SECTION: ARTICLES

Pupils' representations about the curricular integration of ICT in primary school education

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Abstract

This article is a summation of a broader research project carried out for a PhD thesis, which investigated the potential and limits of the implementation of Information and Communication Technology (ICT) as a cross-subject educational area. The study was undertaken using a qualitative methodology, compatible with the phenomenological approach, which aimed to capture the meaning that a group of primary school pupils attributed to an integrated educational experience based on the involvement of teachers of different school subjects. Hence, the content of interviews with the pupils was analysed, which gave rise to their representations about the experience and their ideas on the topic, including a set of suggestions for making improvements. The conclusion arrived at is that despite the importance attributed to ICT as a cross-subject educational area, the curricular model based on a framework of subjects is a difficult paradigm to break, even by the pupils, who do not reject the possibility of retaining a specific time and space to learn about the technology.

Keywords

ICT – Integrated education – Transversal skills – Pupils – Representations.

Introduction

In recent years, the issue of the curricular integration of Information and Communication Technology (ICT) has been the object of abundant pedagogical experiences, intervention projects and/or small or large-scale research. At the same time, it has been a huge challenge for educational policy, starting with the scope of action of the school curriculum decision makers and reformers (VANDERLINDE; VAN BRAAK, 2010; AESAERT et al., 2013). On top of this backdrop, there is a problem regarding the ICT identity crisis, which is clearly reflected in the proliferation of initiatives outlined in educational policy

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involving expressions, goals and conceptions, which are seldom aligned with the most recent thinking about the functions that the technology may carry out in the act of learning itself (CRUZ; COSTA; RODRIGUEZ, 2014). Effectively, as Çapuk points out (2015), in contrast to what happens with the traditional curricular subjects, like mathematics, the mother language and history, ICT not only does not have a guaranteed slot in the school curriculum, but it is also the object of several different learning approaches, ranging from more objectivist visions to more constructivist ideas.

Among the many attempts tried and experimented all over the world (VANDERLINDE; VAN BRAAK, 2011; VANDERLINDE; AESAERT; VAN BRAAK, 2014), our attention focuses on the Portuguese context. The following pages present a study carried out as part of a broader research project, funded by the Science and Technology Foundation (SFRH/BD/68461/2010), within the scope of a PhD programme in education at the Instituto de Educação da Universidade de Lisboa (CRUZ, 2015).

Based on a qualitative methodology, compatible with the phenomenological approach, this study intends to relate the meaning that a group of primary school pupils attributed to an integrated education experience[2], involving teachers of several subjects in the conception and implementation of learning scenarios considered appropriate for the mobilisation and development of the skills outlined in the Proposed Transversal Integration of ICT into the Curriculum (PCIT-TIC), produced by the Ministry of Education in 2010, within the scope of the Learning Targets Project.

In this background, the ICT concept is mobilised here not from the point of view of educational computer studies, as a pedagogical resource to be used by the teachers, but as a component of teaching integrated into primary education as a whole[3], which was a concept introduced in Portugal in 2001 as an area of education that crosses all subjects and that was reaffirmed, almost a decade later, upon the launch of the PCIT-TIC. From the curricular point of view, it is a perspective that emphasises *learning with technology* (JONASSEN, 2007) in all the curricular areas (subjects and non-subjects), instead of *learning about technology* or even the *teaching of the technology*, which is generally restricted to activities carried out in computer laboratories with the aid of professionals trained in the area.

Before delving into the results found, we present an essential part of the background to the study, giving a necessarily brief description of the PCIT-TIC, but which is sufficiently detailed to point out the aspects we deem crucial to better understand the topic under analysis. We also describe the methods used in the research in some detail, clarifying the approach we adopted, the context in which the study was carried out, the profile of the pupils that took part in it and the procedures used to gather, analyse and process the data.

Description of the PCIT-TIC

2- The work systematising the implementation of pedagogical methods of curricular integrations, by Guimarães, Pombo and Levy (1994), is extremely enlightening with regard to the diversity of possibilities for the implementation of integrated education situations.

