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Types of Use of Technologies by Spanish Early Childhood Teachers

Rosalia Romero-Tena
University of Seville, SPAIN

Lidia Lopez-Lozano
University of Huelva, SPAIN

Maria Puig Gutierrez[*]
University of Seville, SPAIN

Abstract: Young pupils engage with technology daily, however, the use that preschool teachers make of technologies and their level of digital expertise are largely unknown. The objective of this study was to determine how these teachers make use of ICT (Information and Communication Technologies) and the frequency with which they use them, as well as to explore the sociodemographic and professional factors related to the different uses. 477 preschool teachers from Spain took part in a survey. The questionnaire, validated by experts, covered the use of ICT as a teaching-learning tool. Three different analyses were carried out, a principal component analysis and a descriptive analysis to determine the type and intensity of use and a multivariate analysis of variance to explore their relationships with sociodemographic and professional variables. The findings defined eight distinct uses of ICT, which seemed to be related to different factors. Teachers did not employ these technologies openly and consistently in their classrooms, but instead used them for occasional tasks that were administrative and bureaucratic in nature. They manifest a limited ICT use for assessment of pupil and for communication and exchange of ideas, information and materials. Instead, ICT were widely used to prepare classroom work (planning, classroom posters…) and as classroom support as a learning tool (routines, games, to record audios…). Among the studied variables, the more significant were teaching experience and type of centre. We discuss the need to advocate for continuous and comprehensive training on the educational potential of these digital resources.

Keywords: *Multivariate statistical methods, technology, teacher knowledge, early childhood education.*

Introduction

Even though young children already start school with multiple experiences with technology, the use and digital competences of Early Childhood Education (ECE, hereafter) teachers are largely unknown. Young children who reach schooling age already possess technological skills from their experiences at home (Kaye, 2017; Romero et al., 2019). Lepicnik and Samec (2013) point out that 4-year-old children live in a technological environment where families support learning through the use of the Information and Communication Technologies (ICT). Nikolopoulou et al. (2010) show that most of the children aged between 4 and 6 use the computer as well as a wide range of technologies available in their homes. Marsh et al. (2005), McKenney and Voogt (2010) and McPake et al. (2005) confirm these findings and reaffirm the existence of a family context in which ICT are available to children from an early age. Thus, it is recognised that small children are immersed in digital technologies at home, and are competent users as well (Mertala, 2017; Plowman et al., 2008). McKenney and Voogt (2010) emphasize that children use technology even before they know how to read and write, so that their leisure and learning are determined by the technologies found in their surroundings (Edwards, 2016; Roberts-Holmes, 2014).

In light of this situation, the integration and inclusion of technologies in ECE classrooms must be better understood (Plowman & Stephen, 2003). To this end one must consider the previous experiences of the pupils (Hatzigianni & Margetts, 2012; Zevenbergen, 2007) and the studies that have evidenced the positive effects of ICT as tools for learning while being shown as tools that favour social interaction, the assumption of values, empowerment, participation and creativity. Among these positive effects we highlight the development of literacy, science, mathematics, problem solving and self-efficacy (Ballesteros-Regana et al., 2019; Kalas 2010; Herodotou, 2018; Pila et al., 2019; Ruckenstein, 2010; Siraj-Blatchford & Siraj-Blatchford 2003).

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[*] **Corresponding author:**
Maria Puig Gutierrez, Facultad de Ciencias de la Educacion. Departamento de Didactica de las Ciencias Experimentales y Sociales. Sevilla, Spain.
✉ mpuig@us.es

It is a fact that the education policies of early childhood in Europe (NAEYC & Fred Rogers Centre, 2012), have emphasized the importance of integrating the ICT into the curriculum in the early years. The European Commission (2011) has shown their conviction that education and the care of early infancy are the essential foundations for permanent learning, social integration, personal development and future employment.

