
Pre-service teachers' perceptions and training contributions towards ICT use*

Percepciones y enseñanza del uso de TIC por maestros en formación

M^a CAMINO BUENO-ALASTUEY

Departamento de Ciencias Humanas y de la Educación
Universidad Pública de Navarra
Los Magnolios. Campus de Arrosadía s/n, 31006
Pamplona (España)
camino.bueno@unavarra.es
<https://orcid.org/0000-0001-7027-5382>

Resumen: Investigaciones previas han concluido que las TIC se emplean escasamente en las aulas de Educación Infantil y Primaria debido en parte a una insuficiente formación en TIC. Este estudio explora su uso y la validez de una propuesta de formación basándose en una encuesta completada por dos grupos de estudiantes durante su periodo de prácticas. Los resultados indican un uso más frecuente de herramientas tradicionales que de colaborativas y sugieren que un curso específico de TIC dota al alumnado de un kit de herramientas más amplio, favorece una opinión crítica sobre su uso y genera voluntad de intervención.

Palabras clave: TIC, Percepción, Aprendizaje activo, Formación preparatoria de docentes.

IZASKUN VILLARREAL

Departamento de Ciencias Humanas y de la Educación
Universidad Pública de Navarra
Los Magnolios. Campus de Arrosadía s/n, 31006
Pamplona (España)
izaskun.villarreal@unavarra.es
<https://orcid.org/0000-0002-8196-5968>

Abstract: Previous studies have concluded that ICT are underused in primary and early childhood classrooms partly due to lack of appropriate training. This study explores ICT use and the validity of a training proposal as reported on a survey by two groups of students after their teaching practicum. Results showed traditional technological tools were used more frequently than collaborative tools and suggest that receiving an instructional technology course provided students with a broader toolkit of ICT tools, a more critical opinion of technology use and an increased sense of agency.

Keywords: ICT, Experiential learning, Attitudes, Pre-service teacher education.

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INTRODUCTION

The use of ICT tools has been shown to have many educational benefits (García-Valcárcel, Basilotta and López 2014), contributing to a richer learning experience and environment (Lund, Bakken and Engelién, 2014). However, various barriers to their implementation have also been identified and classified into first-order barriers, which are external and institution-related, and second-order barriers, which are internal and teacher-related (Ertmer, 1999). Governmental and institutional efforts have focused on eliminating the former and, currently, access to technologies is no longer an obstacle for ICT implementation (European Commission, 2019; Suárez-Rodríguez, Almerich, Orellana and Díaz-García, 2018; Wastiau *et al.*, 2013). Nonetheless, second-order barriers still cause reluctance to integrate ICT and need to be overcome (Beltrán-Sánchez, García, Ramírez-Montoya and Tánori, 2019; Ghitis and Alba, 2019). Recent reports have shown that they are not used as extensively as assumed (Almerich, Suárez, Jornet and Orellana 2011; European Commission, 2019) and they are not fully integrated into teaching and learning (Wastiau *et al.*, 2013), especially in the early years (Blackwell, Lauricella and Wartella, 2014; García-Valcárcel *et al.*, 2014; Liu, Toki and Pange, 2014). Nevertheless, ICT use in primary and nursery settings remains under explored.

Insufficient training and support have been mentioned as the sources of failure to integrate technology successfully (Blackwell *et al.*, 2014). Dissatisfaction is often related to the technocentricity of the courses (Liu *et al.*, 2014), the rather conventional applications of technology taught (Albion and Tondeur, 2018), and the lack of pedagogical support for enhanced learning (Blackwell *et al.*, 2014). Furthermore, recent research (Collet-Sabe and Beneyto Seoane, 2018) has pointed out that informal training, such as that provided by peers or colleagues, is more effective than formal training courses. Consequently, there seems to be a need to explore alternatives to traditional ICT training, and employing trainee teachers as models and trainers to create improved training opportunities to maximize ICT integration in schools might be a possibility which should be investigated.

Accordingly, this study seeks to contribute to ongoing research efforts in two directions: first, by exploring how technology is used in early childhood and primary classrooms based on observations, and, secondly, by exploring the effectiveness of using pre-service teachers as appropriate models and ICT trainers for their in-service teacher tutors.