3- In Portugal, primary education is universal, compulsory and free and is divided into three sequential teaching cycles, which covers the first nine years of formal schooling and the age group from six to fourteen years old. The 1st cycle lasts four school years (1st to 4th year), the 2nd cycle two years (5th and 6th years) and the 3rd cycle three school years (7th to 9th years).

The Proposed Transversal Integration of ICT into the Curriculum (PCIT-TIC) produced by the Ministry of Education in Portugal in 2010, within the scope of the Learning Targets Project (COSTA, 2010), is a non-regulatory official curricular document, which reinforces the principle of that ICT should be transversally present in the school curriculum, consecrated in 2001 as part of the curricular reorganisation of primary education. It comprises two kinds of complementary documents, both considered curricular management tools to help the work of teachers: a framework of Learning Targets (MA) and a set of Examples of Teaching and Assessment Strategies (EEEA). The Learning Targets framework was implemented through the establishment of parameters that define the scaled ICT learning targets for primary education, including the definition of the final targets, to be achieved by the end of each school cycle, and the intermediate targets, to be reached in a progressive form in each cycle.

From an operational point of view, the Learning Targets framework was organised and structured around four areas of transversal skills in ICT: information, communication, production and security (COSTA, 2010; COSTA et al., 2012; CRUZ; COSTA; FRADÃO, 2012). These skills, as well as being able to be developed in all the curricular areas, simultaneously involve the integration of several cognitive and technological capacities, but also ethical, aesthetic, social, metacognitive and organisational competencies among other capacities. For a global vision of the learning progress planned in the ICT area, Table 1 outlines the final targets defined for the three cycles of primary education.

Table 1 – Final learning targets of ICT defined for primary education

	1st cycle (4th year)	2nd cycle (6th year)	3rd cycle (9th year)
Information	The pupil uses online and offline digital resources to search for, select and process information, in accordance with the objectives and the guidelines defined by the teacher.	The pupil uses online and offline digital resources, with the support of the teacher, to search for, select and process information in accordance with specific objectives and criteria of quality and pertinence.	The pupil uses online and offline digital resources to search for, select and process information in accordance with specific objectives, deriving from previously identified questions and problems and with criteria of quality and pertinence.
Communication	The pupil communicates and interacts with other people, and with the teacher's support uses synchronous and asynchronous communication tools in compliance with the underlying rules of conduct.	The pupil communicates, interacts and collaborates with other people, using network tools and communication environments, selected with the help of the teacher, as an individual and collective learning strategy.	The pupil communicates, interacts and collaborates with other people, using network tools and communication environments, selected in accordance with the respective potential and constraints, as an individual and collective learning strategy.
Production	With the support and guidance of the teacher the pupil does school assignments using the digital tools provided to represent knowledge, ideas and feelings.	With the support and guidance of the teacher the pupil designs and does school assignments using different digital tools, to express and represent knowledge, ideas and feelings.	The pupil designs and does school assignments using different digital tools, and creates original documents that express and represent knowledge, ideas and feelings.
Security	The pupil adopts basic behaviours of security when using the digital tools supplied, respecting copyright.	The pupil adopts secure behaviours, respects copyright and intellectual property, and complies with rules of conduct in online digital environments.	The pupil adopts secure behaviours, respecting copyright and intellectual property, and complying with rules of conduct in online digital environments.

Source: Cruz; Costa; Fradão, 2012, p. 26.

