Comunicar, nº 46, v. XXIV, 2016 | Media Education Journal | ISSN: 1134-3478; e-ISSN: 1988-3293
www.revistacomunicar.com | www.comunicarjournal.com

Generation Z's Teachers and their Digital Skills

Los docentes de la Generación Z y sus competencias digitales

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ABSTRACT

The presence of technological resources in schools and the high performance of so-called «Technology Generation» or «Generation Z» students are not enough to develop students' digital competence. The primary key is determined by the technological and pedagogical skills of teachers. In this paper, we intend to analyze the level of ICT skills of teachers in primary and secondary establishing a competency framework adapted to the Spanish educational environment, using as a basis the standards established by UNESCO in 2008 and reformulated in the year 2011. For this purpose, a questionnaire was done to show the profile of ICT teacher training faculty of the sample (80 schools and 1,433 teachers in the Community of Madrid) to study the characteristics of better training for the development of teachers was conducted under the digital jurisdiction of the Ministry of Education of Spain. The study results show a significant difference between optimal ICT skills and the low skills that teachers really have to develop learning activities with technological tools for their students. Teachers' digital skills are very important in the development of learning processes to introduce technologies as tools in the service of education, and this study will allow us to make decisions in policy formation and throughout early career teachers.

RESUMEN

La mera presencia de recursos tecnológicos en los centros y las altas capacidades de los alumnos de la «Generación Tecnológica» o «Generación Z», no son suficientes para desarrollar en los alumnos la competencia digital. La clave fundamental viene determinada por las competencias tecnológicas y pedagógicas de los docentes. En este trabajo, se pretende analizar el nivel de competencias en TIC de los profesores de Primaria y Secundaria estableciendo un marco competencial de referencia adaptado al ámbito educativo español, utilizando como base los estándares establecidos por la UNESCO en el año 2008 y reformulados en el año 2011. Para ello, se realizó un cuestionario que permitió establecer el perfil de formación docente en TIC del profesorado de la muestra (80 colegios y 1.433 profesores de la Comunidad de Madrid), para estudiar las características del profesorado mejor formado para el desarrollo de la competencia digital que establece el Ministerio de Educación de España. Los resultados muestran una alarmante diferencia entre las competencias que debieran tener los profesores para desarrollar la competencia digital en sus alumnos y la que verdaderamente tienen. Las competencias digitales del profesorado son muy relevantes en el desarrollo de procedimientos de aprendizaje que introduzcan las tecnologías como herramientas al servicio de la educación y este estudio nos permitirá tomar decisiones en política de formación inicial y a lo largo de la carrera profesional del profesorado.

KEYWORDS | PALABRAS CLAVE

Digital competence, ICT standards, learning management, teacher, curriculum, training, professional career.
Competencia digital, estándares TIC, gestión del aprendizaje, profesorado, currículum, formación, carrera profesional.

Received: 25-03-2015 | Reviewed: 10-04-2015 | Accepted: 16-07-2015 | Preprint: 01-11-2015 | Published: 01-01-2016
DOI http://dx.doi.org/10.3916/C46-2016-10 | Pages: 97-105

1. Introduction and state of the question

The concern throughout the education community (parents, teachers, students and society as a whole) triggered by the development and implementation in 2014 of the 2nd Education Act (Organic Law 8/2013), which establishes further measures to address core competencies, highlights the importance of reflecting on the learning processes and educational needs of the generations currently attending our schools. Such reflection must be based on a thorough understanding of what has come to be known as Generation Z. Other names have also been used to refer to this population group, such as Generation V (for virtual), Generation C (for community or content), the Silent Generation, the Internet Generation or even the Google Generation, but they all have a common denominator, information and communication technologies (ICTs).

Generation Z (Schroer, 2008) encompasses children or teenagers who were born between 1995 and 2012, as opposed to Generation Y (1977-94), also called the 2nd «Baby Boomer» Generation, and Generation X (1966-76), or the lost generation. Other authors (Mascó, 2012) have been even more specific, identifying the Z1 generation, born between late 1990 and 2000, and the Z2 generation, those born after 2005. A new generation has been proposed for those born after 2010, namely Generation α or «Google Kids» (Grail Research, 2011), defined to be the first generation of the 21st century, the most numerous to date, to be early adopters of technology, to start sooner and stay longer in school and to be focused on technology (figure 1).