REVIEW OF LITERATURE

Use of technology in early childhood education

The trend indicating that technological tools are available in education but under-used in terms of quantity and quality has been confirmed across countries including Europe (European Commission, 2019), North America (Blackwell *et al.*, 2014), Australia (Ainley, Kos and Nicholas, 2008), or China (Liu *et al.*, 2014). However, few studies have focused or described ICT use in early childhood (Blackwell *et al.*, 2014; Liu *et al.*, 2014) and primary school (European Commission, 2019; Fartura, Pessoa and Barreira, 2014; (Losada Iglesias, Correa Gorospe and Fernández Olas-coaga, 2017).

To date, reports of teachers' use of ICT tools have revealed that even though teachers are aware of the positive effects of ICT integration (Ghitis and Alba, 2019; Linne, 2020), they are constrained by time and heavy workloads, and technology integration requires time and effort in order to be effectively embedded into curriculum and teaching practices (Aust, Newberry, O'Brien and Thomas, 2005). Research on ICT use and level of integration into the curriculum has also stressed the importance of pre-service training in Computer Assisted Language Learning (CALL) (Gil-Flores, Rodríguez-Santero and Torres-Gordillo 2017), which is still lacking in many pre-service training programmes (Ghitis and Alba, 2019), and of raising teachers' self-confidence to improve and increase technological tools usage and integration (Dooly, 2009; Liu *et al.*, 2014).

Some investigators (Area and Sanabria, 2014; Bueno-Alastuey and García Esteban, 2016; Fartura *et al.*, 2014; García-Valcárcel *et al.*, 2014; Gil-Flores *et al.*, 2017; Iglesias *et al.*, 2017) have explored how ICT are used in primary and secondary schools. Their work has revealed technological tools are used infrequently and by few teachers, and mostly for presentation purposes or as information tools. In Spain, in the higher grades of primary education and in secondary education, in-service teachers report using technological resources to introduce micro innovations in their teaching practices, but those resources seem to be employed for conventional teaching practices (García-Valcárcel *et al.*, 2014) based on individual completion of exercises, essay writing and teacher-based transmission of content.

Research in other countries has confirmed this trend of using ICT mainly for presentation purposes (Uluyol and Sahin, 2016), and computers as information tools (Fartura *et al.*, 2014; Tondeur, van Braak and Valcke, 2007). In fact, the required methodological reconversion in which ICT will become the channel for communication and information that fosters more personal and independent learning environments which are interactive, mobile, universal, and full of incentives

and sources of information have not entered the classrooms yet (García-Valcárcel *et al.*, 2014; Ghitis and Alba, 2019; Linne, 2020). Some authors (Tondeur, Aesaert, Prestridge and Consuegra, 2018) have indicated that differences at the student level such as computer proficiency, support structures and teacher readiness and beliefs account for the main differences in teachers' technology integration. Consequently, the need for initiatives to promote professional development for teachers to acquire technological and pedagogical enhanced learning competencies and skills, as well as personal and vicarious experiences should become a priority.

ICT training in teacher education programmes

ICT is seen as a catalyst for transforming teaching and learning (Ainley *et al.*, 2008), but “if education is to be transformed by the application of ICT, then the manner of that application will depend upon the presence of teachers who are appropriately prepared to apply ICT to enhance learning and teaching” (Albion and Tondeur, 2018, p. 5). Professional development or the process by which teachers develop or update their professional knowledge, skills, or attitudes (Tondeur, van Braak, Ertmer and Ottenbreit-Leftwich, 2016) frequently lags behind the reality of in-service teachers' classroom needs, also when training in technology use is concerned (Ghitis and Alba, 2019; Gil-Flores *et al.*, 2017; Liu *et al.*, 2014). As effective professional development has been shown to be more successful when teachers can directly apply it to their own situation (Wilson, 2012), and when provided by colleagues or peers as informal training (Collet-Sabe and Beneyto Seoane, 2018), the present article explores the possibility of pre-service teacher trainees serving as trainers of their in-service tutors. This role shift, in which student teachers become agents of change as ICT experts, can bolster agency, essential in the transformation of teachers and educational systems (Albion and Tondeur, 2018).

