

Socio-pedagogical impact of an Educational Innovation Project Supported by ICT

Meritxell Cortada, María G. Badilla y Jordi Riera
Ramon Llull University

This article is focused on a case study of an educational innovation project supported by technology. Its aim is to analyze the socio-pedagogical effects of this project on the participants –students, teachers, family and community representatives– at individual and interpersonal levels applying an integrated methodology through different self perceptive research instruments –interviews, surveys and focus groups–, non-participant observations and semi-experimental tests. Results show significant effects at individual level are observed, not only during the teaching exercise but also during the pupils' scholarly tasks. Also there are remarkable aspects in the interactions between the educational community agents –for example families, students and teachers– and strengthened relationships among them.

Keywords: Technology integration, education community, relationships, computer use, teacher-student roles.

Impacto socio-pedagógico de un Proyecto de Innovación Educativa con el apoyo de las TIC. El presente artículo se centra en un estudio de caso de un proyecto de innovación educativa con el apoyo de las TIC. Con el objetivo de analizar los efectos socio-pedagógicos del proyecto en los participantes –estudiantes, profesores, familiares y representantes de la comunidad– a nivel personal e interpersonal, se empleó una metodología integrada a través de instrumentos de recogida de datos auto perceptivos –entrevistas, encuestas y grupos de discusión–, observaciones no participantes y pruebas cuasi-experimentales. Los resultados muestran efectos significativos a nivel individual, ya sea durante el ejercicio de la profesión docente, como también en el desarrollo de las tareas escolares de los estudiantes. También hay aspectos destacables en las interacciones entre los agentes de la comunidad educativa –por ejemplo, familias, alumnado y profesorado–, y un fortalecimiento de las relaciones entre ellos.

Palabras clave: Integración tecnológica, comunidad educativa, relaciones, usos TIC, roles profesorado-alumnado.

The emergence of Information and Communication Technologies (ICT) in the last few years has become the stimulus for a change that affects many different fields of society. Many competing terms have been proposed to describe this phenomenon -Post Industrial Society, Information Revolution, Technotronic Society, Information Society,

Knowledge Society, etc.- but the undeniable truth is: no matter the different implications and fine detail around every coined term, technological advances heavily influence our reality nowadays, not only politically, but also economically and socially.

The accelerated evolution of science and technology allows us to face these transformations, thus creating a need to take new measures in the educational field to ensure that future citizens learn to live with these changes and to successfully deal with upcoming ones. The Spanish society certainly

agrees and has taken a public stand through its elected representatives by declaring in the preamble of the Organic Law on Education 106/2006 (BOE 04-05-2006) that “it is more necessary than ever that our educational system prepares [children] adequately to live in this new knowledge society and to respond to the new challenges it will offer” (LOE, 2006, pp. 17160).

Several studies showed the educational potential of ICT in schools. Passey, Rogers, Machell, and McHugh (2004) pointed out the connection between ICT and pupils’ motivation. Higgins (2003) argues that ICT can make a difference to pupil’s learning and, about students’ information search strategies, Badilla, Cortada, and Riera (2011) showed that students in elementary and secondary education who frequently use ICT in school show better web literacy skills although they have missing key skills in analyzing, assessing and summarizing information. Specifically in elementary education, Smeets (2005) discovered that these changes are greater with teachers who created powerful learning environments, and when there were more computers available to pupils.

In regards to the teachers, some studies—such as Somekh et al. (2002) report—observed an increase in teachers’ motivation due to teaching supported by ICT. Additionally, how these integrated uses of ICT contribute on their professional development has been examined by several authors such as Daly, Pachler, and Pelletier (2009).

As Cortada, Badilla, and Riera suggest (2010) any process of ICT integration requires constant updating of professional teaching staff to provide them with the needed skills to develop ICT-based pedagogical innovation. This process transforms teaching practice, school life and personal development, among others.

In this frame, the relationships between students and their participation become more active during the teaching and learning process as Sandholts, Ringstaff, and Dwyer (1997) found. This can be seen also in the family when children help their parents in

ICT matters (Amorós, Buxarrais, & Casas, 2002; Naval, Sádaba, & Bingué, 2003).

Nowadays, the impact of technology on all the agents of the educational community—students, teachers, families, among others—is still under analysis (Underwood et al., 2010).

Lately, the Spanish government has invested €200 million in order to promote the *Escuela 2.0* project for 2009–2011. As a result 650,000 students, aged between 10 and 13, and 160,000 teachers were given a laptop and 30,000 classrooms have been provided with interactive whiteboards and Internet wireless connection (Ministerio de Educación, 2011a, 2011b; Alumnia, 2009).

Meanwhile, different initiatives by some of the Spanish Autonomous Communities have started taking ICT closer to schools, such as Aragon’s *Ramón y Cajal* program, the Canary Island’s *Medusa* project, or Navarra’s *Nuevas Tecnologías y Educación* program. In the same way, public organisations and private parties have been funding and supporting a growing number of smaller projects by districts, locally, and even in single schools. The success of these kinds of initiatives can be an unlimited source of educational innovation opportunities for new organisations (Anantmula & Stanosky, 2008) as well as representing changes in the regular educational environment. Furthermore, all of them can help to update processes and include new generations of citizens.

This article studies one of the privately funded initiatives: a project on Educational Innovation called *Ponte dos Brozos*. It has been supported by the Amancio Ortega’s Foundation since 2001 and recognised by the Consellería de Educación e Ordenación Universitaria of the Galicia’s Xunta.