As can be seen in Table 1, the implementation of the final targets reflects a growing complexity from cycle to cycle, especially as regards the level of mastery of the digital tools, as well as in relation to the cognitive and metacognitive resources that the pupils should mobilise. For example, by the end of the 1st cycle pupils are expected to use a variety of tools and digital resources with several purposes, albeit still with the close support of the teacher. By the end of the 3rd cycle, the pupils are expected to have acquired more independence in using digital resources, selecting the most appropriate tools for the respective learning objectives by themselves. To build a framework based enabling the teachers to have a basis for a richer questioning suitable for the curricular demands outlined in the Learning Targets framework, nine EEEA were designed and provided, three for each primary education cycle in Portugal. Such examples, as well as being illustrative of sequences of learning activities and assessment devices to achieve some of the targets outlined for the ICT area, also aim to shed light on and clarify the logic of connection that presided over the definition of the targets (CRUZ; COSTA; FRADÃO, 2012, p. 26). Therefore, each of the strategies produced arises from one or more subject areas and involves, predominantly, more than four transversal skills in ICT, highlighting the articulation between the different areas of skills so characteristic of the proposal presented.

As briefly as possible, we present some of the characteristics of the examples of the strategies provided to support the implementation of the Learning Targets framework in Table 2, highlighting precisely the principle of articulation between the different domains, as well as the learning purpose inherent to three of the nine EEEA that we selected to present in this text.

Table 2 – Brief description of three EEEA that are part of the PCIT-TIC

My family's past and the present: strategy designed for the 1st cycle of primary education as an illustrative example of the articulated development of three areas of transversal ICT skills (information, production and security), also bringing into play content from the environmental studies and Portuguese language subjects. The purpose of this strategy is to stimulate the pupils to analyse the changes that have occurred in society, identifying changes and/or things that have remained the same in certain areas/social activities.
Our favourite sports: strategy designed for the 2nd cycle of primary education as an illustrative example of the articulated development of the four areas of transversal ICT skills (information, communication, production and security), also involving the integrated development of foreign language learning skills (e.g. English). The purpose of this strategy is to stimulate the pupils to produce a text in a foreign language about their favourite sports, using data obtained from internet searches, the results of which can be presented in the school newspaper or class blog/ school webpage.
Us and the internet, statistically speaking: strategy designed for the 3rd cycle of primary education as an illustrative example of the articulated development of three areas of transversal ICT skills (information, production and security), also involving the integrated development of mathematics skills. The purpose of this strategy is to raise awareness among the pupils of how the internet is used by themselves and their colleagues, through an assignment that requires the compilation and application of a questionnaire, the responses to which will be the analysed and statistically processed.

Source: adapted from Cruz, Costa, Fradão (2012, p. 29-31).

This section briefly highlights that the purpose of the last PCIT-TIC is to serve as guidance for all the parties involved in the educational process, especially teachers and educators. In the background of the pedagogical, curricular and organisational decisions

of each school, the PCIT-TIC paves the way to build a guided intervention to improve the teaching and learning processes.

Methodology

Research approach

As mentioned at the start, this study, of a qualitative nature, is part of a broader research project compatible with the phenomenological approach, in which it is assumed that "neither objects, people, situations or events are endowed with their own meaning; instead of this, a meaning is attributed to them" (FLICK, 2005, p. 55). Rejecting conceptions and research techniques in which the reality is taken as a given worldly object, with its own existence regardless of who studies it, we base our work on the understanding, as suggested by Bourdieu (1996), that all the social universes tend to offer material or symbolic gains, at different degrees, for the work of apprehending and construction of the real (the object to be known), influencing the definition of our categories of analysis and the very way we approach educational problems.

It is a stance, however, that does not entail rejecting the objective conditions of human knowledge, and does not exempt the researcher from scientific responsibility in the process of building the possible truth, which Deschenaux and Laflamme (2007), Mialaret (2009) and many others have spoken about, upon reflecting on the conditions, the types and the pertinence of the knowledge produced in the field of education. As such, we opt to follow a multiple triangulation pathway (DENZIN, 2009) in articulation with certain principles of data-based theory (STRAUSS; CORBIN, 1998; GLASER; STRAUSS, 2006; CHARMAZ, 2009).