The teaching practicum period permits student teachers to collaborate closely and seamlessly for an extended period of time with their tutors, an opportunity which allows pre-service teachers to identify content and pedagogical needs which may be appropriately filled using various technological tools. This accrued knowledge together with ICT knowledge and skills, which might have been garnered in instructional technology courses, place those trainees at a privileged position to provide differentiated ICT training tailored to the in-service teacher's specific methods and content areas. This process could benefit both pre-service and in-service teachers alike as involving teachers in collaborative designs has been reported to bolster their self-efficacy and expert identity, and to shape their beliefs about ICT use (Albion and Tondeur, 2018; Hansen-Thomas, Dunlap, Casey

and Starret, 2014). Furthermore, taking instructional technology courses has been shown to result in improved ICT use (Tondeur, Pareja Roblin, van Braak, Voogt and Prestridge, 2017) and increased technological knowledge, which reliably predicted high levels of technological pedagogical and content knowledge (TPACK) (Nelson, Voithofer and Cheng, 2019). However, the effect taking instructional technology courses might have on trainees' perceptions and their capacity to integrate those resources in their teaching practicum and to teach their tutors remains under researched.

This pilot study tries to widen our understanding of observed ICT use in nursery and primary education, contrasted to previous self-reports, as well as increasing our knowledge about the perceptions and contributions of trainees to their tutors' ICT training. Reporting on the ICT learning processes of in-service and pre-service teachers while in the practicum might foster effective ICT learning designs.

OBJECTIVES AND RESEARCH QUESTIONS

The objective of our study was to illustrate how often and which technological tools teachers in primary and nursery schools use for teaching in the classroom based on the reports of trainee teachers who had been observing and training with the in-service teachers for 7 to 8 weeks. This study also aimed at studying trainees' perceptions about the adequacy of ICT use, and their possible contribution to their tutors' training in ICT.

The research questions that guided this study were:

1. How often and which technologies do in-service teachers use for teaching purposes?
2. How do pre-service teachers deem the use of technologies in schools and what do they consider would improve using ICT more?
3. Do trainee teachers contribute to their tutors' training in ICT and is there a difference between students who have taken educational technology training and those who have only had basic technological skills training?

METHOD

Context

This research was carried out in schools located in two provinces in Spain: Madrid and Navarre. The schools were mainly state schools (79.6 % in Madrid; 87.8% in

Navarre), which provided either immersion programs in two languages (44.6% of the schools in Madrid; 51% in Navarre) or monolingual Spanish programs with English as a Foreign Language (44.6% in Madrid; 21% in Navarre).

Participants

The participants were a convenience sample of 142 pre-service primary and nursery teachers (103 from Madrid; 39 from Navarre) in their last year of a four-year program in Primary or Early Childhood Education. The participants from Navarre had taken an instructional technology course in the fourth year of the program immediately before the teaching practicum. The course included an overview of many different types of technologies and examples on how they could be used for teaching. The participants in Madrid had been provided with training on Microsoft Office programs and blogs in the first year of their degree, and the focus had been on using the programs, but not on the educational uses of those programs.

All the pre-service teachers answered a survey after their teaching practicum period (ranging from 7 to 8 weeks) in the aforementioned schools. The students in Madrid answered the survey in a paper-based format in class, while the students in Navarre answered the survey on-line.

Instrument

The survey was designed by the university teachers in both locations. Two expert ESL teachers and an instructional technology teacher with over ten years teaching experience revised the survey to validate its content. The changes suggested were applied and the questionnaire was pilot-tested with two similar cohorts of students, who reported no difficulties. The survey consisted of 7 questions:

- three closed questions in which students had to select the type of school they had done their teaching practicum in,
- one Likert-scale question, in a scale from 1 (“never”) to 4 (“often”), about their school tutors’ frequency of use of specific technological tools for teaching during their teaching practicum,
- and three open questions asking about i) whether technologies had been used sufficiently; ii) how teaching could be improved in those schools by using technologies; and iii) whether they had taught their tutor to use any technologies and a description/evaluation of that experience.

Data and data analysis

A mixed method research design (Creswell and Clark, 2017) combining quantitative and qualitative data was used. Quantitative data were collected from the three closed questions, and the Likert-scale question. Percentages were obtained for all the students and for each cohort to analyse both general trends, and possible divergences between both locations.

First, the number of students selecting each option was registered. Secondly, means of use were obtained and technologies were ordered from the highest to the lowest depending on those means. Finally, Likert-scale ratings were grouped into two categories: high vs. low frequency of use, technologies were ordered based on that frequency, and both cohorts' usage was compared.