This educational project supported by ICT was carried out in three public schools at Concello de Arteixo: Elementary School Ponte dos Brozos, Secondary School Pastoriza and Secondary School Sabón. The aims of this project were both to provide technological equipment and to promote pedagogical aims, such as training teachers and encoura-

giving a bidirectional relationship between parents-students. Thus it provided technological equipment to the participating centers, such as didactic resources, interactive whiteboards, audiovisual systems, computers, broadband Internet access or a local net with shared resources (printers, discs, etc.) Also the secondary school students were able to purchase laptops through the project, allowing the regular use of them in school and at home. In addition, training activities were carried out. Their main objectives were to introduce adjusted changes to each school context, to encourage teachers' reflection and collaboration in the introduction of innovative ICT methods in the classroom. Furthermore, teachers were involved in practical classes, lectures, seminars, conferences, workshops, visits to other educational institutions and national and foreign schools, exchanges between teachers, parents and students; advice on the development of platforms and websites, among other activities. Even though there were some organized and prepared activities, computer clubs to share practices and provide simple solutions and technical support to both teachers and students were also formed.

Thus, Ponte dos Brozos Project (PdBP) promoters' vision is that 'technology is nothing more than a way to reach an end, never an end by itself, or the only method to modernise education' (Amancio Ortega Foundation [FAO], 2001).

Therefore, both in objectives and chronological placement, the PdBP was contextualised by what has been called "a digital integration stage," according to the divisions suggested by Martínez (2006). This stage classified the different periods of introduction of ICT in the Spanish educative system. According to this author, a policy of integrating new methods –and particularly new technologies– defined this stage, where pedagogy overshadowed technology.

Scientific literature based on the impact of educational innovation through new technologies is often focused on isolated studies or the partial analysis of different sides of the technology-education combination. Due to the need to study all the constituting fac-

tors, both of the educational context and of the impact that the introduction of ICT generated, the Social Pedagogy and Information and Communication Technology research group (PSITIC) at the Ramon Llull University made an external evaluation of PdBP over a two year period (2005-2007) from a holistic perspective.

The present article has two main objectives. First is to describe and analyse the most important conclusions of this investigation in order to set a precedent and guide to the current ICT introduction in the schools. Second is to investigate the effects produced by the development of an educational innovation project supported by ICT on personal and interpersonal relationships.

More concretely, the research focuses on the effects that ICT project's involvement has over Spanish teachers and students alike, and how it affects their daily lives. It will be necessary to observe if the teaching staff practice are altered by the new resources given by the Project. Similarly, the same must be done with students' school tasks: will the use of a laptop alter the way they carry out their tasks? Will they use the Internet as a new communication tool and information source? Will their academic results be affected, and if so, how? Will it alter their behaviour in the classroom?

Regardless of the answer, the interrogations create a new task for the educators. On one hand, pondering these questions in front of the new situation created by this project; and on the other hand, paying attention to these new facts on a daily basis. Therefore, it seems obvious that the dependence between teachers and students will be a decisive factor, as the changes experienced by one side affect and change the other side as well, while other more simplistic approaches focus only on the technology. Indeed individual transformations (personal) have an effect in interactions between subjects (interpersonal relationships).

In an educational community (geographical, social and relational contexts), there are more agents involved than those described before, so it is not just the students and

teachers, but also their friends and families acting out these interpersonal relationships and experiencing the abovementioned changes. And so, it seems interesting to study the effects that an introduction to an ICT project has, not only on an individual basis, but also on the relationship network that exists around the subjects. Previous studies related to the introduction of new technologies to an educational community have only treated this subject superficially, or not at all.

Related to the second objective our task was to find out about these effects on an individual level, in the practice of the teaching profession as well as in the performance of school tasks by the pupils. In addition, we inquired about the changes experienced in the diverse relationships, with special attention to the relationships between students, between teachers, and also between students and teachers.

Method

This investigation is centred on a case study, Ponte dos Brozos project, and thus it is an ex-post-facto research. The population of this study is formed by students, of both elementary and secondary schools, and their teachers, families, and other agents of the community of Arteixo involved in this ICT Project. According to the methodological lines used, different sectors of this population were analysed.

Based on a complementarity of paradigms, positivist and interpretive (Bisquerra, 2004), our research design is non-experimental, with a mixed character, integrating quantitative and qualitative methodology. In order to cover the multidimensional environment of teaching and learning, we combined three techniques of data collection: self perceptions, observational, and semi experimental.

Our first technique sought to understand the agents' perceptions through three different tools: surveys completed by teachers and students, semi-structured interviews with teachers and other individuals of the community, and focus groups with teachers,

students and families. In all we aimed to understand perceptions through five channels: participants' identity, structure -way in which the project was implemented-, relations between agents, participants' skills and future expectations.

Surveys were the first instrument we used: 223 students answered a poll that contained 60 items. Eleven participants had to be excluded from the study for not answering all the questionnaires correctly. 57 teachers answered a poll that contained 25 items. Both polls included open, closed and mixed questions. Interviews were the second tool used to obtain self-perception data, carried out with 43 teachers and 20 community agents -local representatives from the educational, business, commercial, cultural, religious, associational and administrative fields-, who were interviewed individually. Finally, focus groups were held -formed by 8 to 10 people each- with students, teachers and families (10, 3 and 4 groups respectively).

In our second technique, we proceeded to observe regular classes with no participant observation, so as to describe the dynamics and interactions occurring during these lessons. The observations were carried out taking into account that a minimum of one observation per teacher had to be done and they were made following a random order. A total of 90 observations were made using a systematic observational grid validated by experts.