However, in order to determine what the future of Generation α will be like, the Generation Z currently attending school presents a number of characteristics that authors such as Dolors Reig (Blog «El Caparazón»: http://goo.gl/VSEQ52) have attempted to study and which are summarised below (Geck, 2007; Hoffman, 2003; Posnick-Goodwin, 2010; Lay-Arellano, 2013; Aparici, 2010; Bennett, 2008): 1) Expert understanding of technology; 2) Multi-taskers; 3) Socially open through the use of technologies; 4) Fast and impatient; 5) Interactive; and 6) Resilient.

According to a Spanish Ministry of Education, Culture and Sport (MECD) report (2014), there are 8,081,972 students enrolled in general non-university education, from the 1st cycle of pre-school education to initial vocational qualification programmes. These belong to Generation Z, and are in our schools today.

The MECD (2013) has also published data on the number of teachers working in non-university education. From a total of 664,325 teachers, 10.8% are under 30 years old, 30% are between 30 and 39, 28.9% are between 40 and 49, 26.3% are between 50 to 59 and 4% are over 60 years old. Thus, about 40% belong to Generation Y (1977-1994), 30% to Generation X (1966-1976) and another 30% to the 1st generation of post War II World (1945-1965) «Baby Boomers». This generational divide between teachers and students, combined with the need to develop core competencies in compulsory education (especially digital competence), adapt to new social skills related to the use of technologies and address the new learning needs of a changing society, raise questions about the preparation of current teachers for leading the teaching-learning processes that Generation Z students will use.

1.1. Teachers' ICT teaching competencies, according to UNESCO

Teachers' information and communication technology competencies remain a crucial element for educational development. These can be understood as the suite of necessary skills and knowledge that teachers must possess in order to make more integrated

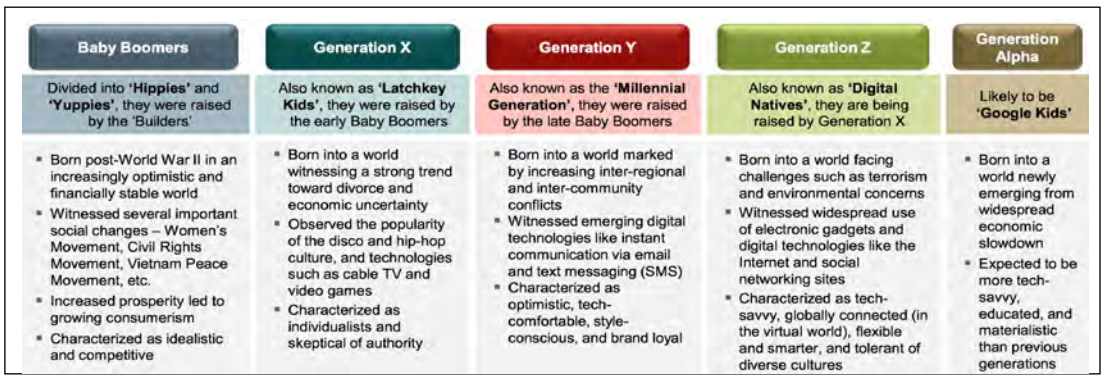

Figure 1. Generation Terminology by Birth Year (Grail Research, 2011).

use of these technological tools as educational resources in their daily practice (Suárez-Rodríguez, Almerich, & al., 2012).

As a result of the educational importance and value given to digital competencies in present day education systems over the last decade, various legislative measures have been implemented, establishing the need to include ICT competencies in the curriculum as an essential learning tool (Organic Law 2/2006, Organic Law 8/2013). Likewise, government institutions and NGOs have developed various models of ICT competency standards for teachers (Department of Education of Victoria – Australia; International Society for Technology in Education – USA / Canada; the Enlaces (learning networks) Project of the Chilean Ministry of Education –Chile; North Carolina Department of Public Instruction – USA; ICT Competency Framework for Teachers –UNESCO; PROFORTIC of Almerich, Suárez, Orellana, Belloch, Bo & Gastaldo – Spain). Each of these studies has examined the importance of teachers' digital competencies for the satisfactory development of ICT competencies in their students.

Several studies have explored teachers' lack of confidence and inadequate competence in the field of ICTs from both a technological and a pedagogical perspective (Banlankast & Blamire, 2007; Hew & Brush, 2007; Mueller, Wood, Willoughby, Ross & Specht, 2008; Ramboll Management, 2006). The conclusions drawn in most of these studies raise questions about the adequacy of both initial and continuing teacher training as regards reducing the «digital divide» between teachers and students, between «digital native» students and «digital immigrant» teachers (Prensky, 2001).