Qualitative data were obtained from the open questions of the survey. As not all participants responded to the open questions, raw number of respondents and percentages will be provided for each question. To group the data which enquired about whether technology had been used sufficiently and whether they had taught their tutor any ICT, the answers were coded into three categories: *positive*, *negative* and *not mentioned*. This last category, which was excluded from the analyses, was employed when there was no mention to the use of technology or some technology was mentioned with no positive or negative judgment (see Examples 3 and 4). Examples 1 through 4 illustrate these coding categories:

Example 1 (coded as positive)

“Survey question: Do you think New Technologies were used sufficiently in your school? [...]

Student response: The technologies used in my school were sufficient because, they use a lot of types of technologies in all groups”.

Example 2 (coded as negative)

“Survey question: Did you teach your tutor or other people in the school to do anything with New Technologies? [...]

Student response: No, because I had to do what the teacher said”.

Example 3 (coded as not mentioned)

“Survey question: Do you think New Technologies were used sufficiently in your school? [...]

Student response: My school had IWB”.

Example 4 (coded as not mentioned)

“Survey question: Did you teach your tutor or other people in the school to do anything with New Technologies? [...]

Student response: The children use the computer to see videos or pictures”.

Finally, the open question regarding how teaching could be improved in the schools was analysed using thematic analysis (Guest *et al.*, 2012) to identify common themes.

RESULTS

Frequency of ICT use for teaching purposes

As shown in Table 1, only three technological tools (audio files, video files and multimedia) had a mean higher than 3 and, thus, were used frequently for teaching purposes. Five other types of technology had means higher than 2 and, thus, were often employed: two Internet tools (games and Internet search for information), two software programs (Microsoft Word and PowerPoint), and Interactive Whiteboards (IWB). The rest of the technologies had means lower than 2 and, consequently, were used rarely.

Table 1. Mean frequency of ICT use for teaching purposes. Often>2, Rarely<2

TECHNOLOGY	MEAN >2	TECHNOLOGY	MEAN < 2
Audio Files	3.52	Blogs	1.96
Video Files	3.33	VL Platforms	1.92
Multimedia	3.24	Microsoft Excel	1.60
Games	2.99	Wiki	1.39
Internet search	2.72	Forum	1.39
Microsoft Word	2.52	Dropbox	1.38
IWB	2.38	Surveys	1.30
Microsoft PPT	2.26	Facebook	1.28
		Skype	1.27
		Tuenti	1.13

The tutors in both settings appeared to be using most technologies with similar frequency rates (see Table 2). The first four most frequently used technological

tools were the same as in the common classification (see Table 1) in both settings, although games had a mean lower than three (2.92) in Navarre so they were not used as regularly.

Table 2. Mean frequency of ICT use for teaching purposes by setting. Often>2, Rarely<2

TECHNOLOGY	MEAN >2		TECHNOLOGY	MEAN < 2	
	MADRID	NAVARRA		MADRID	NAVARRA
Audio files	3.55	3.43	Blogs	1.97	1.91
Video files	3.33	3.34	Microsoft Excel	1.72	1.27
Multimedia	3.32	3.05	Forum	1.48	1.13
Games	3.02	2.92	Wiki	1.47	1.18
Internet search	2.66	2.89	Dropbox	1.46	1.16
Microsoft Word	2.46	2.66	Facebook	1.38	1.02
Microsoft PPT	2.32	2.12	Surveys	1.34	1.18
IWB	2.18	2.89	Skype	1.23	1.35
VL platforms	2.09	1.45	Tuenti	1.16	1.02

Internet search, Microsoft Word, PowerPoint and IWB had means higher than two, and, thus, were often employed in both settings (see Table 2). IWB were used more frequently in Navarre (2.89 vs 2.18) and Virtual Learning (VL) Platforms were employed frequently (2.09) only in Madrid. The rest of the tools had means lower than two and, thus, were used rarely or hardly ever in both settings, and their means were lower in Navarre than in Madrid. Social networks (Facebook and Tuenti, $M= 1.02$) were almost “never” used in Navarre.

Trainees' perceptions of ICT use and ways ICT could improve teaching

A hundred and twenty-eight (90%) participants answered the question regarding the (in)sufficient use of technological tools by their tutors during their teaching practicum. After eliminating 22 (17.2%) responses categorized as *not mentioned*, the final sample comprised 106 (74.6%) valid responses. ICT use was considered insufficient by a majority of those students (66 trainees [62.26%]), while only 40 students (37.74%) judged it as sufficient.