It is along these lines of methodological thinking that we present the study herein, specifically carried out with the aim of finding the meaning attributed by a group of primary school pupils to an innovative pedagogical experience, consisting of the involvement of teachers from several school subjects in the conception and implementation of learning scenarios considered appropriate for the mobilisation and development of transversal ICT skills, defined in the PCIT-TIC within the scope of the Learning Targets Project (2010).

Context in which the study was carried out

The study was carried out in a head school of a vertical school group from Cascais council, which had 818 pupils attending the 2nd and 3rd cycles of primary education and secondary education. Aimed at providing a high-quality educational service, the school management channelled their efforts to solutions that aimed to allow an improvement in the quality of the pupils' learning, on the one hand, and the perfecting of the pedagogical work of each teacher on the other hand.

According to the documentation consulted, the school management policy was based on the delegation of powers and responsibilities among various bodies and structures of the school, with a strong emphasis on the development of a climate favourable to change

and curricular innovation. This emphasis, which was explicitly outlined to us during informal conversations we had with school administrators, has been put into practice through the implementation of initiatives with a view to the promotion of collaborative work among the intermediate pedagogical structures, especially within the scope of the subject groups. One of these initiatives translated, for example, into the creation of a ninety-minute period in the teachers' timetable in which each subject group could be managed in a more flexible manner.

As for the school's willingness to use technology in the teaching, we noted that on the date the study was carried out the school had a total of ninety computers (desktop and laptops). Of these, a considerable percentage of them were located in areas with no internet connection (27%) and most of the teachers were unaware about the availability of a high number of these computers, namely sixteen Magalhães laptops4. Taking into account the total number of computers in the classrooms with connection to the internet (only 43 computers), and the number of pupils in the school (n= 818), we concluded that in the academic year of 2012/2013, when we carried our study, the pupil/computer ratio was 19.02, i.e. there was one computer for around 19 pupils.

As well as this circumstance, apparently a hindrance to the possibility of transversal integration of ICT, the school does not have any ICT plan of action in place to encourage and facilitate the use of the resources available in the academic activities. In practice, although the school administrators showed themselves to be in full agreement with the idea of using technology as an essential support to improve the teaching and learning processes, there seemed to be a leaning towards the preservation of the existing resources to carry out the work required for the ICT subject.

These were the circumstances in which, during the 2012/13 academic year, we monitored a group of fourteen teachers who accepted the challenge to (re)think about the organisation of the learning processes with the goal of implementing the PCIT-TIC, designing and implementing integrated teaching plans to stimulate the development of transversal ICT skills in several different subjects (mathematics-M, natural sciences-CN, French-F, visual education-EV, history-H, Portuguese Language-LP and think, explore and construct-PEC) and non-subject areas (personalised pedagogical support-APP).

Participants in the study

To carry out the study, a 7th-year class comprising 21 pupils took part, broken down into thirteen girls (62%) and eight boys (38%), aged between ten and fourteen years old, with an average age of twelve. The class included two pupils with permanent special educational needs. It also included three pupils who had failed previous years and four pupils with serious health problems, namely hyperactivity, kidney impairment, a spine injury and a brain tumour, which the teachers believed hindered the learning process.

4- The Magalhães is a laptop computer specially designed for children from six to eight years of age, which was introduced into the 1st cycle of Portuguese primary schools in the academic year of 2008/09 as part of the *e-Escolinha* initiative, within the scope of the Education Technological Plan defined by the 17th Constitutional Government of Portugal (2005-2009).

According to the profile of the class, as drawn up by the respective class council, we are talking about a "friendly, interested and participative class, but also one that lacks concentration and sometimes takes part in a disorganised manner, often chatting in the classroom about subjects unrelated to the lessons. [...] Most of the pupils do not have study habits, so they do not consolidate the knowledge and skills, leaving gaps in knowledge that are more obvious in some subjects than in others." In general, the average level of learning of the class on a scale from one to five was around three. In the second period, for example, only 10% obtained a mark over four, but without surpassing 4.5. Despite the difficulties detected by the class council, the teachers believed that the work carried out in the classroom could lead to profitable results, especially because the group had several kinds of pedagogical support (collective, personalised and specialised), to ensure the best learning conditions for the pupils who had the biggest difficulties.