In 2008, UNESCO (2008; 2011) produced and published an extremely important document for states such as Spain, and education institutions that had not yet created any specific recommendations about what their teachers should know regarding the use of ICTs in education. The guidelines for teacher training in ICTs given in the «Planning guide» of «Information and communications technologies in teacher education» published by UNESCO in 2004 include a detailed study of «standards for teacher technology competency».

In general, the UNESCO ICT Competency Standards for Teachers project (UNESCO, 2008; 2011) is aimed at improving teachers' practice in all areas of their professional work, combining ICT competencies with innovations in teaching, the curriculum and organisation of the teaching institution. A further objective is to ensure that teachers use ICT competencies and resources to improve their teaching, cooperate with colleagues and ultimately to become innovation leaders within their institutions. The overall goal of this project is not only to improve teaching practice but also to do so in ways that contribute to improving the quality of an education system so that it furthers the economic and social development of the country (UNESCO, 2008). To this end, UNESCO has defined three levels of ICT competencies for teacher education:

- Understanding the technologies and integrating technological competencies in the curriculum (1st level: Technology Literacy).
- Use of these competencies in order to add value to society and the economy, and applying this knowledge to solve complex and real problems (2nd level: Knowledge Deepening).
- Production and subsequent leverage of new knowledge (3rd level: Knowledge creation).

These three approaches (UNESCO, 2008) correspond to alternative visions and goals for national policies on the future of education. However, each level possesses different characteristics according to the dimension analysed: 1) Policy and vision: aspects of ICTs in the curriculum; 2) Curriculum and assess-

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ment: planning and assessment of ICTs; 3) Pedagogy: ICT methodology issues; 4) ICTs: use and management of the technologies; 5) Organisation and administration: management of ICT resources; 6) Teachers' professional learning: continuing education in ICTs.

The goal of UNESCO's ICT-CST project has been to produce the UNESCO ICT Competency Standards for Teachers (ICT-CST) framework shown in figure 2.

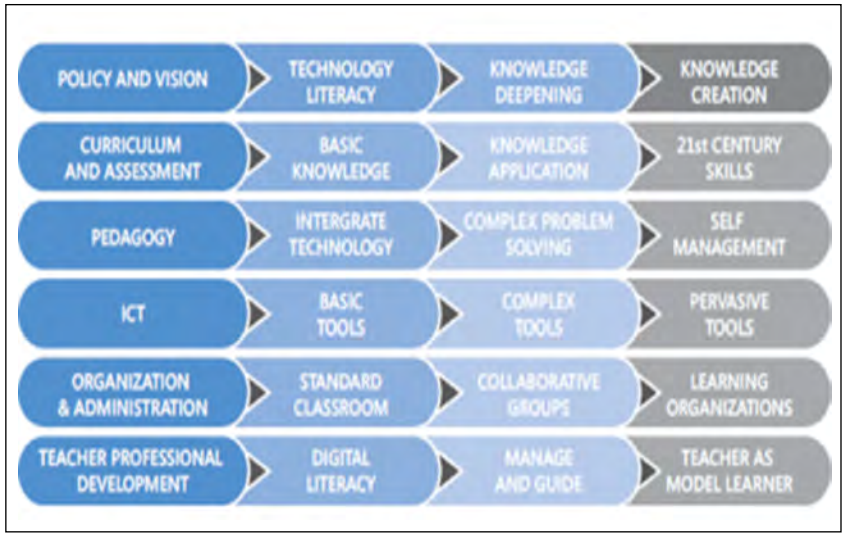

Figure 2. Modules of the UNESCO ICT Competency Framework for Teachers (UNESCO, 2008).

A study of the standards defined by UNESCO (2008; 2011) raises a number of questions which we aimed to answer in the present study: What ICT training have today's Generation Z teachers received? Are they equipped to help our students achieve digital competence? What characteristics do «digital immigrant» teachers possess? What aspects of teacher training should be improved in order to produce teachers with satisfactory digital competence? Are we are meeting our students' educational needs regarding the use of technological tools for independent learning?

The overall objective of this study was to analyse the level of ICT competencies among primary and secondary education teachers in the Community of Madrid in order to identify teacher training needs, based on a theoretical study using UNESCO's ICT competency standards for teachers and the design of an instrument which made it possible to conduct the pertinent analyses and identify the factors associated with differences in the ICT teacher training profile.

2. Material and methods

This was a non-experimental study, since it was not possible to manipulate the variables or randomly assign participants or treatment (Kerlinger & Lee, 2002). It therefore comprised an «ex-post-facto» study in which it was necessary for the phenomenon to occur naturally and conduct subsequent analyses, as the independent variables could not be manipulated.