Differences were observed by location (see Table 3). Students in Navarre, who had followed an instructional technology course before the practicum, were

less positive and more critical regarding the adequacy of technological use. Nearly three thirds (72.97%) of the students in that location judged the use of instructional technologies in class as insufficient. Students in Madrid, who had only had initial training on ICT for personal use in the first year of their degree, displayed a more positive view and nearly half of them (43.48%) considered that the use of technologies in the schools was sufficient.

Table 3. Sufficient use of technology in class

	TOTAL (N=106)	MADRID (N=69)	NAVARRA (N= 37)
Sufficient use	40 (37.74%)	30 (43.48%)	10 (27.03)
Insufficient use	66 (62.26%)	39 (56.52%)	27 (72.97%)

Examples 5 and 6 represent the two main views of students. The former provides a positive view and acknowledges a slow but steady integration of ICTs into the primary and nursery classrooms. On the contrary, example 6 gives a negative view of ICT use in the classroom explaining that ICT use highly depends on teachers' willingness to adopt them and on their ability to employ them adequately, which his/her tutor did not seem to have had.

Example 5

“Yes. I think that most of the teachers are trying to get familiar with ICTs and they are trying to introduce them in their classes. Using smart board for any activity motivates a lot the children. Also, simple things as watching a video on the board engaged children a lot”.

Example 6

“No, it depends on the teacher's ability to use them and their interest”.

Regarding the question about the tools students thought could improve teaching in their school (see Table 4), 101 tools were proposed by 45 of the respondents (51.11% from Navarre and 48.89% from Madrid).

Table 4. ICT tools listed to improve teaching by number of mentions

TOOL	TOTAL MENTIONS	MADRID	NAVARRRE
IWB	20	8	12
ICT/computers in general	10	7	6
Blogs	7	1	6
Videos	7	3	4
Games	6	6	
Skype	5	1	4
Survey monkey or assessment tools	5		5
Visual resources/images	4		4
PowerPoint	4	3	1
Digital platforms	3		3
Stories/Storyjumper	3	1	2
Wikis	3		3
Computer labs	2		2
Interactive programs	2	1	1
Websites	2		2
Tools to adapt activities	2	2	
Multimedia	2	2	

Students mentioned mainly the use of IWB, followed by frequent references to the need to enhance ICT and computer use overall in class. Mentions to collaborative tools such as Blogs (7) or Skype (5) also ranked high, as did those referring to technologies to make learning more attractive and playful such as videos (7), games (6) and visuals (4). Other tools such as recorders, Hot Potatoes, Microsoft Word, Podcasts, Prezi, and PowerPoint were mentioned only once.

Once more, clear differences were observed between both settings (see Table 4). Students in Navarre suggested a larger number (61) of possible ICT tools to enhance teaching than those in Madrid (40). Additionally, in Navarre, 12 different tools were mentioned more than once, while only seven were listed in Madrid. Furthermore, although interaction was highlighted with the suggestions to use IWB or interactive games in Madrid, students in Navarre included a wider variety of tools which offered collaborating opportunities including IWB, blogs, wikis, or Skype. The results seem to indicate that students who had taken an instructional technology course immediately before their teaching practicum appear to have had more ICT resources/tools available in their teaching repertoire.

When asked about how technologies could help to enhance the teaching and learning process, ten themes (see Table 5) arose. The most frequent theme (17 mentions) was the idea that using ICT could enhance learning as students said that ICT use could improve explanations, the overall learning experience, content teaching, as well as assessment. The second most common purpose they suggested (12 mentions) was to learn English, they considered ICT offered authentic language and interaction opportunities, and opportunities for exchanges with native speakers, and were helpful to improve pronunciation. The possibility of learning through playing or of making learning more playful by using technologies was mentioned 9 times. 8 people also underscored the importance of getting children acquainted with technologies for their future, and mentioned that acquiring computer skills and learning how to use ICT was necessary for their pupils' future. The fifth most frequently mentioned aspect (6 mentions) was the opportunities offered by ICT tools for differentiated learning. Students mentioned the fact that ICT tools allowed for differentiation and individualization of activities and tasks, and a closer individual monitoring of students, by revising their mistakes or canvassing their opinions. Additionally, they said that it encouraged the integration of shyer students. The sixth most frequent category (5 mentions) was labelled as additional benefits because it comprised the extras such as graphs that teachers could get if they used ICT resources instead of pen and paper, and the fact that they could be stored and used as many times as needed saving valuable teacher time. The possibility offered by ICT of developing the acquisition of other skills and/or key competences such as thinking skills, creativity and autonomy was mentioned 4 times, the same number of times as the possibility of accessing multimedia resources such as songs, videos or stories. 3 comments were made regarding the interest boost brought about by technologies because they could catch children's attention and increase their motivation. And finally, the fact that ICT could be used to foster motor activities was mentioned once.