Finally, on the third technique, we studied what repercussions on academic results the participation in the Project had, through reading comprehension tests, mathematical reasoning tests and an ICT skills tests. For its realisation, we used pre-made tests from the Spanish education field, which were given to students of the experimental group that had been participating in PdBP for 4 years, as well as to the control group, students that had not been involved. The first group was formed by 72 students, and the second by 97 students, both of the same age range and socio-cultural context. To be able to observe the differences that may exist between

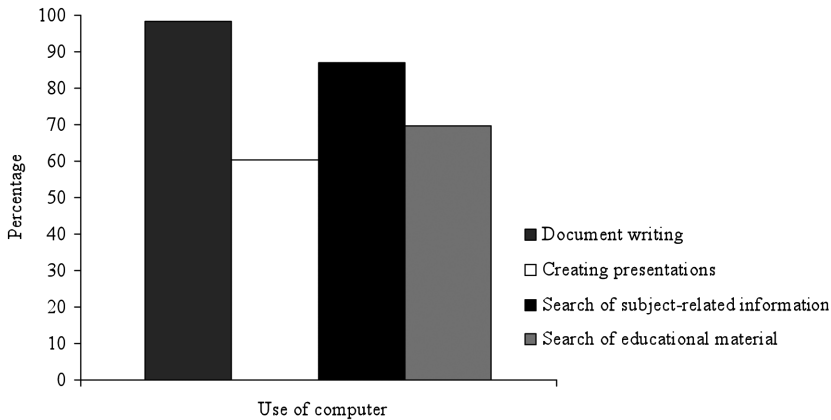


Figure 1. Percentage of different uses of the computer made by teaching staff outside the classroom.

both groups in the three variables, besides the Average and Typical Deviation calculations on all of them, we used parametric (*Students t*) tests where rules for parametric data were met and if not, the relevant non-parametric test (*U* the Mann-Whitney) was used.

Results

Personal effects: teaching and learning process

Initially we report the results of the project on a personal level: the individual changes of conduct and behaviour caused by the use of ICT that can be observed on teachers and students.

Regarding students the use of a computer is quite common, as 71.8% claim to use it for school tasks. The most commonly used tools are text processors (77.1%) and Internet (86.4%), which is used principally as a communication tool (67.7%) –although it is not made clear if that is for educative purposes or for regular socialization through chats and social networks– and for researching information to be used in school tasks (76.3%). Other tools must not be forgotten –software for presentations, spreadsheets, etc.– as they are used by 20% of the subjects.

The use of new technologies for instructor tasks has also spread considerably, both

inside and outside the classroom. Outside of it (Fig. 1) 98.2% of teachers use the computer to write documents, and 60.4% use it for presentations, while Internet is also shown as a commonly used tool (80.8% use e-mail, and 86.5% browse the net), mostly searching for information related to the taught subject (87.1%) and for pre-made didactic material (69.8%). In the same way, these new tools dominate the classroom, albeit with some differences, where the personal computers are used “often” and “always” (71.7%), as well as projectors (48%), text processors (60.4%), presentations (52%) and Internet (50%).

It is important to note also that most teachers agree in their interviews that incorporating ICT has increased their dedication to the job. This is reflected in our surveys, where 81.7% of the staff claim to spend “a lot” or “a lot more” time in their instructional functions. Moreover, 92% of the teachers reckon that these tools allow them to upgrade their knowledge on their subjects, and facilitate the preparation and completion of lectures in a 78.4% and 90.2% respectively.

Continuing with the results of the impact that this project had on the learning process, acknowledging the attitudes it provokes in the students and considering also their academic performance, from two

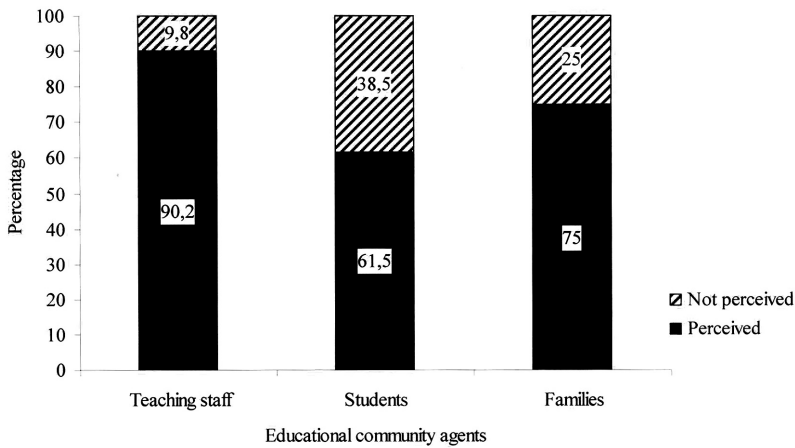


Figure 2. Perception of the educational agents about the impact of the PdBP in the increase of students' motivation towards learning.

points of view: through the own subjects' opinions –subjective perceptions– and through the results of the experimental tests.

Thus we see that teachers consider that the use of ICT improves the students' motivations towards learning (90.2%) and makes their participation in class easier (64.7%). Similarly, a 61.5% of students claims that since the introduction of ICT to the classroom their interest in learning has grown, and 75% of families have expressed their agreement in focus groups (Fig. 2).

Surveys show also that 79.4% of the students believe that since ICT was introduced in the classroom, the quality and quantity of their learning has improved, that the computer allows them a more economic use of time for school tasks (81.7%) and that it also makes them easier to complete (83.1%). The teaching staff agree with this perception of facts, and 58% of teachers collaborating with PdBP claim as well that ICT gives students an improved learning experience. Concretely, they are of the opinion that ICT facilitate the acquisition of new knowledge, concept retention, the expressing of acquired knowledge, and the generalisation and transference of learned material “fairly well” and “a lot” in a 84.3%, 66.7%, 72.5% and 82% of cases respectively.

In order to determine if the previous claims about the improvement of school performance hold true, students have been subjected to reading comprehension tests, mathematical reasoning tests and ICT skills tests, and the results have been analysed through the statistical package SPSS 15.0.