2.1. Sample

The study was conducted with teachers working in primary and secondary schools in the Community of Madrid; 80 primary schools and secondary schools participated, of which 43.75% were public schools, 11.25% were private and 45% were state-funded private schools. The establishment of the core competencies defined in the 2006 Education Act and in the 2014 Organic Law for the Improvement of Educational Quality has meant that all schools in the Community of Madrid are required to include the development of digital competencies in the curriculum.

A total of 1,433 teachers participated, of whom 66.57% were female and 33.43% male. Participants were selected by means of incidental non-probability sampling (Kerlinger & Lee, 2002; Bisquerra, 2004); 70% of the study participants were aged between 26 and 45 years old (Generation X), 81.09% were teachers (the rest were members of the management team or ICT coordinators) and 35.05% had between 0 and 5 years of teaching experience. A total of 53.73% of the teachers who participated in the study taught in primary education, 42.78% taught in secondary schools and 3.49% taught at both educational levels.

2.2. Design of the instrument

To carry out this study, a questionnaire was developed as a tool for collecting information to assess the ICT teacher training profile of teaching staff in the Community of Madrid, and identify the underlying and observable relationships between the dimensions and variables studied.

The questionnaire consisted of a series of items referring to the ICT teacher training profile according to UNESCO. Subjects responded to each item by indicating their score, situation, knowledge or attitude using a 5-point Likert-type scale where 1 was the lowest score and 5 was the highest score.

The variable studied (the dependent variable) was the ICT teacher training profile (UNESCO), establishing three different profiles: Profile 1: Technology literacy; Profile 2: Knowledge deepening; Profile 3: Knowledge generation.

To better define the dependent variable, and in accordance with the standards established by UNESCO, this was divided into the following sub-dimensions, which were subsequently operationalised in the questionnaire items: curricular aspects of ICTs, planning and assessment of ICTs, methodological aspects of ICTs, use of ICTs, management of ICT resources, continuing education in ICTs.

2.3. Instrument reliability

The SPSS statistical package was used to study the reliability of the instrument (George & Mallery, 1995), employing Cronbach's α. This is the most widely used coefficient in this kind of analysis, and it indicates the internal consistency of a scale. An analysis of the overall α obtained for the instrument yielded the results shown in table 1.

Homogeneity indices (corrected item-total correlation) were within what could be termed «Excellent», as they were all above 0.3. In conclusion, the instrument employed to study the ICT teacher training profile presented excellent reliability, obtaining a Cronbach's α of .973 (George & Mallery, 1995).

3. Analysis and results

3.1. Descriptive and differential analysis

The overall score obtained was 2.78 on an assessment scale of 1 to 5, indicating that the ICT training profile of schools in the sample was medium-low. Almost 39.71% of the teachers possessed an «Average» ICT training profile (UNESCO), although it should be noted that 36.85% had a «Poor» profile and 9.56% had a «Very poor» profile. In other words, a total of 46.31% of teachers presented a negative profile in terms of ICT training in education. The 20, 40, 60 and 80 percentiles were used for these assessments, enabling us to identify a «Very poor profile» with scores below 1.6, a «Poor profile» with scores between 1.7 and 2.5, an «Average profile» with scores between 2.6 and 3.4, a «Good profile» with scores between 3.5 and 4.3, and a «Very good profile» with scores between 4.4 and 5.

Table 2 summarises the differential analyses conducted to identify the variables influencing the ICT teacher training profile according to the UNESCO standards in each of the sub-dimensions. Two statistical tests were used for this, the Student's t-test and one-way ANOVA, both for independent groups (together with subsequent Scheffé contrasts). In the differential analyses, the value of statistical power (P) was added to determine the rejection or acceptance of the hypothesis with a higher degree of certainty and significance. Therefore, when significance was high and power was close to 0.8, the values were considered significant Cohen, 1992).

The differential analyses performed (ANOVA - $p \leq 0.01$) according to the «Post» variable (Teacher, ICT Coordinator and Management and Coordination) clearly indicated significant and important differences in all sub-dimensions (CA, PA, MA, ICT, MR and CE) and in the questionnaire in general (0.000 sig. and 23.819 F), and as was to be expected, those who were ICT coordinators presented a higher level in the ICT teacher training profile.

When the Student's t-test was applied to the «Sex» variable (with an alpha of 0.05), no statistically significant differences were observed in any of the sub-dimensions or in the questionnaire in general (0.158 sig.), and no differences were obtained between men and women in relation to their ICT teacher training profile.