In Spain, the current Organic Law for the improvement of the quality of education (LOMCE, 2013) presents the ICT as one of the areas that should be stressed for the transformation of the educational system. Thus, in the case of the ECE stage, a non-compulsory stage that is organized into two cycles (1st cycle, from 0-3 years old, and 2nd cycle, from 3-6 years old), the ICT are found in one of the three areas around which the curriculum is organized. More specifically, we are referring to the area of Languages: communication and representation, which indicates that 'The audio-visual language and the information and communication technologies present in the child's life, require an educational treatment that, starting with their appropriate use, start the children in the understanding of the audio-visual messages and their adequate use' (MEC, 2007 p. 480).

This has had a deep impact relate to the use of the ICT in the teacher's every day work, as well as the instruction methods, the teaching content and the relationship with small children, creating new expectations about their work and their roles (Edwards, 2016). However, we have found few studies that present empirical data on how ECE teachers use ICT, the degree to which they use them and the factors that influence their use.

In this regard, Blackwell et al. (2014), conducted a study that analysed the factors that influenced the use of ICT in ECE, finding that the support, educational policy on the integration of ICT and teaching experience, had direct positive effects on the use of technology in the classroom. Teachers with more experience used technology more often, with these results coinciding with those from Karaca et al. (2013) and Russell et al. (2003).

Focusing on the use given to the ICT in ECE, Kerckaert et al. (2015) distinguished two types of ICT use in ECE: 'ICT use supporting basic ICT skills and attitudes' and 'ICT use as support for contents and individual learning needs'. The first of these is more frequent and is linked to the children's age (James et al., 2019), the self-perceived competences that the teachers have in the field of ICT and the number of years of experience with ICT at school. The second is also closely related to the children's age and the self-perceived competences of the teachers in the field of ICT, but also to the professional development of ICT and the teacher's attitudes about the possibilities of introducing ICT in ECE. This indicates that the professional development of teachers is a crucial factor for the use of ICT, moving beyond the teaching of basic technological skills and attitudes about technology. Therefore, in accordance to previous studies (Hatzigianni & Margetts, 2012; McKenney & Voogt, 2010), the teacher's feelings of being capable and believing they have the skills and competences seems to be essential for the use of ICT in classrooms.

In this regard, the teachers' lack of confidence as one of the factors that hinders the use of ICT in classrooms has been reported in various studies (Balanskat et al., 2000). Dong (2016) indicates that the high perceptions of the teachers of the benefits of the ICT come into conflict with the low frequency of their use in the classroom, and therefore the low frequency of use of the children as well. This lack of confidence is often associated with their perceived lack of skills for using technologies with their pupils. In addition, this attitude has also been related to their lack of experience with technology (Cox et al., 1999a; Osborne & Hennessy, 2003). These studies affirm that the teachers who do not use ICT are those who attribute little utility to them and, on the contrary, the teachers who feel secure in the use of technologies and acknowledge their usefulness are the ones who use them frequently (Cox et al., 1999b). This same author (Dong, 2018) found that the more significant barriers for adding the ICT into their teaching activities were mainly the effective training on ICT and professional development. Likewise, teachers who did not perceive themselves as competent in the use of technology were not enthusiastic about the changes needed and the need to integrate them into teaching-learning processes (Balanskat et al., 2006). Thus, the worry of many teachers about the negative effects of the ICT on the health of small children, the resistance to change and the negative attitude shown towards the usefulness of technologies to improve teaching and learning (British Educational Communications and Technology Agency, 2004) are factors that make difficult their use in classrooms.

Research Goal

The main objective of this study is to determine which ICT do ECE teachers use as working tools, to know the intensity of this use in terms of frequency and to explore the sociodemographic and professional factors related to these different uses.

Methodology

Sample and Data Collection

The study involved 477 ECE teachers from various geographical locations in Spain during the 2017-18 academic year, with most being women (93% of the sample). A convenience sampling was used, as the researchers relied on existing contacts or a person who provided access to various educational centres who collaborated in the study. These contacts (also called area managers) took on the role of administrators of the questionnaire for their centre. The administration of the questionnaires was voluntary by the participants, so that a conflict of interests was not present.