Procedures for data collection, analysis and processing

To achieve our objectives, we decided to individually interview all the pupils. To do so, we followed an interview layout split into five different moments:

1st moment: contextualisation of the research;

2nd moment: collection of data about the ICT learning achieved, through structured answer questions, comprising eight items with a five-point Likert scale to classify the ICT skill level achieved;

3rd moment: collection of data about the meaning of the learning situations specifically set to develop the transversal ICT skills, through structured answer questions using a five-point scale to classify the importance of the work carried out in each the subjects involved in the intervention;

4th moment: collection of data about aspects that can influence the effort the pupils put into the school assignments that involve the use of digital technology, through non-structured questions that look to elaborate on the answers given by the pupils in the previous moments (e.g. "Why do you think subject x was more important for the development of the ICT skills than subject y? If I asked you to highlight an activity, which one would it be? Why? And what about the opposite? What activity least interested you? Why?");

5th moment: end of the interview, thanking the collaboration of the pupils and reiterating the importance of their opinions to complete this study.

Among the 21 pupils who took part in the study, nineteen were interviewed between 4 and 11 June 2013 at the school itself. This task was carried out only after duly obtaining permission to collect the data intended from the educational guardians, guaranteeing protection of the participants' identity whereby the pupils would remain anonymous when processing the data.

Each interview lasted 25 minutes on average, varying between fourteen and fifty minutes. They all began with the respective explanation of the context through the presentation of a concept map drawn up specifically for this purpose. Seeking to maintain a climate of fluid communication which was as natural as possible, the sequence of closed

questions (moments 2 and 3) was followed by a sequence of open or semi-structured questions (moment 4). The open questions which aimed to elaborate on certain aspects experienced by the interviewees were asked put to the pupils through an articulated and logical sequence of interactions established between the researcher and interviewees.

The interview recordings were transcribed immediately, but the data was systematically analysed only after the final interview. To analyse the content of the interviews, we used strategies and reduction techniques on the text collated, aiming in the final instance to "understand a text, drawing up and attributing categories" (FLICK, 2005, p. 183). Using the Weft Qualitative Data Analysis (QDA) programme and following the guidelines for analysis of the texts in line with data-based theory, the analysis began with open coding, a technique defined as an "analytical process through which the concepts, properties and dimensions are identified that emerge from the data" (STRAUSS; CORBIN, 1998, p. 101).

In practice, the first concepts we identify translated into dozens of codes attributed to units of meaning, which we expressed in words that were as close as possible to the expressions used by the interviewees (in vivo codes). The next step, although not necessarily sequential, consists of separating and grouping the first codes resulting from the open coding technique, in accordance with semantic criteria (meaning). This procedure, which following data-based theory corresponds to axial coding, translated into the reorganisation and reworking of the initial codes, naturally leading to the reduction of data through the establishment of relations between two or more codes in the formulation of new categories, progressively and continually refined throughout the analysis and interpretation of the data.

The next step involved the *objective* organisation of the results using frequency distribution charts – both absolute (FA) and relative (FR) – of the registry units (UR) through categories and subcategories. From the results found, we point out three analytical axes in the following section, recounting the pupils' representations with regard to the possible transversal integration of ICT, the aspects that triggered the highest levels of satisfaction in using the digital technology and the action-intervention axes to bring about improvement in the future.

Results

Curricular integration of ICT from a transversal perspective

Asked to opt between using technology across all subjects and using technology only in the ICT subject, many of the pupils said without hesitation that they would opt for "using the technology in all the subjects". When asked to elaborate, they said that "pupils today work a lot with the computer" and that the quality of the learning could improve if they could take advantage of the technology in the subjects, especially in the subjects where they experienced more difficulties ("in spite of hating mathematics, of not understanding anything, I think it was good"). With regard to the kind of assignments and activities set and the methodologies used to mobilise the technology, they believed that the curricular transversal integration of ITC comprised "a different way of learning", which some pupils contrasted to the typical image of conventional teaching.