However, an analysis of the «Age» and «Teaching Experience» variables (ANOVA - $p \leq 0.01$ = 0.000 sig. /9.826 F for Age and 0.000 sig. /9.942 F for Experience) indicated that teachers who were older (56 - 66 years old) and had more teaching experience

Table 1. Analysis of instrument reliability: Cronbach's α

UNESCO ICT TEACHER PROFILE	No. items	Cronbach's α	Reliability
	63	**.973**	**Excellent**
DIMENSION	No. items	**Cronbach's α**	**Reliability**
General Curricular Aspects (CA)	3	.738	Acceptable
Planning and Assessment (PA)	10	.878	Good
Methodological Aspects (MA)	14	.903	Excellent
Use of ICTs (ICT)	21	.935	Excellent
Management of ICT Resources (MR)	8	.896	Good
Continuing Education in ICTs (CE)	7	.894	Good

presented a much lower level of ICT teacher training profile than teachers who were younger and had less experience, and teachers aged between 20 and 25 years old had the best profile.

As regards the variable «Degree» held by teachers (ANOVA - p<.01), the analyses only revealed statistically significant differences in some sub-dimensions (PA, ICT and CE), while for the questionnaire in general (0.014 sig. and 4.248 F) there was lack of significance in the difference of variation between groups (teaching and undergraduate degrees). The mean differences in all sub-dimensions presented very low levels of statistical significance and were not considered relevant in the ICT teacher training profile in relation to the degree held.

Table 2. Analysis of differences by sub-dimensions and questionnaire

		Sub-dimensions						
		CA	PA	MA	ICT	MR	CE	Questionnaire
Post - ANOVA (p <.01)	F	21.023	14.29	7.868	14,463	39.167	14.934	23.819
	Sig.	.00	.00	.00	.00	.00	.00	.00
	P	1	0.992	0.858	0.993	1	0.995	1
Age - ANOVA (p<.01)	F	3.007	4.121	6.966	17.374	6.821	15.072	9.826
	Sig.	.01	.001	.00	.00	.00	.00	.00
	P	0.693	0.87	0.992	1	0.991	1	1
Sex - Student's t-test (p<.05)	F	2.053	0.529	0	0.833	5.411	0.455	1.995
	Sig.	.152	.467	.992	.362	.02	.5	.158
	P	0.933	0.985	0.885	1	0.981	0.939	0.997
Experience - ANOVA (p<.01)	F	2.414	3.326	7.101	18.668	4.64	16.744	9.942
	Sig.	.034	.005	.00	.00	.00	.00	.00
	P	0.552	0.755	0.993	1	0.917	1	1
Degree - ANOVA (p<.01)	F	1.386	8.211	4.081	8.028	2.571	11.005	4.248
	Sig.	.25	.00	.017	.00	.077	.00	.014
	P	0.126	0.876	0.496	0.867	0.282	0.963	0.519
Stage - ANOVA (p<.01)	F	3.753	17.156	10.197	12.354	0.971	16.34	8.614
	Sig.	.024	.00	.00	.00	.379	.00	.00
	P	0.451	0.998	0.946	0.98	0.081	0.997	0.895
Subjects - ANOVA (p<.01)	F	1.911	10.866	5.383	9.558	7.603	4.782	6.972
	Sig.	.09	.00	.00	.00	.00	.00	.00
	P	0.414	1	0.959	1	0.996	0.927	0.992
ICTs at home - ANOVA (p<.01)	F	6.833	12.084	7.545	24.906	8.583	22.599	17.223
	Sig.	.001	.00	.001	.00	.00	.00	.00
	P	0.79	0.977	0.839	1	0.893	1	0.998
Usefulness - ANOVA (p<.01)	F	24.944	17.596	15.813	18.1	12.945	22.189	24.969
	Sig.	.00	.00	.00	.00	.00	.00	.00
	P	1.	0.999	0.997	0.999	0.985	1	1
Attitude - ANOVA (p<.01)	F	38.761	17.379	19.647	20.448	21.493	27.921	32.947
	Sig.	.00	.00	.00	.00	.00	.00	.00
	P	1.	0.999	1	1	1	1	1
Level ICT Training - ANOVA (p<.01)	F	79.374	96.432	74.843	157.14	112.28	92.616	147.19
	Sig.	.00	.00	.00	.00	.00	.00	.00
	P	1	1	1	1	1	1	1
ICT training received - ANOVA (p<.01)	F	53.448	33.409	32.083	54.242	56.942	37.104	61.205
	Sig.	.00	.00	.00	.00	.00	.00	.00
	P	1.	1	1	1	1	1	1

The «Educational Stage» variable was also analysed (ANOVA - p<.01), revealing statistically significant differences in almost all sub-dimensions (except CA and MR) and in the questionnaire in general (0.000 sig. and 8.614 F), and an important difference of means, whereby teachers working in secondary education presented a better profile than those working in primary education.