The participants were aged between 23 and 63, although 75% of the sample was aged between 23 and 49, with an average age of 41. Regarding work experience, they had a wide range of profiles, from one year of service (1.9% of the sample) up to 40 years (0.6% of the sample). However, 80% of them had between 1 and 24 years of experience, resulting in an overall average of 15 years of service (SD = 8.884). Thus, three strata according to this variable were defined: beginners, from 1 to 8 years of experience (28%), juniors, from 9 to 16 years (39%) and experts, from 17 to 40 years (33%). According to the data, a large majority of participants possessed a Bachelor's in Education (B.Ed.) (74.5%), some had a Master's in Education (M.Ed.) (24.8%) and a minority of them (0.7%) had a Doctorate (Ph.D.). Most of our participants (74.2%) occupied a fixed teaching position, followed by teachers who occupied a provisional one (16%), with a low percentage of the sample represented by people who were interns (8.4%). Regarding computer training, 79% said they had received it. More commonly, they had been trained on the use of the digital blackboard (69.8%), a text editor (62.2%), a browser (60.6%) and email (50.7%). In addition, almost 76% said they did not download free educational software from online sources.

Most of the educational centres where our participant taught were public (67.9%) and located in urban areas (69.8%), with the remaining 30.2% being located in rural areas. In a lower percentage, we found semi-private centres (30.2%) and only 1.9% were private centres.

A questionnaire on the use of ICT as a teaching-learning tool in ECE classrooms was created. It was iteratively submitted to experts for validation until reaching its final version, which was used for the present study (Recio, 2015). The expert group was comprised by 8 people −4 ECE teachers (3 women and 1 man) considered to have "Good Practices" of ICT use in their classrooms, and 4 professors from the Faculty of Education who taught Education Technology in the Early Childhood Education Degree at the University of X−. Data collection was carried out with the help of area managers: known contacts who handled the collection locally, in charge of the distribution of the questionnaires and subsequent retrieval once it was completed by the participants. Lastly, the questionnaires were returned by post to be analysed.

The questionnaire consisted of two parts. The first part was designed to probe sociodemographic data and teaching activities that characterized the respondents. Its items contained the independent variables of this study: academic degree, years of teaching experience, administrative situation, type and location of the centre. In addition, a dichotomous question on whether the participants had received computer training was included to complete the profile. If this last question was answered affirmatively, they had to indicate, given 17 nominal response items, on which office software programs they had received training.

The second part was aimed at studying the use that ECE teachers gave to technologies. This part contained the dependent variables of the study, consisting of 7 questions with Likert-type response options (items), with which the participants had to indicate their degree (or frequency of use) of various tools and techniques. Each question had a range of four answers, from never (1) to a lot (4). This section contained a total of 42 items. The technologies, programs and the use that appeared in the questionnaire were considered by the experts as the most utilized in ECE.

Analysing of Data

The data obtained was analysed with the statistical software SPSS (version 21 for Windows). An exploratory factor analysis, based on principal component analysis (PCA), was carried out to determine the types of use of ICT and, through a descriptive analysis, their degree of use, in order to infer the technological competences of the participants. The reliability coefficient was calculated using Cronbach's Alpha. Lastly, using a multivariate analysis of variance (MANOVA), the existing relationships that these uses had with the characteristics of the participants (independent variables, IV, hereafter), were explored.

Findings / Results

Constructing the dependent variables

A principal component analysis (PCA) with Varimax rotation was first performed to reduce the number of variables and to determine the dimensionality of the scale. In our case, these were the different uses that technologies could provide in ECE. This reduction was feasible, as the determinant of the correlation matrix was very low (2.65E-11), the KMO index obtained was .820 (significant if .8≤ KMO≤.89, Kaiser, 1974 in Beavers et al., 2013) and the Bartlett sphericity test was significant with a p-value of $p<.01$ (χ^2 = 9998.075; gl = 703) showing a significant level of correlation among variables. To determine the factorial structure of the questionnaire, the requirements of factor loads greater than .30 (Gardner, 2003), we considered that each component grouped at least 3 items with high saturation indexes (Beavers et al., 2013). Given these requirements, 4 items and a question from the original questionnaire were excluded. In addition, the scale had a high reliability according to the Cronbach's coefficient obtained (α = .936).