Regarding students with the age of 12, no significant conclusions can be drawn from the results of the reading comprehension and mathematical reasoning tests, as the degree of significance of t between the experimental group and the control group is always higher than 0.05. However, as Table 1 shows, on relation to the tests on ICT skills, important differences are observed favouring the experimental group ($t = 2.91$; $p = .005$). Nevertheless there have been no significant differences by gender, for boys and girls ($t = .497$; $p = .623$).

Referring to the 15-year-old students from Secondary Schools similar results are observed in reading comprehension tests and mathematical reasoning tests (Table 2), in which the same parametric test has been used, and no important differences can be found between the students participating in the project and those of the control group. After running Mann-Whitney's U nonparametric tests through the results of ICT skills

Table 1. *Studied variables according to the involvement in the Project of 12-year-old students of Elementary schools*

Variable	Participants		Non participants		<i>t</i>	<i>p</i>	<i>df</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Reading comprehension	7.06	1.58	6.80	1.82	-0.664	.508	82
Mathematical reasoning	3.94	2.14	4.73	2.13	1.629	.107	82
ICT skills	6.42	1.57	5.41	1.47	2.910	.005**	82

Note: Statistical significance legend ** $p < .01$.

Table 2. *Reading comprehension and mathematical reasoning tests results according to the involvement in the Project of the 15-year-old students of Secondary schools*

Variable	Participants		Non participants		<i>t</i>	<i>p</i>	<i>df</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Reading comprehension	4.27	1.38	4.67	1.63	1.223	.225	83
Mathematical reasoning	4.89	1.62	5.25	1.41	1.066	.289	83

tests (Table 3), is observed that there were significant differences favouring the results of the experimental group ($U = 190.5$; $p = .000$), as well as in the 12-year-old students group. Related to the gender there have been no significant differences for boys and girls ($t = .726$, $p = .471$).

But beyond the academic results, all the participant agents in the Project share the perception that pupils will be benefited in future professional environments as well. 60.8 % of the teaching staff believe that the use of ICT makes the students “fairly” or “a lot” more prepared for the professional world, while 37.3% believes it makes them “not a lot” more prepared. The pupils themselves also believe that this experience will improve their chances in the professional

world, as 90% of them claimed in the focus groups and 73.8% expressed in the surveys. 50% of families agree with this perception, as well as some of the community agents, who believe that businessmen and workers of the future will have received an education according to their future needs. Therefore, there seems to be the extended belief those students who have been able to learn ICT skills will be able to use them more successfully in their professional future lives than those students who had not.

Interpersonal effects: Relationships between agents inside the educational community

Going on to interpersonal relationships, only 24.3% of the students involved in PdBP feel that it has affected the relations-

Table 3. *ICT skills tests results according to the involvement in the Project 15-year-old students*

Variable	Participants		Non participants		<i>U</i>	<i>p</i>	<i>df</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
ICT skills	5,76	.95	2.52	1.95	190.5	.000***	83

Note: Statistical significance legend *** $p < .001$.

hip with teachers in a positive way. What's more, 69.4% of the surveyed students claim that their participation in the project hasn't affected their relationship with the teaching staff in any way, or that it hasn't improved their relationships (67.2%). Nevertheless, a vast majority of the surveyed teaching staff (74%) claims that the use of ICT has made the relationships with students easier.

One of the common subjects treated in different tools used with both pupils and teachers (interviews, focus groups, surveys and observation) is the mutual helping and learning about ICT. Several times students themselves offer technical support to teachers, and occasionally as well teachers allow them a more considerable role in the development of classroom activities.

This exchanging role is also happening inside households: 86% of students claim to teach their families about ICT (45% do it sometimes, 27% often, and 14% always), 75% of families confirm this fact in focus groups, and sometimes feel that their children know more about ICT than teachers.

About relationships between students, 75% of the pupils think that they improved, a claim that teachers confirm in 78.5% of surveys. Similarly, 87.2% students believe that they share now more information with their peers. Both the teachers' opinions in most of the interviews, as well as the observations realised, show that collaborative learning has been increasingly promoted since the beginning of the project.

It is also worth mentioning the students' creation and administration of a technical support service in two of the schools involved in the project. This way, different initiatives are created by and for the students, which allow them to manage themselves (keeping an incident logbook, trying to solve problems, etc.).

The students' initiatives to improve their own school adds to the increased interest in attending lessons expressed by 64.7% of students. Also schools data register show a very important decrease on scholar absenteeism, which is also attributed to the project by teachers. In a similar manner, the studen-

t's sense of belonging has grown, as seen by the 68.9% of students that now claim to feel proud about their school.

This seems to happen at home too, where a majority of students (95.1%) claim that since the beginning of the project their families feel proud of being a part of the educational community, and of the school's efficiency. Additionally, every focus group mentioned this kind of satisfaction. Nevertheless, 75% of the focus groups resent the lack of opportunities for the parents to be more involved in PdBP.

Finally, a strengthening of the relationships between teaching staff members is perceived since the implementation of the project, as 70% of the surveyed teachers claim. Furthermore, 74.1% of instructors believe that their engagement to the project has increased the degree of sharing their work with other professionals. This can also be seen in the improved climate in the teachers' room, which has turned into a space for cooperation, experience exchange, help and collective complicity.

Discussion

A project with a socio-pedagogical impact, which has been carried out within a holistic vision, has been described during this article. Three methodological lines are followed and for this purpose, a great diversity of tools are used to obtain data both in quantitative and qualitative way. Their integration and complementation allows us to observe what kind of personal and interpersonal effects are derived from the development of an educational innovation project supported by ICT such as Ponte dos Brozos project.