Similarly, important significant differences (ANOVA - p<.01) (questionnaire 0.000 sig. and 6.972 F) were observed between teachers forming the study sample for the «Subject Taught» variable, whereby teachers in the fields of Technology and the Experimental Sciences presented a better ICT teacher training profile.

Lastly, the final differential analyses (ANOVA - p<.01) revealed important and statistically significant differences regarding the «Technologies at Home», «Usefulness of ICTs», «Attitude towards ICTs», «Level of ICT training» and «ICT training received» variables. The data obtained indicated that teachers who had a computer and Internet access at home were convinced of the usefulness of ICTs for improving the teaching-learning process, presented a good attitude, had a good level of training in ICTs, had received both technical and teacher training on the use of ICTs, and had a better ICT teacher training profile

according to the UNESCO standards. These data were corroborated by the values of statistical power, all above 0.8 (Cohen, 1992), indicating a high probability of obtaining a statistically significant result.

4. Discussion and conclusions

Teacher training in the application of ICTs in education has a long way to go, and requires identification of the factors that can help improve the competencies that current and future teachers must acquire in order to implement digital literacy in our schools.

This study has revealed the existence of a significant deficit in teacher training in the use of ICTs and their application in the classroom, an inherent aspect of digital competence established by Organic Law 2/2006 and Organic Law 8/2013.

According to the sub-dimensions established by UNESCO (2008; 2011), it can be concluded that the ICT teacher training profile corresponds to a medium-low level. As has been seen in the sub-dimension of «General curricular aspects», most teachers do not know what is meant by digital competence in education or how to achieve this in the classroom. Similarly, the results for the «Planning and assessment» sub-dimension indicate that further work is required as regards planning activities and assessment of competencies by means of rubrics with the incorporation of ICT resources. Continuing in this pedagogical line, one of the most important sub-dimensions for the definition of the ICT teacher training profile is that of «Methodological and instructional aspects». The results of this study have revealed that teachers' classroom strategies regarding the use of ICT resources as an avenue for complex and collaborative learning have not yet been implemented as teaching methods in the development of students' digital competence.

The poor results obtained for teachers' instructional application of ICT resources may be explained by the data provided by the sub-dimension «Use of ICTs». This sub-dimension has made it possible to assess teachers' technical competencies regarding the use of technologies, yielding a very low profile among teaching staff. This is one of the problems facing the incorporation of ICTs in education: if teachers do not possess technical knowledge about the use and application of digital tools, these are unlikely to be implemented in education. Teachers' lack of knowledge about the use of technological tools effectively prevents them from applying these in educational activities with their students, as has been reported in other studies (Suárez-Rodríguez, Almerich, & al., 2012). These conclusions are supported by the results obtained for the sub-dimension «Continuing teacher education in ICTs», which revealed a considerable need for teachers working in public and private schools to update their knowledge. Although there are many training courses related to ICTs in education promoted by the different authorities, only a very small percentage of teachers attend these courses, as described in European Union reports (Eurydice, 2011) which state that only 16% to 25% of primary education students are taught by teachers who have participated in continuing education programmes on the use of ICTs.

Lastly, the sub-dimension «Management of ICT resources» obtained very low results, supporting the idea that an ICT coordinator is an indispensable member in the school.

Based on the structure suggested by UNESCO regarding ICT teacher training profiles, it can be concluded that:

- Teachers who are older (56 - 66 years old) and have more teaching experience present a much lower ICT teacher training profile than teachers who are younger and have less experience, and teachers aged between 20 and 25 years old have the best profile.
- No large discrepancies exist between primary and secondary school teacher profiles. Both obtained a poor profile according to UNESCO indicators. This suggests that the initial training of both teaching professionals (teaching degree or diploma for the former and a master's degree in secondary education for the latter) exerts no influence on the application of ICT tools in education, and further reveals the limited training that pre-service teachers receive in terms of digital competence in education faculties, as reported by Prendes and others (2010).
- This study indicates that teachers working in secondary education have a better profile than those teaching in primary education. As the above suggests, although the initial qualification does not lead to a better or worse teacher training profile, continuing professional development (life-long learning) does endow secondary education teachers with greater specialisation in digital competence throughout their professional careers.
- As corroborated by this study, science and technology teachers present better digital competencies; teachers in the fields of Technology and the Experimental Sciences possessed a better ICT teacher training profile.
- Other studies (Tejedor, 2014) have shown that teachers with ICT tools at home present a better attitude and better training in the use of these resources in education. Likewise, in the present study, teachers who had a computer (PC, laptop, tablet or smartpho-

ne) and an Internet connection at home presented a better ICT teacher training profile.