Table 1 shows the factorial structure with a solution of 8 components (ICT uses) that represents 65.7% of the variance. The first component (C1) encapsulates the use of ICT to communicate with the pupil's families. C2 refers to the use of ICT as classroom support as a learning tool in collaboration with children and documentation of activities, C3 represents the use of ICT for assessment. C4 portrays the use of technologies to interact with other people or work

groups that can include unknown participants: forums, blogs and social networks. C5 characterises the use of ICT to solve tasks on a personal level, including PC software tools. C6 represents the use of ICT to design didactic resources and it was comprised by 5 design programs. C7 contains the ICT used as support for the teachers in the preparation of their classroom work. Moreover, lastly, C8 denotes ICT used to interact with known people or work groups and was composed by 4 tools. Once the unidimensionality of the sets of items was verified with factor analysis, each set was unified into a single variable with a global value provided by the sum of all the items they contained (see Table 1 for the descriptive statistics values and Figure 1 for their graphical representation). This new set of variables allowed us to discover the intensity of use of technologies.

Table 1. Factorial structure of the scale and statistical summary of the factorial model

C	*N* Items (factorial load)	Eigenvalue	% Explained Variance	α	N	Min-Max	*M* (*SD*)
C1	6 items: 1. To send information (.865) 2. To send notes (.792). 3. To send pupil assignments (.729) 4. To set meetings (.875) 5. To set tutorship (.877) 6. To exchange materials (.799)	10.065	26.487	.929	471	6-24	10.70 (5.656)
C2	7 items: 1. Routines (.622) 2. Stories (.681) 3. To surf the Internet (.830) 4. To create case files (.702) 5. To record audios (.513) 6. Games (.609) 7. Photography (.788)	3.353	8.825	.856	472	7-28	17.43 (5.495)
C3	4 items: 1. Observation sheets (.846) 2. Report card (.864) 3. Pupil self-assessment (.809) 4. Information notes to families (.830)	2.849	7.497	.909	468	4-16	6.94 (3.942)
C4	3 items: 1. Forums (.816) 2. Blogs (.765) 3. Social networks (.748)	2.654	6.985	.787	468	3-12	4.46 (2.389)
C5	4 items: 1. Text editor (.785) 2. Image editor (.642) 3. Spreadsheets (.591) 4. Presentation editor (.735)	1.999	5.261	.869	475	4-16	9.11 (3.395)
C6	5 items: 1. JClick (.635) 2. PowerPoint (.578) 3. NeoBook (.592) 4. Paint (.481) 5. WebQuest editors (.646)	1.510	3.973	.737	452	5-20	8.07 (2.892)
C7	5 items: 1. Planning (.699) 2. Assessments (.674) 3. Notes to families (.775) 4. Classroom posters (.575) 5. To prepare classes (.490)	1.379	3.628	.858	472	5-20	14.97 (3.244)
C8	4 items: 1. Emails (.619) 2. Messenger (.749) 3. Chat services (.737) 4. Video calls (.565)	1.174	3.089	.823	468	4-16	5.60 (2.449)
%Total Variance Explained:			65.744				

A little over half of the participants stated that they used the ICT to communicate with families (C1) (50.7%) although they did not use the various tools presented as choices in the questionnaire very much (M_{C1}= 10.7; *SD*= 5.656). The