Personal effects: teaching and learning process

Habits and uses of ICT

When evaluating the general habits and use of new technologies from a personal perspective, clearly higher frequencies on ICT use can be perceived –by teachers and by students– compared with those described

by the report on the implementation and use of ICT in elementary and secondary school centres conducted by the Spanish state during the 2005-2006 school year (Ministerio de Educación y Ciencia [MEC], 2007). The principal causes for this disagreement are found in the infrastructure of the studied centres –which offer one laptop per student, integrated inside the classroom–. Furthermore, the advanced state of the PdBP development, which is in its fifth year, shows better habits on students' learning process.

Besides this, evidence indicates that the most used tools were text processors and Internet, and also how these tools were almost indispensable both for teachers and students. Following this path, it is also observed that having ICT changes the habits and routines substantially and evolves into a new way of working in which books, blackboards and notepads are not the only tools used anymore. Even so, it would be suitable to continue following the project in order to determine if this new habit is long lasting or if it is exclusively caused by the initial interest, as Cuban (1986) claims has happened during the 20th century when introducing a new tool or technology to education.

Regarding the teaching staff, besides the already mentioned habit change, it must be highlighted that most teachers firmly believe that ICT allows them to prepare lessons more easily than before. They agree as well, with almost unanimity, that it makes their upgrading their knowledge easy. This data evidences that the project helps to accomplish the long term training needs, which have become more essential in their profession than ever before and fall in with Zhao (2010), who said teachers must learn in order to improve professional development. It is important to note that knowledge acquired by this collective can quickly become obsolete, and learning and formation are constantly needed as Marcelo and Estebanz (1999) or Escudero (1998) point out.

Learning and motivation

The results obtained in this study show a clear perception –both from pupils and tea-

ching staff– that the introduction of ICT has improved the learning process and, as a consequence, students are learning more easily. In sharp contrast, the tests carried on during the project showed no significant differences in the students' results, especially when it comes to reading comprehension and mathematical reasoning; such results agree with most of the studies carried on until now (Castells, Tubella, Sigalés, Mominó, & Menezes, 2007; Kulik, 1994; Leuven, Lindahl, Oosterbeek, & Webbink, 2004, as well as many others). As Kirkpatrick and Cuban (1998, ¶ 2) claim: 'The studies carried on during the last 30 years about the use of computers in classrooms have found moderate evidence of an improvement in the students' academic performance. In some cases minimum evidence has been found. In others, none are found at all'.

This contradiction between the implied party's perception and the observed reality can be explained by another important conclusion of the study: the development of the project has highly increased the students' motivation towards the learning process.

On one hand, numerous investigations also conclude that there is a direct relationship between ICT and the students' motivation, such as *The Motivational Effect of ICT on Pupils* (Passey, Rogers, Machell, & McHugh, 2004) or the study *Integrated Learning Systems* (NCET, 1994, 1996; Wood, 1998). Relating both results, the feeling of increased interest is what takes the teaching staff and the students to believe that the learning process improves with the introduction of new technologies in class.

On the other hand, the idea that motivation by itself is a decisive factor in the improvement of the learning process has been refuted by authors like Broc (2006). In this matter, it is interesting to note what has been pointed out by Gallo, Lozano, and García (2000):

“Motivation is needed to obtain good results, but it is not enough by itself. For such ends, other variables, such as previous knowledge, intellectual capacity, le-

arning style (Sternberg, 1999), and self concept (Shavelson, Hubner & Stanton, 1976), are necessary for satisfactory results” (p. 346).

In the previously mentioned report about the ICT implementation (MEC, 2007), a very positive attitude within students can also be observed. Still, a low percentage of students also express their scepticism in relation to the improvement expectations. Nevertheless, as mentioned in the same report, the students’ experience with ICT inside the school was limited, which could have an effect in the low assessments towards the learning process. In the work presented by Cebrián and Ruiz (2008) about a similar project carried out in schools in Andalucía, the same conclusions were reached about the increasing motivation, as well as about the improved ICT skills, agreeing with this study.

The results show a significant ICT skills level for PdBP participants being essential nowadays in order to process and critically evaluate web information as pointed out by Kuiper, Volman, and Terwell (2008) and Gerjets and Hellenthal-Schorr (2008).

Job expectations

The improvement on ICT skills should be highlighted, as it becomes an important fact once interrelated with other data and interpreted in a bigger context than the purely educational. Thus, if the vision of the project’s impact is widened and it is tried to foresee the long and medium term consequences, it is estimated that skills in new technologies will be the utmost important items in students’ future professional lives. This fact is backed up by the present data on the Spanish job market. According to *Infoempleo Report 2007* (2007), which analyses –through more than 250.000 job offers published in printed press and websites alike– the links between academic education and job market: 91% of companies ask university graduates for knowledge in computer science, and 81% of companies do it with lesser degree students. Therefore, new skills

such as creating a text document, looking for information in databases or using e-mail, have become basic functions that most companies need.

Besides the mentioned ICT skills, the results of this investigation also show that other abilities have been acquired –such as the ability to successfully collaborate with classmates, team building, and communication–. These abilities have a significant impact when it comes to the needs of the professional world. In this way, although the introduction of ICT does not have a major effect on academic results, is important to remember that extra-curricular factors are the ones highlighted and positively valued by the educators interviewed during the research. In fact, the research group did not focus on the professional impact at first, and it was the different agents’ insights which brought this subject to attention. In this sense, it is convenient to dig deeper into the consequences related to the professional world in future studies in accordance with Ben Youssef and Dahmani (2008).

Interpersonal effects: Relationships between educational community agents

The different results observed on an interpersonal level show that the development of an ICT project in an educational community can produce positive changes in the relationships between its agents: students, teachers and families.