• As regards attitude and inclination towards ICTs, the results also indicate that there is a better ICT teacher profile among teachers who believe in the usefulness of these technologies in education, have a positive attitude and are convinced of their usefulness for improving the teaching-learning process, as has been reported in numerous studies (Alonso & al., 2014).

• This study has highlighted the need for teachers to be trained in the application of digital competence in the classroom. Thus, teachers who have received training that combined technical aspects of the use of technological tools and pedagogical aspects regarding their instructional application in learning activities, had a better ICT teacher training profile according to UNESCO standards.

The results suggest that further work is required in terms of incorporating information and communication technologies in education into teacher training programmes, whether in education faculties as part of the initial training or on courses organised by public and private education institutions that promote continuing professional development in order to develop digital competence among teachers. They also highlight the considerable difference between Generation Z, corresponding to students currently attending our primary and secondary schools (basic education in which they must develop digital competence according to the LOE and LOMCE) and the scant training received by present day teachers to implement this. It is therefore important to define teacher training programmes (both initial and continuing) in greater depth in order to help improve the training teachers receive in relation to digital competence and reduce the «digital divide» between teachers and their students.

In sum, this study has revealed clear indications of a lack of preparation among current teaching staff to facilitate the development of digital competence in students. Clearly, teachers cannot help students develop a competence that they themselves do not possess in depth.

References

Alonso, F.G., González, M.C., Vidal, J.E., & García, O.A. (2014). *Niños 2.0, una experiencia formativa en actitudes y valores para el profesorado ante la Web 2.0 y TIC. Metodologías de aprendizaje colaborativo a través de las tecnologías.* Salamanca: Universidad de Salamanca.

Aparici, R. (2010). *Conectados en el ciberespacio*. Madrid: UNED.

Area, M. (2011). *Informe ¿Qué opina el profesorado sobre el Programa Escuela 2.0? Un análisis por Comunidades Autónomas.* (http://goo.gl/Jyvzgd) (03-07-2014).

Balanskat, A., & Blamire, R. (2007). *ICT in Schools: Trends, Innovations and Issues in 2006-07*. European Schoolnet. (http://goo.gl/FdDFYs) (05-11-2014).

Bennett, S., Maton, K., & Kervin, L. (2008). The Digital Natives Debate: A Critical Review of the Evidence. *British Journal of Educational Technology, 39*, 775-786. DOI: http://dx.doi.org/10.1111/j.1467-8535.2007.00793.x

Bisquerra, R. (2004). *Metodología de la investigación educativa*. Madrid: Plaza.

Cohen, J. (1992). A Power Primer. *Psychological Bulletin*, *112*, 155-159. (http://goo.gl/vBcYFJ) (01-02-2015). doi: http://dx.doi.org/10.1037/0033-2909.112.1.155

Colón, A.O., Moreno, L.A., León, M.P., & Zagalaz, J.C. (2014). Formación en TIC de futuros maestros desde el análisis de la práctica en la Universidad de Jaén. *Píxel-Bit*, *44*, 127-142. (http://goo.gl/g6WSRy) (01-02-2015).

Eurydice (2011). *Cifras clave sobre el uso de las TIC para el aprendizaje y la innovación en los centros escolares de Europa 2011*. Bruselas: Agencia Ejecutiva en el ámbito educativo, audiovisual y cultural. (http://goo.gl/DXXLJw) (02-05-2014).

Grail Research (2011). *Consumers of tomorrow insights and observations about Generation Z*. (http://goo.gl/7qYuWt) (17-08-2014)

Geck, C. (2007). *The Generation Z Connection: Teaching Information Literacy to the Newest Net Generation. Toward a 21st-Century.* School Library Media Program, 235. (http://goo.gl/1tur7F) (01-12-2014).

George D., & Mallery, P. (1995). *SPSS/PC + Step by: A Simple Guide and Reference.* Belmont (CA): Wadsworth Publishing Company.

Hew, K.F., & Brush, T. (2007). Integrating Technology into K-12 Teaching and Learning: Current Knowledge Gaps and Recommendations for Future Research. *Educational Technology Research Development*, *55*(3), 227-243. doi: http://dx.doi.org/10.1007/s11423-006-9022-5

Hoffman, T. (2003). Preparing Generation Z. *Computerworld*, *37* (34), 41. (http://goo.gl/w6jIt9) (05-10-2014).