sending of information and the exchange of teaching resources was done quite frequently (45.4% and 40.3%, respectively), while 45% of them never used the ICT to send assignments to pupils. The participants showed little use of the ICT for support in the classroom (M_{C2}= 17.5; SD= 5.495). Stories, search for information, games and photographs (around 35%) being the tools that were used the most and with sound recording and routines being the opposite ('never used' reaching percentages of 38.9% and 36.4% respectively for these 2 items). The ICTs commonly employed for assessment saw very little use (M_{C3}= 6.94; SD= 3.942). In fact, around 70% of the respondents never used the procedures provided. In addition, ICT meant to solve tasks on a personal level were scarcely used (M_{C5}= 9.11; SD= 3.395). They mostly declared that they did not have knowledge about these tools, except for text editors, of which they considered having a good understanding (73.89%). Half of the teachers (50.4%) claimed to collaborate with some groups through the internet; however, the tendency was not to use ICT that allowed for the interaction with open groups that included unknown users (M_{C4}= 4.46; SD= 2.389), and more than 73% of respondents said they did not use forums, blogs or Social Networks. The same situation was also reflected in the use of technology to interact with known individuals or working groups (M_{C8} =5.60; SD= 2.449): the percentages of negative answers were very high (91% never used video calls, more than 80% neither used Messenger nor chat services and 62.18% never even used email). The participants also said that they did not use ICT to design didactic resources (M_{C6}= 8.07, SD= 2.892). In fact, 85.27% of them did not use design programs to create Webquest, 78.67% never used NeoBook, 68.8% never used JClick and PowerPoint was only used by 35.84% of the respondents. Even so, technologies were widely used as support for the teachers to privately prepare their work (M_{C7}= 14.97, SD= 3.244), with the notes to parents and the creation of posters for the classroom being the most frequently used tools (39.41% and 36.8%, respectively).
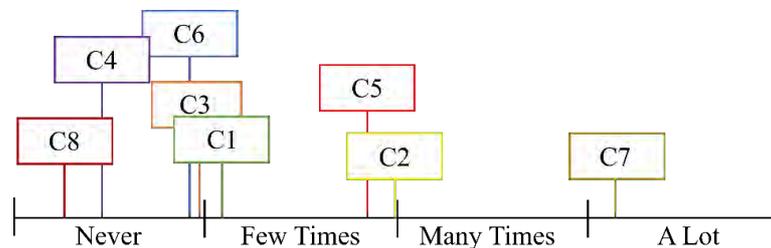

Figure 1. Representation of the evaluation of the uses of ICT

Based on these results, we now present the analysis corresponding to these dimensions as dependent variables (DV hereon after) and analyse their relationship with the IV (type of centre, location of the centre, teacher qualifications, years of teaching experience –Beginners, Junior and Expert– and work situation).

Multivariate analysis (MANOVA)

At a multivariate level, the IV 'type of centre', whether it be public, semi-private or private, had a statistically significant influence on the use of ICT within the sample (Wilks' Lambda = .671, F = 11.598, p = .000, with an effect of size η^2 partial = .181 large).

In general, as can be observed from both the results of the descriptive analysis and the results of the MANOVA (Table 2), low frequencies in the use of technologies were detected. Within this trend, it can be observed that teachers working for private centres had a higher average for the C1, C3, C5 and C6 components while the C4 and C8 components were better exploited by teachers working for semi-private centres. These differences, at the multivariate level, were statistically significant (p <.05, with a partial effect of η^2 from .015 to .152). As Levene's test does not grant homogeneity, they were compared by using the results obtained from Games-Howell's test. Concerning the use of ICT to communicate with the family (C1), there were statistically significant differences between how teachers from public centres operated with respect to the other two, with the former being the ones that used the ICT the least. This difference was especially acute when compared to teachers working in private centres (8.8 points of difference). Differences in the use of ICT to maintain open social contacts (C4) were statistically significant when comparing teachers working in semi-private centres to those who worked at the other two types of centres, especially to those working for private centres. Regarding the use of software on a personal level (C5), teachers from private centres differed significantly from the other two, while there were no differences between public centres teachers and semi-private centres ones. With respect to cooperation within groups at the personal level (C8) it seemed that teachers who belonged to semi-private centres had a higher activity, which was statistically significant when compared to the rest of the teachers. Between the remaining two, more activity was shown in public centres. Even if the use of ICT was high for both C2, support for the teacher during class, and C7, tools to prepare work, there were no statistically significant differences according to the IV 'type of centre'.

Table 2. Results of the multivariate analysis according to the IV 'type of centre' in the use of ICT.