Students and teachers

One of the research evidence is that students interact differently within the classroom, both with teachers and with other students. The possibilities offered by ICT tools –Internet, e-mail, office software, etc.– grant new ways of mutual communication, and as a consequence, new relationships, according to Palomo, Ruiz, and Sanchez (2006). In addition, the results show that teaching staff noticed increased collaboration and interaction between classmates since the integration of new technologies and they pointed that this exploits students’ knowledge and skills.

It can be stated that the interactions generated by the Project foster a learning climate of equality and collaboration between peers. The teaching staff even encouraged students to take the initiative in various classroom activities, being consistent with the findings by Alonso and Gallego (2002) in their analysis of ICT integration in schools. In the same way, researchers in *Apple Classroom of Tomorrow* project (Sandholtz, Ringstaff, & Dwyer, 1997) observed that students were not used to asking their peers for help initially and quickly took preference to teaching-learning methodologies which require an active participation instead of a passive one. Once the students feel that they have more responsibility over their learning process, their sense of involvement grows. This exchanged role between teachers and students changes their relationships, which is a relevant key in the educative context, as well as several reports advocate (Kendall, Cullen, White, & Kinder, 2001; McLean, 2003; Riley & Rustique-Forrer, 2002).

Students and families

Similar situations can be observed in families' lives in which children stop asking their parents for help and include parents who need their children's advice about new technologies; a conclusion that has also been reached by Amorós, Buxarrais, and Casas (2002) and Naval, Sádaba, and Bringué (2003).

Consequently, the introduction of ICT becomes an ideal reason to create new communication channels between parents and children, a deduction also backed by the previously mentioned studies. This is of the utmost importance as communication is the first and most necessary step to get parents involved in their children's education (National Research Council Institute of Medicine [NRCIM], 2003).

To active the parental participation is crucial that they become involved in the school's projects such as this one. These way children are benefited by their parents' involvement, as it has often been argued by

Epstein (1996) or NRCIM (2003). However, in the project studied, communication between school and parents seems like one of the most sought-after factors by parents. They voiced this opinion in the focus-groups although, as it has been mentioned, they also expressed their satisfaction with this project.

Consequently, children perceive the approbation and thrill from their parents towards the project, which increases their own motivation. This motivation is one of the factors that help to decrease absenteeism in schools, as also mentioned by Gettinger and Guetschow (1998), who found a lower abandonment rate in schools where there was a high level of parents' involvement.

Certainly there is a growing number of investigations that show that students' academic results improve when parents participate in the schools' activities (Jeynes, 2003; Lawson, 2003), but others, such as Stewart (2008), have debunked this theory. Nevertheless, it was observed that communication between parents and children is indeed significant in academic achievement. Therefore, increased communication in the familiar nucleus—in which ICT act as a pretext—, can be considered a positive consequence of the project.

Another investigation that emphasizes the families' and teachers' roles is one of Gallego and Alonso (1999) who argue that the starting point of ICT incorporation in school can be found in Parents' Associations and school boards. All these agents must advance together in order to smooth out the process.

Teaching staff and school

The old individualism used to characterise this profession has evolved into a collaborative climate between colleagues, and the studied schools of this project are no exception. Thus, teamwork has become a professional need as Perrenoud (2004) claims in his book *Diez nuevas competencias para enseñar*. On an institutional level, these requirements can be found as well in the Andalus Teacher Continuing Training Plan

(1992) or Delors report (Delors, 1996). Nevertheless, there are still many teachers working in isolation, and in these cases, the introduction of ICT at schools could help them to connect with each other (Wiske, Sick, & Wirsig, 2001). This study shows that, during the Project development, communication and collaboration between professionals have increased, reaching the conclusion that its influence is positive as it promotes two essential values: trust and sharing didactical products.

According to the results observed in this research, involvement of teaching staff in this project is obvious; this is probably one of the reasons why the increase in commitment has been received by the teachers as an opportunity –to increase the quality of their work, upgrade their knowledge, etc.– instead of perceiving it as a burden or obligation. Other studies have also observed an increase in teachers' motivation due to the introduction of ICT – as Somekh et al. (2002) report–. This positive attitude is one of the requirements mentioned by Cabero, Duarte, and Barroso (1997) for the successful introduction of ICT in schools and for the creation of positive dynamics between teachers, which surely will have repercussions in whole educational community.

PdBP has become a strategy to accomplish with some authors such as Zhao (2010) have identified as school knowledge management.

Conclusion

This study evidences the fact that an educational innovation project supported by ICT causes changes in students' and teachers' roles. Thus, new emerging habits and routines promote teachers' lifelong learning and become relevant for students to face future professional challenges as they acquire technological skills and teamwork abilities, as well as other professional advantages.

As exposed, there are changes in the relationships and interpersonal communication at almost all levels of the educational

community. These changes bring new dynamics and strengthen the relationships between all community agents.

Similarly, it has been agreed that the project has become a source of motivation, in which all involved actors took part for their own further development. This compromise towards a common goal has been used to improve the existing relationship dynamics of the educational community.

Evaluating what has been explained, it would be necessary to ponder something relevant about the main causes of the socio-pedagogical effects of the projects observed in this research. Is the ICT development the catalyst of attitudinal and relational changes? Or is it the participation on a common project – regardless of the subject – that has moved agents to get involved and interact in differently?

Finally, we reassert the need to face global investigations from a holistic systematic vision that aims to analyze how technology is integrated in real educational contexts and groups. The same way new research lines are needed to answer how these tools can be used to generate new pedagogy, relational, motivational, learning and communication dynamics between all actors of the educational community –including both curricular aspects and those that, although may be further from the academic field, may have a direct involvement in the social context–.