Table 3 – Characteristics of the learning process from the perspective of the transversal use of ICT

	Pupils		UR		Evidence (examples)
	FA	FR	FA	FR	
More productive and efficient	17	89%	51	47%	"I think I develop more than if it was in one subject only"; "writing in the exercise book by hand gives much more work"; "we can search for things better in some subjects that we don't understand very well".
More interesting and motivational	11	58%	26	24%	"We are working with things that we find more interesting"; "it makes the lessons more interesting"; "the pupils put in more effort"; "the material becomes more interesting"; "we concentrate better".
More enjoyable and fun	10	53%	26	24%	"Who doesn't like working with technology?"; "I think it makes the work more enjoyable"; "it also serves to relax us a little"; "it's more enjoyable // cool // fun".
More independent	6	32%	6	6%	"I think it's preferable that we do the reading and the interpreting instead of the teachers explaining things"; "we can learn without the lessons being through the teachers, but instead learn through the technology".
Total = 67 UR					

Key: UR – Registry Units; FA –Absolute Frequency; FR –Relative Frequency

Source: research database, compiled by the author.

In a more objective way, as can be seen in Table 3, what stands out in this new form of learning, according to the pupils interviewed, is the possibility to make the learning process "more independent", "more enjoyable and fun", "more interesting and motivational" and above all, "more productive and efficient". Contrasting the pupils' opinions expressing the importance of the instrumental use of the ICT as resources that can be applied across all areas of the curriculum, it is curious to observe the lack of references about the development of transversal skills in ICT, in an articulated way with the skills worked on in each curricular subject. This means, in truth, that the pupils seem unaware of the ICT learning targets to be achieved progressively in each cycle, placing value only on the potential of the technology for other subjects. Perhaps this is why they believe and advocate the retention of a specific time and space to learn about the technology. In other words, although they admit that it is preferable to use technology in all the subjects, they also believe that the ICT subject in itself is important because it encourages equally significant learning experiences. To justify this point of view, they tend to highlight the opportunities specifically channelled towards the construction of knowledge about computers ("we learn how to work with computers"), as well as the possibility of putting into practice the ICT knowledge acquired in other subject areas ("Look, for example, now we're doing an assignment on a website that we didn't know about, and as we didn't know it, I think it's also cool to present it in the other subjects").

Aspects leading to greater satisfaction in the use of digital technology

The findings show that the learning and the pupils' experience was, overall, very positive. Based on the analysis of the pupils' opinions regarding which activities they thought were the most significant, we aimed to understand the aspects that brought the most satisfaction in using the digital technology in the classroom. As a corollary of the analysis carried out, we understand that this positive assessment of the experiences as recounted by the pupils derived from several aspects of the teaching and learning process that broadly surpassed the idea that the technology can comprise a motivational factor in the learning.

As can be seen in Table 4, the aspects that bring about the most satisfaction in the use of digital technology integrate and articulate "issues of a technological nature", namely the novelty effect and the quantity of tools mobilised by the pupils, and "issues of a didactic-pedagogical nature", especially a set of references that point to a very positive assessment of certain strategies implemented by the teachers, such as the groupwork with specialisation of tasks, the simultaneous presence of teachers from different curricular areas and the support provided by the teachers to the pupils in carrying out their assignments.