DV	Type of Centre	Descriptive		MANOVA			Games-Howell Test		
		M	*SD*	*F*	Sig.	η^2 par.	(J)	Difference in average (I-J)	Sig.
C1	Public	9.54	5.158	38.339	.000	.152	Semi-private	-4.23	.000
							Private	-8.80	.001
	Semi-private	13.76	5.569						
	Private	18.33	4.770						
C3	Public	7.06	3.923	3.164	.043	.015			
	Semi-private	6.65	3.928						
	Private	10.00	5.196						
C4	Public	4.30	2.229	7.035	.001	.032	Private	1.30	.000
	Semi-private	5.09	2.679				Public	.78	.009
							Private	2.09	.000
	Private	3.00	.000						
C5	Public	8.97	3.105	7.770	.000	.035			
	Semi-private	9.59	3.592						
	Private	13.00	2.291				Public	4.03	.002
							Semi-private	3.41	.004
C6	Public	7.82	2.665	3.198	.042	.015			
	Semi-private	8.52	3.314						
	Private	9.00	2.291						
C8	Public	5.18	2.116	20.541	.000	.088	Private	1.18	.000
	Semi-private	6.67	2.908				Public	1.50	.000
							Private	2.67	.000
	Private	4.00	.000						

Regarding the IV 'type of location', at the multivariate level, there were statistically significant differences (Wilks' Lambda = .944, F = 2,701, p = .007, and a small effect of partial size η^2 = .056) in three components: to communicate with the family (C1), to evaluate (C3) and to collaborate with people or groups publicly (C4) (Table 3). In all cases, teachers working in rural centres had a higher average use of ICT with respect to teachers working in urban areas. This difference was statistically significant (p <.05), although with a small partial effect of η^2 (from .014 to .024).

Table 3. Results of the multivariate analysis according to the IV 'location of the centre' in the use of ICT

DV	Location of the Centre	Descriptive		MANOVA		
		M	*SD*	*F*	Sig.	η^2 par.
C1	Urban area	10.34	5.301	9.056	.003	.024
	Rural area	12.19	6.229			
C3	Urban area	6.75	3.942	8.674	.003	.023
	Rural area	8.05	4.225			
C4	Urban area	4.25	2.205	5.209	.023	.014
	Rural area	4.83	2.564			

The teacher's work situation, at a multivariate level, has a statistically significant influence (Wilks' Lambda = .911, F = 2.411, p = .002, and a small-size effect, partial η^2 = .046) when using programs to design didactic materials (C6) and to collaborate with other groups at a personal level (C8). The other components showed an average intensity of use of ICT that was very similar in all measured dimensions. In C6 and C8, the differences were statistically significant (p < .05, with an effect of partial size η^2 of .048 and .003, respectively, of little relevance) (Table 4). When the different work situations were compared, it was verified that the only significant differences were observed within the group of teachers who were already occupying a fixed destination with respect to those occupying provisional ones. Teachers in their fixed destinations used the ICT to design didactic materials and to collaborate with other groups more frequently.

Table 4. Results of the multivariate analysis according to the IV 'work situation' in the use of ICT

DV	Work Situation	Descriptive		MANOVA			Games-Howell Test		
		M	*SD*	*F*	Sig.	η² par.	(J)	Difference in average (I-J)	Sig.
C6	Fixed position	7.87	2.859	3.061	.048	.015			
	Provisional position	8.43	2.551						
	Interns	8.92	3.359						
C8	Fixed position	5.87	2.662	5.986	.003	.028	Provisional	1.14	.000
	Provisional position	4.73	1.512						
	Interns	5.54	2.532						

The teachers' education degree, at a multivariate level also had a statistically significant influence (Wilks' Lambda= .946, *F*= 1.428, *p*= .040, and little effect of partial size η²= .039). According to the results obtained, except when ICT were used to solve tasks at a personal level (C5: $M_{B.Ed}$= 9.25 and $M_{M.Ed}$= 9.44), it was the B.Ed. Degree holders the ones who had higher ICT use averages as compared to the M.Ed. Degree ones. However, this difference in scoring was only statistically significant in terms of use of ICT as a support to prepare work (C7) (*p* <.05, although with little effect of partial size η² of .022). Showing in addition a very frequent use according to the established range (see Table 5).