Table 5. Suggested ways in which ICT can improve the learning process by number of mentions

PURPOSE OF ICT	TOTAL MENTIONS	MADRID	NAVARRRE
Enhanced learning	17	13	4
English learning	12	4	8
Play	9	7	2
Acquainted with technologies	8	7	1

[CONTINÚA EN LA PÁGINA SIGUIENTE]

Table 5. Suggested ways in which ICT can improve the learning process by number of mentions

PURPOSE OF ICT	TOTAL MENTIONS	MADRID	NAVARRRE
Differentiation	6	3	3
Additional benefits	5		5
Skill acquisition	4	1	3
Multimedia resources	4	3	1
Interest boost	3	2	1
Motor games	1		1
Total	69	40 (57.9%)	29 (42.03%)

Table 5 illustrates suggested improvements by location. Navarre students listed fewer reasons (29 vs 40) although they were of a more varied kind (10 vs 8). Although the positions varied, enhanced overall learning, English learning and differentiation were 3 out of the 5 most frequent benefits suggested.

Example 7 from Navarre includes a commentary which integrates those suggestions:

Example 7

“I do think they [in-service teachers] can use them [technologies] more. For example, to teach pronunciation it would be very enriching to use the interactive blackboard. They also can make some exams using the computers, with survey monkey, for example. In this way, students could make these exams at home to practise for the final exam. And this also will allow the teacher to see the students' level and mistakes. Finally, they could integrate ICT when giving explanations. Instead of using the traditional blackboard they can use interactive blackboards”.

This example clearly shows she can list different ICT tools and integrate them into the learning process. She underscores the opportunities offered by technology by focusing on its benefits for learning about pronunciation, revising for exams, assessment and individual monitoring.

The remaining two most common themes vary according to location. In Madrid, the third and fourth most mentioned themes referred to playful learning and learning by playing with technologies, and getting acquainted with technologies and their use. Meanwhile, students in Navarre emphasized the affordances of tech-

nology to help teachers save time, including specific possibilities such as plotting graphs, but also the opportunities to foster the development of high order thinking skills, imagination or autonomy.

Contribution to their tutors' training in ICT use

The question of whether they had taught something to their tutors was answered by 76 students (53.5% of the total number of participants): 49 students, which represented 47.6% of the participants, from Madrid and 27, which accounted for 69.2% of the participants, from Navarre (see Table 6).

Table 6. Responses to whether they taught any ICT tool to their tutor

	TOTAL (N=76)	MADRID (N=49)	NAVARRRE (N=27)
No	34 (44.74%)	27 (55.10%)	7 (25.93%)
Yes	42 (55.26%)	22 (44.90%)	20 (74.07%)

When the responses from the two locations were collapsed, over half of the students (55.26%) had contributed to their tutors' ICT training, while the other half (44.74%) had not. Nevertheless, there were clear differences between both locations. In Navarre, a little over 70% of the trainees who had answered the question admitted having taught something to their tutors, whereas this percentage dropped to 44.9% in Madrid.

Table 7. Tools taught to tutors and number of students teaching those tools by number of mentions

TOOL	MADRID	TOOL	NAVARRRE
Play and download music	3	Story Jumper	8
Prezi	3	Hot Potatoes	5
IWB	2	Blog	2
Use Bookbuilder	2	Calameo	1
Microsoft Word	2	C-map	1
PowerPoint	2	Digital resources	1
Reproduce a video with alternative programme	2	Dropbox	1
Blog	1	IWB	1

[CONTINÚA EN LA PÁGINA SIGUIENTE]

Table 7. Tools taught to tutors and number of students teaching those tools by number of mentions

Check information	1	PowerPoint	1
Download programme	1	Print screen	1
PC use	1	Skype	1
Radio cassette	1	Uploading videos	1
Transferring files from camera to PC	1	Video editing, movie maker	1
Using the printer	1	Webpages	1
Wiki	1	Windows 8	1
Total	24	Total	27

The tools taught differed between the locations (see Table 7). While in Madrid the uses taught were mostly linked to common ICT tools or technologies (IWB and Prezi) and more general computer skills (reproducing and downloading music and videos and using Microsoft Word), in Navarre, pre-service teachers taught their tutors less common tools such as Storyjumper, Hot Potatoes, Blogs or even Calaméo and C-maps. It seems that trainees having attended the instructional technology course had more innovative ICT resources available to disclose to their tutors.