Table 4 – Aspects encouraging greater satisfaction in the learning

	UR (Ind./subjects)							UR (Cat.)	
AFFECTIVITY AND COGNITIVE AFFECTIVITY	CN	M	EV	LP	F	PEC	H	FA	FR
Recognition of academic achievement/progress ("I got a good mark", "we developed//I learned more");	7	10	2	4	11	1	11	104	68%
Learning challenge inherent to the activities ("it was more enjoyable//fun", "I did almost everything that I didn't do before");	15	0	0	3	4	0	24		
Effort and attention of the pupils ("[the pupils] paid more attention to their classmates who were talking");	0	6	0	0	0	0	1		
Interest in the content/subject ("I always liked the subject", "I liked the topic").	0	0	0	2	0	0	3		
DIDACTIC-PEDAGOGICAL ISSUES	CN	M	EV	LP	F	PEC	H	FA	FR
Efficacy of the workgroup with specialisation of tasks ("if we were all doing the same thing it would take more time");	9	0	0	0	0	0	0	25	16%
Simultaneous presence of teachers from different areas ("we had several people helping us");	5	0	0	0	0	0	0		
Quality of the support provided by the teacher responsible ("the teacher also helped a bit");	1	3	0	0	0	0	1		
Suitability of the support resources ("the teacher gave some books to us");	0	0	0	0	0	0	4		
Making good use of the curricular time ("we had more time").	0	0	0	0	2	0	0		
TECHNOLOGICAL ISSUES	CN	M	EV	LP	F	PEC	H	FA	FR
Novelty of the tools used by the pupils ("we had never used them before", "we had never spoken through 'chat' services");	0	9	0	0	8	0	0	25	16%
Quantity of tools mobilised ("we used more tools").	8	0	0	0	0	0	0		
								Total = 154 UR	

Key: UR – Registry Units; FA – Absolute Frequency; FR – Relative Frequency; CN – Natural Sciences; M – Mathematics; EV – Visual Education; LP – Portuguese Language; F – French; PEC – Think, Explore and Construct; H – History.

Source: Research database, compiled by the author.

Action-intervention axes to improve in the future

Despite the overriding feeling of great satisfaction with the process implemented and the results achieved, the pupils also recognise that if they could go back in time they would do certain thing differently, and therefore presented some suggestions for change. Specifically, as can be observed in Table 5, a total of 22 improvement actions were implemented that we split into 3 categories and which, within the scope of this analysis, we believe are action-intervention axes for future improvements. Putting the onus (above all) on the action of the teachers, the pupils begin by identifying some aspects that supposedly could have even further stimulated their interest, and explicitly outline fifteen "practices and pedagogical processes" (accounting for 60% of the UR). A second action-intervention, with a very low percentage of references (24% of the UR), according to the pupils would be to improve the "technological equipment and infrastructures" available at the school, especially in the classroom. Finally, a third action-intervention axis for improvement in the future takes us to the field of "learning practices and processes" (16% of the UR), which includes a set of references that to a certain extent reveal the acknowledgement of the importance of the role pupils play and how their attitudes can bring success for everybody.

Looking at the improvement suggestions of the discourses analysed, listed in Table 5, we believe we can extract a set of relevant data for a systematic reflection about the educational reality regarding the use of technology in the classroom. Without wanting to generalise, the evidence gathered shows that the use of technology, as well as not being a common practice in all the subjects, is not always implemented in a coordinated manner among the teachers of the same class. According to the representations analysed, we are left with the idea that the teachers of the different subjects still do not take full advantage of the potential of the technology to, in the words of the pupils, make the lessons more interesting, more fun and more enjoyable, leading to the suggestion to "make more use of the technology to support the teaching processes". Also noticeable, albeit implicitly, is a connection between the technology and the so-called traditional pedagogy, leading the pupils to call, for example, for greater freedom of action in the use of the computers ("Allow the pupils to use the computers in a more active way"). To sum up, it is a situation that points to a set of structural conditions that can made the difference in the processes of integrating ICT into the curriculum as a cross-subject educational area, but which also raise a set of challenges that we believe require deep reflection.

