						61.8%	76.6%	84.5%
ICT is used to practise skills						48.8%	51%	28.6%
Educative games are used in their classes								
Teachers who use web logs their classes			0%	13.7%	5.3%			
Teachers who have participated in teacher training activities			72.9%	96.8%	96.1%	77.3%	88.8%	92.3%
Teachers who are still enrolled in teacher training activities			86.2%	98.4%	96%			
Teachers who have had teacher training on line						34.7%	21.3%	14.8%
Teachers who have had teacher training courses						12.5%	3.2%	4.7%
Better communication among students	25%	41.7%						
Better communication between student-teacher	25%	48.8%	26.5%	57.4%	53.8%			
Better individual work from students	50%	65.7%						
Better communication among teachers	25%	51.5%						
Better collaboration among teachers	50%	70.4%	54.2%	80%	72.5%			

**Table 2. Involvement of Teachers in Training Activities**

teachers involved in training processes is higher, which might be due to diverse factors like their own training style. In the case of Primary teachers, they discovered that they are more involved, in a significant way, in training programs at the centre than those from Secondary. This training modality can be considered a facilitating factor of teachers' participation in these activities.

The effect of the use of computers at classroom and centre level seems to depend, partly, on two factors: having a computer at home, and the teacher's seniority at the centre. In this regard, the authors have noted that, in general, teachers who have a computer at home have improved teacher-pupil communication, communication

among pupils, and the autonomous work of pupils at classroom level.

The percentages of these teachers are always significantly higher than those who do not have computers at home. Therefore, they think that this factor is associated to the presence of the computer in the daily life of the teacher, and it determines the use of ICT at classroom and centre level. So, this didactic use is a consequence of the extension of daily and normalized ICT use. Thus, at the centre level, those teachers who have got a computer at home show they have improved communication and collaboration among teachers at the centre.

As a consequence, they understand that the normalized use of computers in the centre contributes to the improvement of didactic processes in the classroom and of communication and collaboration among teachers. Nevertheless, the growth of training processes, especially in centre-training, has also contributed to the positive feeling towards these processes since the incorporation of ICT.

### Conclusion

The presence of ICT in the educational centres, promoted by the policy of the regional Government of Andalusia (and centred on the spirit of the knowledge society), has generated a visible, progressive and continued increase (almost 70%) in the use of computers in the classroom. The majority of teachers declare that they use ICT regularly in their classes, whereas slightly more than one third states that they do not use them with such regularity. Its use is more frequent as we scale the levels and stages of the education system.

As also demonstrated in recent reports (Perez & Sola, 2006; Cebrián & Ruiz, 2006), the most widely used didactic applications (and the most satisfactory ones for teachers) are information search, programs for reinforcement, such as JCLic, and presentations:

The use of the Internet as a research tool is one of the ICT applications most widely used by teachers. It generally appears in the frame of web quests, that is to say, to research, to analyze, and to obtain information in collaborative group dynamics. It is also used as a search tool for information related to the topic that is being worked on in class.

A second option is that pupils use tools for the presentation of information (or work presentation). The expressive possibilities of these applications and their visual and interactive attraction facilitate the accomplishment of attractive presentations of pupils' work, thus becoming an especially motivating instrument for them. These presentations generally imply the development of competences, such as the summary of ideas and their representation.

The reinforcement material, such as puzzles, web stories and association is different to that mostly used by teachers. The authors refer to interactive and visual applications designed to develop either the reinforcement or the application of concepts, as well as the skills previously worked on in the classroom.

They cannot make a general statement that a change has taken place in class dynamics due to the use of the computer in the classroom. These resources would have to be generally integrated in the classroom. In addition, they find that their use is irregular, specific and discontinuous.

The authors mean by this that teachers, at the beginning of the classes in which they incorporate these resources, do not generally connect these sessions to previous ones, and do not even consider collective feedback to evaluate what has been learnt. Thus, there exists just a small group of teachers who motivate students for the following sessions. In the same way, pupils who use ICT generally get information about the topic treated in class, working individually or in pairs, without the existence of situations of exchange of information and communication among partners in the classroom or at other centres.

Nevertheless, teaching staff who state that their teaching-learning processes have been modified, say that their classes have become more active and participative, thus facilitating the pupils' autonomous learning, and acquiring new knowledge through research works in which the teacher becomes a guide in their pupils' learning process. In addition, the use of technological support gives rise to an increase in pupils' motivation. They have a more favourable attitude towards the academic tasks proposed by the teacher, improving attention and their involvement in learning.

Teachers' self-production of materials seems to stimulate those who either make them or take part in their making. In some centres, teachers choose to ask for the help of their students for this task, which has a good result in their production and use.

Accordingly, they understand that the really interesting

point of these activities is not the resulting material but the attitudes, feelings and skills which come from pupils taking part. Nevertheless, this work is not widely extended among teachers. Due to this situation, education administrators are working towards letting teachers have materials that are adequate for the school curriculum. Thus, administrators are considering the creation of a place in which all teachers could see and share materials, resources, either institutional or published.

On the second level of analysis, they observed that the use of the computer and its didactic applications, the effects that it has had on the communicative dynamics of the classroom, and the implication of teachers in training processes (derived from the incorporation of ICT at the centre) depend partly on teachers' personal and professional factors, as well as on the educational stage. According to these data, the study state that:

The frequency of ICT use depends on the job stability of teachers and their experience at the centre. Thus, in general, permanent teachers use the available technological resources regularly, even managing to use them daily in their classes. At the same time, those teachers with 3-6 years at the centre regularly incorporate ICT in their teaching, in opposition to the scant ICT use among those who have been working at the centre either for a longer or a shorter period of time. This study proves that the intermediate periods, in which the teacher is not new at the centre or has not been there for too long, are high-activity ones. These data are repeated in teacher participation in training activities and in the acknowledgement of improvements at classroom level, so we can conclude that the segment of 3-6 years' seniority at the centre is identified as a period of close educational involvement.

The age, educational experience and educational stage determine the purpose of ICT use in the classroom. The older and more experienced teachers (with teaching experience

at Primary Education) use computers mainly to reinforce learning. Secondary teachers use computers especially for practising skills. According to the nature of Secondary Education disciplines, the teachers use more specific programs for presentations, evaluation, practice of skills and knowledge, whereas Primary teachers use computers in a playful way through educational (e.g.: JClic) and cooperative games with the use of web quest, treasure hunt...

The study states that teachers of average seniority show changes in the communication among pupils-teachers when they use the computer; thus, there is greater involvement in the didactic use of resources. Likewise, the authors think that the relationship between having a computer at home and the subsequent changes in collaboration and communication among teachers in the centre, among teachers and pupils, and among pupils in the classroom, is due to a higher level of technological culture in these teachers, which enables better use of ICT.

The educational stage seems to affect the level of teaching staff's involvement in training activities, so a higher percentage of Primary teachers are observed in training programs.

One cannot consider the effects of ICT use in teaching institutions until its real, normalized integration in classroom dynamics, which is not yet observable systematically. However, it is necessary to state that ICT is beginning to be perceived as a complementary resource, which opens up didactic possibilities, limited at other time to the exclusive use of the textbook. Besides, the didactic use of these resources and their favourable consequences mean a shift in teachers' mentality, a circumstance that, as some head teachers state, is beginning to take place. It is a question of a change in the understanding of education, from which knowledge has multiple dimensions, sources of access and representation.

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