In addition, 28 teacher trainees (36.8% of the students who had answered this question) evaluated the experience. 24 (85.71%) of those students considered teaching new technologies or technological uses to their tutors a valuable experience, while only 14.28% (n=4) considered it a bad experience. Example 8 shows a positive view while Example 9 and 10 illustrate resistance from the tutors:

Example 8

“I recommended them the use of some technological tools worked on this subject such as Storyjumper, the use of SKYPE and Blogs. In fact, as they were working on the layout of stories, they used Storyjumper for constructing their own story”.

Example 9

“My school tutor wasn't very keen on using computer. She did a couple of projects which involved searching for information and writing it down on a Word or PowerPoint document. [...]. I also offered the teacher to try Glogster instead of PowerPoint for the project. At first she was open, but then she refused”.

Example 10

“I suggested the teacher to prepare some activities with Hot Potatoes, but he was not interested in it, so I did not do it. In fact, I could not make use of New Technologies at all”.

DISCUSSION

Regarding the first research question about type and frequency of ICT use in primary and early childhood classrooms, teachers seem to know a wide variety of technologies for educational purposes. However, ICT tools still seem to be mainly used conventionally for presentation purposes and as information tools as demonstrated by the highest use of audio and video files, and the residual use of social and/or collaborative tools such as wikis or social media. This corroborates the results of previous studies such as García-Valcárcel *et al.* (2014), who stated that in spite of the many changes in infrastructure that schools and other educational centres have experienced in recent years, teachers still have difficulties when using technologies to teach “in consonance with the new perspectives for learning which demand more personal and independent learning environments, while at the same time being interactive, mobile, universal, etc. and all of this certainly requires new teaching strategies” (p. 72). It may take several years of use to integrate computer technology according to a constructivist philosophy –that is, using the computer as a cognitive tool for knowledge construction rather than to replicate traditional tasks such as word processing, drill and practice, and information searching (Ertmer, 2005). These findings also support previous reports in other educational levels and in different countries illustrating the restricted use of ICT and their use mostly as information tools, for presentation purposes or as preparation tools (Tondeur *et al.*, 2007; Tondeur, Pareja Roblin *et al.*, 2017; Uluyol and Sahin, 2016), and the lack of use as collaborative tools that will foster more personal and independent learning environments. Regarding the amount of use of technologies, the findings obtained bring attention to the need of not only encouraging state policies and programmes to guide implementation of ICT at young ages (Liu *et al.*, 2014), but also to the need of training teachers, who are the driving forces of change in the effective integration and use of ICT in the classroom with young learners.

Considering the second research question which enquired about students’ perceptions regarding the use of ICT, most trainees (69.7%) considered the use of ICT as quite limited in the schools where they had been doing the teaching practicum. This finding supports previously reported results in early childhood

and primary education settings in different countries (Blackwell *et al.*, 2014; García Valcárcel *et al.*, 2014; Liu *et al.*, 2014; Tondeur *et al.*, 2007). It is probably a more accurate perspective of real usage than the one previously reported by the teachers themselves, who might try to justify what they consider their expected use of technological tools and not their real usage. The limited use of technology and the fact that the students who had taken an instructional technology course were more aware of their tutors' poor use of ICT point to the positive effect educational technology courses might have for raising awareness of technological resources and their affordances as instructional tools. This confirms previous research about the positive effect of those courses (Nelson *et al.*, 2019; Tondeur, Pareja Roblin *et al.*, 2017). Furthermore, the students who had received those courses were more informed about the benefits of using ICT, a good predictor of future ICT use (Sang, Valcke, van Braak and Tondeur, 2010; Tondeur, Pareja Roblin *et al.*, 2017), which was also shown in their ability to try out technology in real settings.