Final considerations

The findings described in this article show that the pupils seem to be receptive and open to the implementation of the PCIT-TIC, acknowledging that the development of transversal ICT skills is a facet of learning that should be valued at school. According to the interviewees, it opens the possibility of making the learning process more independent, enjoyable, interesting and motivational, and above all more productive and efficient. However, the effective and intentional practice for the integrated development of the

Table 5 – Action-intervention axes for improvement in the future

	UR (Sub.)		UR (Cat.)	
PEDAGOGICAL PRACTICES AND PROCESSES	FA	FR	FA	FR
Use the technology in all the subjects on a coordinated way	14	8%	100	60%
Make better use of the technology to support the teaching processes	13	8%		
Allow the pupils to use the computers in a more active way	12	7%		
Provide individualised support to all the pupils (autonomy vs. support)	8	5%		
Stimulate the creation of tutorial dynamics among the pupils	7	4%		
Support the development of work organisation strategies	6	4%		
Respect the doubts and questions raised by the pupils	6	4%		
Ensure the participation of all the pupils in using the computer	6	4%		
Try to understand the limitations of the pupils in using the computer	6	4%		
Work with fewer pupils per class	5	3%		
Create dynamics to allow the material to be learned through playing	5	3%		
Seek the pupils' help in dealing with the technology	4	2%		
Improve the knowledge of teachers and their ICT skills	4	2%		
Diversify the tasks in line with the pupils' needs	2	1%		
Improve knowledge in the different subject areas taught	2	1%		
TECHNOLOGICAL EQUIPMENT AND INFRASTRUCTURES	FA	FR	FA	FR
Supply computers in sufficient number for the pupils	16	10%	41	24%
Provide access to the internet in the classroom	10	6%		
Replace the exercise books/textbooks with computers	8	5%		
Equip the classroom with suitable technological resources (interactive board, projector etc.)	7	4%		
LEARNING PRACTICES AND PROCESSES	FA	FR	FA	FR
Change behaviour/attitudes in the classroom	23	14%	27	16%
Put more effort into the assignments	2	1%		
Improve the self-esteem of the pupils in relation to the learning	2	1%		
				Total = 168 UR

Key: UR-Registry Units; FA-Absolute Frequency; FR-Relative Frequency

Source: Research database, compiled by the author.

transversal ICT skills faces a range of challenges that are not restricted to the problem of the availability of computers and other technological resources, including internet access.

We are talking about challenges that, considering the questions raised by the pupils, require a more lucid and critical commitment by the teachers responsible for their academic learning. They require, namely, greater coordination in the use of technology in all the school subjects, better quality in how it is used to aid the learning, more openness to the active participation of the pupils in the pedagogical activities, a better balance between encouraging the pupil's autonomy and the need to provide individualised support, more incentives to the creation of tutorial dynamics among the pupils, more support for the organisation of the school assignments and more attention and respect for the doubts and questions raised by the pupils. Although the suggestions were mainly in the sphere of the teachers' action, the pupils' experience in this area also contributed to them becoming more aware of the importance of their role towards a transforming educational practice, recognising the need to change their behaviour/attitudes in the classroom, carry out the tasks set with more effort and improve their self-esteem in relation to the learning.

In addition to these challenges, and at a time in which the use of technology arises almost always as an imperative to increase the pupils' motivation, we believe it is important to look at other aspects and characteristics of the teaching and learning processes. Indeed, as the findings of this study show, it is questions of affectivity and the cognitive activity of the pupils who are learning that emerge as the most significant issues in the use of digital technology in the formal learning context.

Seen as a whole, these results point to a conception of pedagogical innovation transmitted in the PCIT-TIC as a highly demanding process, which rather than being confined to individual endeavours, requires a commitment made by all the teachers (of the same class) to create learning environments where the pupils can effectively take on the role of the key players.

Finally, and while fully aware of the limitations of the study carried out, it is possible to conclude that, despite the importance attributed to ICT as a cross-subject educational area, the subject framework curricular model is a difficult paradigm to break. As seen, the pupils themselves do not discard the possibility of setting aside a specific time and space to learn about the technology, highlighting the opportunities that such lessons afford to *learn how to work with computers*.

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