Acknowledgments

This journal article is carried out thanks to the Innovation, Universities and Enterprise Department's Committee for Research of the Generalitat de Catalunya and the European Social Fund by awarding scholarships (Refs.: 2010FI-B100065 and 2010FI-B100224) and the Social Pedagogy and Information and Communication Technologies research group (PSITIC) consolidated by the Catalan Government (Ref.: 2009-SGR-482). This research has been financed by the Amancio Ortega Foundation.

References

- Alonso, C., & Gallego, D. (2002). Tecnologías de la información y la comunicación. *Revista de educación*, 329, 181-206. Madrid: UNED.
- Alumnia, E. (2009). La Escuela 2.0 es mucho más que un portátil por alumno. *Tecnología y Educación*, 2, 14-16.
- Amorós, P., Buxarrais, M.R., & Casas, F. (2002). *Les tecnologies de la informació i la comunicació en la vida de nois i noies de 12 a 16 anys*. Barcelona: Consorci Institut d'infància i mon urbà CIIMU.
- Anantatmula, V. S., & Stankosky, M. (2008). KM criteria for different types of organisations. *International Journal of Knowledge and Learning*, 4(1), 18-35.
- Badilla, M. G., Cortada, M., & Riera, J. (2011). Internet navigation and information search strategies. How do children are influenced by their participation in the Ponte dos Brozos Project. *International Journal of Technology and Design Education*. doi: 10.1007/s10798-011-9158-4.
- Ben Youssef, A., & Dahmani, M. (2008). The impact of ICT on student performance in higher education: Direct effects, indirect effects and organisational change. *Revista de Universitat y Sociedad del Conocimiento*, 5(1), 45-56.
- Bisquerra, R. (2004). *Métodología de la investigación educativa*. Madrid: La Muralla.
- Boletín Oficial de la Junta de Andalucía (1992). *Decreto Plan Andaluz de Formación Permanente del Profesorado. 164/1992 (Vol. 110)*. Retrieved from <http://www.juntadeandalucia.es/boja/boletines/1992/110/d/21.html>
- Boletín Oficial del Estado (2006). *Ley Orgánica de Educación. 106/2006 (Vol. 2)*. Retrieved from <http://www.boe.es/boe/dias/2006/05/04/pdfs/A17158-17207.pdf>
- Broc, M. A. (2006). Motivación y rendimiento académico en alumnos de educación secundaria obligatoria y bachillerato LOGSE. *Revista de Educación*, 340, 379-414.
- Cabero, J., Duarte, A., & Barroso, J. (1997). La piedra angular para la incorporación de los medios audiovisuales, informáticos y nuevas tecnologías en los contextos educativos: la formación y el perfeccionamiento del profesorado. *Edutec: Revista electrónica de tecnología educativa*, 8. Retrieved from <http://www.uib.es/depart/gte/edutece-e/revelec8/revelec8.html>
- Castells, M., Tubella, I., Sigalés, C., Mominó, J. M., & Meneses, J. (2007). *L'escola a la societat xarxa: Internet a l'educació primària i secundària* (Vol. 1). Barcelona: Publicacions UOC, IN3.
- Cebrián, M., & Ruiz, J. (2008). Impacto producido por el proyecto de centros TIC en CEIP e IES de Andalucía desde la opinión de docentes. *Pixel-Bit: Revista de medios y educación*, 31, 141-154.
- Cortada, M., Badilla, M. G., & Riera, J. (2010). Teachers perception about their training process through the Eduticom model using interactive whiteboard. *International Journal of Teaching and Case Studies*, 2, 288-300.
- Cuban, L. (1986). *Teachers and machines: the classroom use of technology since 1920*. New York: Teachers College Press.
- Daly, C., Pachler, N., & Pelletier, C. (2009). *Continuing Professional Development in ICT for Teachers: A literature review*. Coventry: BECTA. Retrieved from http://partners.becta.org.uk/upload-dir/downloads/continuing_cpd_ict.pdf
- Delors, J. (1996). *Learning: The Treasure Within. Report to UNESCO of the International Commission on Education for the Twenty-first Century*. Paris: United Nations Educational Science, and Cultural Organization.
- Epstein, J. L. (1996). Perspectives and previews on research and policy for school, family, and community partnerships. In Booth, A., & Dunn, J. F. (Eds.), *Family-Schools links: How do they affect educational outcomes?* (pp. 209-246). Mahwah, New Jersey: Lawrence Erlbaum Associates.
- Escudero, J. M. (1998). Consideraciones y propuestas sobre la formación permanente del profesorado. *Revista de Educación*, 317, 11-29.
- Fundación Amancio Ortega (2001). *Proyecto Ponte dos Brozos: Un proyecto educativo*. Retrieved from <http://ppdb.faoortega.org/proyecto.htm>
- Gallego, D., & Alonso, C. (1999). *El ordenador como recurso didáctico*. Madrid: UNED.
- Gallo P., Lozano L. M., & García E. (2000). Relación entre motivación y aprendizaje. *Psicothema*, 12(2), 344-347.
- Gerjets, P., & Hellenenthal-Schorr, T. (2008). Competent information search in the World Wide Web: Development and evaluation of a web training for pupils. *Computers in Human Behavior*, 24(3), 693-715.
- Gettinger, M., & Guetschow, K. W. (1998). Parental involvement in schools: Parent and teacher perceptions of roles, efficacy and op-