The third research question examined pre-service teachers' contribution to the training of their tutors and whether having had an instructional technology course prior to the practicum affected that contribution. Results showed that those who had followed an instructional technology course were more willing to teach their tutors new ICT tools which provided them with the opportunity to apply their knowledge in authentic experiences (Valtonen *et al.*, 2015). By teaching their tutors, they might have contributed to boost their tutors' digital literacy and autonomy, as the training they provided was focused on classroom needs and, thus, was relevant and highly contextualized (Gil-Flores *et al.*, 2017; Hansen-Thomas *et al.*, 2012, 2014; Wilson, 2012). It has been reported that teachers need to experience positive outcomes of computer integration personally or vicariously through other teachers, in order to alter their beliefs and encourage more widespread computer integration (Mueller, Wood, Willoughby, Ross and Specht, 2008). Furthermore, our results confirm previous research reporting reduced ICT use when training programs only provide basic technological skills (Fernández-Batanero, Cabero and López, 2018; Tondeur *et al.*, 2017).

Student-teachers seem to have mediated their tutors' knowledge and use of technologies by providing timely and appropriate ICT support, which might encourage further ICT use in primary and nursery classes. That is to say, student teachers provided tutors with tailor-made training, which moved away from technocentric training (Liu *et al.*, 2014) and suited the teaching needs of the tutors. This tandem training meets the three essential components Chen and Chang (2006, p. 181) put forward for effective technology training programs: (i) make support for classroom implementation a priority; (ii) provide more than a week of training;

and (iii) match training to varying lengths of teacher confidence, skill and practice. Additionally, it is also aligned with successful programs which have obtained very positive outcomes in terms of teacher's attitudes and integration rates (Tondeur *et al.*, 2012). In fact, it meets four out of the seven characteristics which distinguish such programmes: using teachers as role models, learning technology by design, collaborating with peers and creating authentic experiences (Tondeur *et al.*, 2012).

CONCLUSIONS

This paper corroborates research regarding the conventional use of ICT for presentation purposes and as information tools in primary and early childhood classrooms. Audio files, video files, multimedia, games, searching the web, Microsoft Word, IWB and Microsoft PowerPoint were the tools used mostly, and only the first four were utilized very often with slight differences between the two settings analysed. Tools such as wikis, Skype, or blogs were almost never used and, consequently, there seems to be an urgent need to boost collaborative uses of technology. Our findings point to the need to integrate more innovative uses of ICT, which emphasize creativity, exploration and interaction, central to learning in the early years (Plowman, 2016).

Most trainees considered the use of ICT as quite limited in the schools where they had been doing the teaching practicum. Yet, the students who had experienced an instructional technology course were more aware of the scarce use of technology and of the possibilities and benefits technological tools can offer, thus, confirming the advantages of appropriate training.

Many students taught their tutors how to use something new, and could identify ways and technologies to improve the use of ICT in those levels. Furthermore, those students who had taken an instructional technology course contributed more to their tutors' training. This suggests that training pre-service teachers to recognise ICT affordances through specific courses aimed at developing their TPACK (Bueno-Alastuey, Villarreal and García Esteban, 2018) will probably increase ICT use in primary and nursery schools, as these students will train their tutors and give them first-hand experiences (Dooley, 2009).

Some limitations of the study include the fact that no description of the ICT tools available or of how they were used was provided. Further research should take into account the existing tools in the schools and provide more detailed accounts of exactly what is done when ICT are used. Another shortcoming could be the fact that the pre-service teachers had not been instructed on how to train the in-service teachers, establishing predefined steps or procedures could have eased the process

by building confidence among the less confident student trainees. A focus-group would also have allowed a deeper understanding of the student trainees' experiences in training their tutors. Finally, further studies should explore the effect the training provided had on the future use of the tutors to evaluate its effectiveness.

This paper contributes to previous research on ICT use in early childhood and primary classrooms by offering a third party description of technology use in those settings based on observation. It also provides evidence that having taken an instructional technology course can modify perceptions on adequacy of ICT use and help students to be aware of ICT affordances to fit their needs. Furthermore, it explores a new way of providing trainees with experiences of real ICT use in authentic settings and in-service teachers with tailor-made and highly contextualized training. It will certainly be challenging to provide all teachers with the extrinsic and intrinsic incentives and training needed, but "systematic and appropriate planning and more distinctive encouragement and opportunities must be developed to increase the level and quality of ICT usage in classrooms" (Uluyol and Sahin, 2016, p. 73). Our findings suggest that pre-service teachers can positively contribute to bridging the gap between ICT training and ICT use in primary and early childhood education settings.

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