International Society for Technology in Education (Ed.) (2008). *NETS for Teachers: National Educational*. (http://goo.gl/a9ur) (15-12-2014).

Kerlinger, F., & Lee, H. (2002). *Investigación del comportamiento. Métodos de investigación en Ciencias Sociales.* México: McGraw Hill.

Lay-Arellano, I.T. (2013). Los jóvenes y la apropiación de la tecnología. *Paakat*, *4*. (http://goo.gl/5L7z43) (07-10-2014).

Ley Orgánica 2/2006, de 3 de mayo, de Educación. Boletín Oficial del Estado, 106, de 4 de mayo de 2006. (http://goo.gl/mxokeX) (29-07-2015).

Ley Orgánica 8/2013, de 9 de diciembre, para la mejora de la calidad educativa. Boletín Oficial del Estado, 295, de 10 de diciembre de 2013. (http://goo.gl/UpKyig) (29-07-2014).

Lieberman, A., Fullan, M., & Hopkins, D. (Eds.) (2010). *Segundo manual internacional del cambio educativo.* Dordrecht: Springer.

Martín, A.H. (2014). La formación del profesorado para la integración de las TIC en el currículum: nuevos roles, competencias y espacios de formación. En *Investigación y tecnologías de la información y comunicación al servicio de la innovación educativa*. Salamanca: Universidad de Salamanca.

Mascó, A. (2012). *Entre Generaciones. No te quedes fuera del futuro*. Buenos Aires: Temas.

MECD (2013). *Datos y cifras. Curso escolar 2013-14.* (http://goo.gl/IGLIoE) (25-02-2015).

MECD (2014). *Estadística de las Enseñanzas no universitarias. Datos 2013-14*. (http://goo.gl/C6grdz) (25-02-2015).

Ministerio de Educación de Chile (2006). E*stándares en la Tecnología de la Información y la Comunicación para la formación*

inicial del docente. Santiago de Chile: Ministerio de Educación de Chile. (http://goo.gl/oKrNPF) (16-09-2014).

Mueller, J., Wood, E., Willoughby, T., Ross, C., & Specht, J. (2008). Identifying discriminating variables between teachers who fully integrate computers and teachers with limited integration. *Computers & Education*, *51*(4), 1.523-1.537. doi: http://dx.doi.org/10.1016/j.compedu.2008.02.003

North Caroline Department of Public Instruction (2000). *Basic Technology Competencies for Educators*. (North Caroline Department of Public Instruction, 2000). (http://goo.gl/ORjJDe) (23-09-2014).

Posnick-Goodwin, S. (2010). *Meet Generation Z. California Teachers Association*. (http://goo.gl/oq8J99) (23-09-2014).

Prendes, M.P., Castañeda, L., & Gutiérrez, I. (2010). Competencias para el uso de TIC de los futuros maestros. *Comunicar*, *35*, 21. doi: http://dx.doi.org/10.3916/C35-2010-03-11

Prensky, M. (2001). Nativos digitales, inmigrantes digitales. *On the Horizon*, *9*(5). (http://goo.gl/4oYb) (23-05-2014).

Ramboll Management. (2006). *E-Learning Nordic 2006: Impact of ICT on education*. Denmark: Ramboll Management. (http://goo.gl/8VircM) (23-05-2014).

Schroer, W. (2008). Defining, Managing, and Marketing to Generations X, Y, and Z. *The Portal*, *10*, 9. (http://goo.gl/Fc40dB) (15-02-2015).

Suárez-Rodríguez, J.M., Almerich, G., Díaz-García, I. & Fernández-Piqueras, R. (2012). Competencias del profesorado en las TIC. Influencia de factores personales y contextuales. *Universitas Psychologica*, *11*(1), 293-309. (http://goo.gl/VCz6jD) (24-07-2014).

Tejedor, F.J. (2014). Presentación de datos globales. En *Evaluación de procesos de innovación escolar basados en el uso de las TIC desarrollados en la Comunidad de Castilla y León*. Salamanca: Universidad de Salamanca.

UNESCO (2004). *Las tecnologías de la información y la comunicación en la formación docente*. París: Informe UNESCO (http://goo.gl/ZRj7l) (23-05-2013).

UNESCO (2008). *Normas UNESCO sobre competencias en TIC para docentes*. (http://goo.gl/pGPDGv) (15-06-2013).

UNESCO (2011). *UNESCO ICT Competency Framework for Teachers*. (http://goo.gl/oKUkB) (24-05-2014).