Table 5. Results of the multivariate analysis according to the IV 'degree of studies' in the use of ICT

DV	Teacher's Degree	Descriptive		MANOVA		
		M	*SD*	*F*	Sig.	η² par.
C7	B.Ed.	15.19	3.179	9.475	.002	.022
	M.Ed.	14.Ağu	3.335			

The last IV, 'teaching experience' showed statistically significant differences at a multivariate level as well (Wilks' Lambda= .818, *F*= 5.467, *p*= .000 and a partial effect of size η² = .096, moderate). As a result of the descriptive analysis, in relation to the teaching experience of the participants, beginners had an average amount of use that was superior in all dimensions with respect to juniors and experts. The exception was when they needed to collaborate with others, either publicly or more privately (C4 or C8), in which case the junior teachers used the ICT more frequently. Following the MANOVA analysis, these differences were statistically significant (*p* <.05, with a moderate effect of partial size η² from .031 to .07) when it came to communicating with the family (C1), as support in the classroom (C2), to solve tasks on a personal level (C5), to design materials (C6) and as support for the teacher (C7). For each of these uses, if the groups were compared, according to the results obtained from the Games-Howell's test, no statistically significant differences were found between beginners and juniors, but both of these two categories had statistically significant differences when compared against experts (Table 6).

Table 6. Results of the multivariate analysis according to the IV 'teaching experience' in the use of ICT

DV	Teaching Experience	Descriptive		MANOVA			Games-Howell Test		
		M	SD	*F*	Sig.	η² par.	(J)	Difference in average (I-J)	Sig.
C1	Beginners	12.30	5.895	13.206	.000	.059			
	Juniors	11.82	6.024						
	Experts	9.02	4.621				Beginners	-3.28	.000
							Juniors	-2.80	.000
C2	Beginners	18.09	5.047	6.762	.001	.031			
	Juniors	18.05	5.168						
	Experts	16.00	5.809				Beginners	-2.09	.006
							Juniors	-2.05	.005
C5	Beginners	9.84	3.465	12.028	.000	.054			
	Juniors	9.64	3.146						
	Experts	8.07	3.073				Beginners	-1.77	.000
							Juniors	-1.57	.000
C6	Beginners	9.13	2.706	15.830	.000	.070	Juniors	1.20	.001
							Experts	1.95	.000
	Juniors	7.93	2.679						
	Experts	7.19	3.025						
C7	Beginners	15.41	3.163	8.570	.000	.039			
	Juniors	15.20	3.134						
	Experts	13.93	3.118				Beginners	-1.48	.001
							Juniors	-1.27	.002

Discussion and Conclusion

The results obtained have given us a general overview of the use of ICT by ECE teachers, highlighting a relatively low use of technological resources. This result is in line with various studies (Almerich et al., 2011; Eckhaus, & Davidovitch, 2019; Instituto de Evaluacion y Asesoramiento Educativo, 2007; Nguyen & Bower, 2018; Van Braak et al., 2004). An important contribution presented in this work is that eight possible uses of ICT by the teachers were found. The first one of these uses is related to communication, referring to the use of ICT as a means to establish communication channels with families (meetings, tutorials, notes, etc.). The second is linked to the support of classroom assignments, employing ICT as a tool to solve everyday tasks in the classroom (routines, stories, internet search, creating case files, etc.). The third use is to design assessment tools, followed by the fourth, using the ICT to establish contact with groups that may include unknown participants, through forums, blogs, etc. The fifth one refers to the knowledge of office software tools, such as Microsoft Office Suite, spreadsheets, presentations, etc. used to solve tasks at a personal level. Next, the sixth type of use is related to the design of didactic resources, including the handling of programs such as JClick, NeoBook, Paint, etc. Lastly, the last two uses, seventh and eighth, are related to teaching support, using ICT as a tool in the management of class programming, evaluations, informative notes, etc. and as a tool to interact with known people or work groups, respectively.