- portunities. *Journal of Research and Development in Education*, 32(1), 38-52.
- Higgins, S. (2003). *Does ICT improve learning and teaching in schools?* Nottingham: British Educational Research Association. Retrieved from <http://www.bera.ac.uk/files/reviews/ict-pur-mb-r-f-p-1aug03.pdf>
- Jeynes, W. H. (2003). A meta-analysis: The effects of parental involvement on minority children's academic achievement. *Education and Urban Society*, 35(2), 202-218.
- Kendall, S., Cullen, M., White, R., & Kinder, K. (2001). *The delivery of the curriculum to disengaged young people in Scotland*. Slough: National Foundation for Educational Research.
- Kirkpatrick H., & Cuban, L. (1998). Computers Make Kids Smarter-Right? *Technos Quarterly*, 7(2). Retrieved from http://www.ait.net/technos/tq_07/2cuban.php.
- Kuiper, E., Volman, M., & Terwel, J. (2008). Integrating critical Web skills and content knowledge: Development and evaluation of a 5th grade educational program. *Computers in Human Behavior*, 24(3), 666-692.
- Kulik, J. (1994). Meta-analytic studies of findings on computer-based instruction. In E. L. Baker, and H. F. O'Neil (Eds.), *Technology assessment in education and training* (Vol. 1, pp. 9-33). Hillsdale, NJ, USA: Lawrence Erlbaum.
- Lawson, M. A. (2003). School-family relations in context: Parent and teacher perceptions of parent involvement. *Urban Education*, 38(1), 77-133.
- Leuven, E., Lindahl, M., Oosterbeek, H., & Web-bink, D. (2004). The Effect of Extra Funding for Disadvantaged Pupils on Achievement. *IZA Discussion Paper*, 1122. Bonn: Institute for the Study of Labor.
- Marcelo, C., & Estebanz, A. (1999). Cultura Escolar y cultura profesional: los dilemas del cambio. *Revista Educar*, 24, 47-147.
- Martínez, M. E. (2006). Políticas autonómicas para la integración de las TIC en centros educativos. *Revista Latinoamericana de Tecnología Educativa*, 5(2), 97-112.
- McLean, A. (2003). *The motivated school*. London: Paul Chapman Publishing.
- Ministerio de Educación y Ciencia (2007). *Las tecnologías de la información y de la comunicación en la educación: Informe sobre la implantación y el uso de las TIC en los centros docentes de educación primaria y secundaria (curso 2005-2006)* (NIPO: 651-07-143-X). Madrid: Instituto de Evaluación y Asesoramiento Educativo, Neturity & Fundación Germán Sánchez Ruipérez.
- Ministerio de Educación (2011a). *III Congreso Escuela 2.0. Granada 6, 7 y 8 de Octubre de 2011*. Retrieved from <http://www.ite.educacion.es/es/escuela-20/iii-congreso-escuela-20>
- Ministerio de Educación (2011b, May 27). *Aprobados los criterios de distribución de 91 millones de euros para el desarrollo del Programa Escuela 2.0*. Madrid. Retrieved from <http://www.educacion.gob.es/horizontales/prrensa/notas/2011/05/escuela20-consejo.html>
- Naval, C., Sábada, Ch., & Bringué, X. (2003). *Impacto de las tecnologías de la información y la comunicación (TIC) en las relaciones sociales de los jóvenes navarros*. Pamplona: Gobierno de Navarra. Instituto Navarro de Deporte y Juventud.
- National Council for Educational Technology (1994). *ILS: Integrated Learning Systems. A report of the pilot evaluation of ILS in the UK*. Coventry: NCET.
- National Council for Educational Technology (1996). *Integrated Learning Systems: A report of phase II of the pilot evaluation of ILS in the UK*. Coventry: NCET.
- National Research Council Institute of Medicine. (2003). *Engaging schools: Fostering high school students motivation to learn*. Washington: National Academies Press. Retrieved from <http://www.nap.edu/openbook/0309084350/html/R1.html>
- Palomo, R., Ruiz, J., & Sánchez, J. (2006). *Las TIC como agentes de innovación educativa*. Sevilla: Consejería de Educación de la Junta de Andalucía.
- Passey, D., Rogers, C., Machell J., & McHugh, G. (2004). *The Motivational Effect of ICT on Pupils* (Research Report 523). London: Lancaster University, Department for Education and Skills.
- Riley, K., & Rustique-Forrester, E. (2002). *Working with disaffected students: Why students lose interest in school and what we can do about it*. London: Paul Chapman Publishing.
- Sandholtz, J., Ringstaff, C., & Dwyer, D. (1997). *Teaching with Technology: Creating Student-Centered Classrooms*. New York: Teachers College Press.
- Smeets, E. (2005). Does ICT contribute to powerful learning environments in primary education? *Computers & Education*, 44(3), 343-355.
- Somekh, B., Lewin, C., Mavers, D., Fisher, T., Harrison, C., & Haw, K. (2002). *Impact 2 -*

- Pupils' and teachers' perceptions of ICT in the home, school and community*. Coventry: BECTA, Department for Education and Skills.
- Stewart, E. B. (2008). School structural characteristics, student effort, peer associations, and parental involvement: The influence of school and individual-level factors on academic achievement. *Education and Urban Society*, 40(2), 179-204.
- Underwood, J., Baguley, T., Banyard, P., Dillon, G., Farrington-Flint, L., Hayes, M., & Le Geyt, G. (2010). *Understanding the Impact of Technology: Learner and School level factors*. Coventry: BECTA. Retrieved from http://archive.teachfind.com/becta/research/becta.org.uk/uploaddir/downloads/page_documents/research/understanding_impact_technology_learner_school_level_factors.pdf
- Wiske, M., Sick, M., & Wirsig, S. (2001). New technologies to support teaching for understanding. *International Journal of Educational Research*, 35, 483-501.
- Wood, D. (1998). *The UK ILS Evaluations: Final Report*. Coventry: BECTA.
- Zhao, J. (2010). School knowledge management framework and strategies: The new perspective on teacher professional development. *Computers in Human Behavior*, 26(2), 168-175.