Despite this variety of dimensions, in general, there is little professional use of technology even when most respondents say they are trained in computer science, albeit in limited content. This invites us to focus on the kind of ICT training given to teachers, on its duration and its periodicity (it is an area subject to constant innovation) since it does not seem to encourage its own integration into teaching practice. This would represent one of the first order barriers, according to the review by Dagnino et al. (2018), about the difficulties that teachers present in the use of technological resources. These findings may be related to the hypothesis proposed by Brito, Dias and Oliveira (2018), according to which, behind these difficulties, there would be a lack of knowledge by ECE teachers for the creation of learning processes that include technology, knowledge that they should have acquired during their initial training. On the other hand, regardless of training, the limited use of ICT could be related to the beliefs of ECE teachers, as noted by Wood et al. (2008), that consider them inappropriate while teaching 4 years old children or younger. This situation leads to the use of the ICT that is not in an open and generalized manner in classroom, but in a manner more associated with specific tasks that are administrative and bureaucratic in nature. The scarce use of ICT for assessment and the scarce use of programs that could be used in the classroom are indicators of the low inclusion of technology in their work with the pupils. Furthermore, the low frequency of use of the ICT as a means to interact with people or groups, whether they were known or unknown, highlights the need to use these tools both during initial training and to promote collaboration among teachers, which is a very important aspect in their daily routine (Roig & Pascual, 2012; Tejada & Pozos, 2018).

In relation to the teaching experience, our study indicated that beginners had a higher average use in all dimensions, except for that related to collaboration with others, publicly or privately, in which the junior teachers were more active. These data partially coincide with the studies by Blackwell et al. (2014), Nguyen and Bower (2018) and Karaca et al. (2013) in which the most experienced teachers showed less favourable attitudes towards technology, but, despite that, displayed a greater use of them. If we examine the teacher's qualifications, it can be observed that except for solving tasks at a personal level, it was the B.Ed. Degree holders the ones who had higher mean scores than the M.Ed. Degree holders.

Analysing the type of centre, it could be observed that private schools had higher averages for uses related to communication with families, evaluation, performance of tasks on a personal level (office software tools) and design of didactic resources. The dimensions related to the collaboration with open groups that may involve unknown subjects and collaboration with known groups were used more frequently by the teachers from semi-private schools. The data seemed to indicate that it was the teachers working in public centres the ones who used the ICT the least. This could be due to what Blackwell et al. (2014) and Dagnino et al. (2018) have defined as a first order barrier, along with the one, mentioned above, that refers to training. That is to say, we could consider that in private and semi-private centres, the teachers have greater support that drives them to a greater use of ICT. In turn, these data can be associated with those found by British Educational Communications and Technology Agency (2004), Barrantes et al. (2011) and Pelgrum (2001), in which the lack of resources played a major role in the scarce use of ICT in ECE.

All this leads us to conclude that knowing the resources does not imply using them regularly according to the professional-didactic potential that they offer (evaluative, communicative, training, planning, etc.). In agreement with the background presented in the introduction and in line with the studies that have addressed the training of teachers in ICT, we must advocate for the improvement of the training of ECE teachers in its three dimensions: disciplinary, pedagogical and technological (Brito et al., 2018; Cabero, 2014; Prendes & Gutierrez, 2013; Valverde et al., 2010). Based on this three-dimensional model of ICT integration, our results, in a way, reflect that training in only one of these (technological) dimensions does not guarantee its integration into the classroom from a didactic-disciplinary perspective. In addition, its achievement is the result of a continuous development that goes through several stages of adoption-adaptation, which, in turn, goes hand in hand with professional development, and it is not just the result of mere digital literacy (Aguaded & Cabero, 2013; Tejada & Pozos, 2018).

Suggestions

Based on the conclusions, we would like to propose actions aimed at familiarising ECE teachers with new technologies highlighting their use and potential as teaching tools. To this end, it would be very interesting to elaborate and spread a *Decalogue of Good Practices*, a report resulting from a review of educational work in early childhood education under quality criteria based on ICT and its potential as a tool according to the 8 uses that we have identified.

As for the research instrument, our questionnaire has allowed us to relate the different uses given to ICTs with sociodemographic and professional variables of ECE teachers However, we must point out the need to expand it including other attitudinal variables, inherent to the teachers themselves, which may be influential in the degree of use of ICT, for instance variables such as self-perception, confidence, degree of technological knowledge and attitude towards technology. In addition, there are other external factors to take into account such as educational policies, the institutional environment, the teaching staff, etc.

We would also like to give warning of the possible differences regarding the initial training of the participants depending on the university where they studied as well as possible differences of in-service training provided by the different regional autonomies. Lastly, we would not like to conclude without acknowledging the limitation that exists in the sample used in terms of gender, but we consider it an example of the current situation.

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