

## Teachers 3.0: Patterns of Use of Five Digital Tools

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### Abstract

Nowadays, improvements in teaching are closely related to the use of technologies which have been defined as unprecedented educational tools. This study analyzes the use that 118 Spanish teachers make of five digital tools; Google, Wikis, Blogs, YouTube and WhatsApp in the educational center and the impact of the socio-labor variables of these teachers on the greater or lesser use of digital tools for teaching and evaluation. To this end, a questionnaire is designed and validated, in both its versions, printed and online, and two types of analysis are carried out, one descriptive and the other multivariate, using General Linear Model. The results show different patterns in the use of digital tools by teachers according to their age, gender, professional experience, type of school and performance of academic positions. The implications of these results are discussed and evaluated.

### Keywords

ICT; Digital competence; Technology use; Teaching; Educational Context

## I. Introduction

The more digitised society becomes, the greater the demand there is for digitally competent teachers capable of finding new ways to incorporate technologies in education (Instefjord & Munthe, 2017). The ability to integrate and use technologies for educational purposes requires generic and specific teaching skills, known as professional digital competence (Lund, Furberg, Bakken & Englien, 2014).

Previous research has reported a relationship between teachers' level of digital competence and their use of technologies in schools (Almerich, Suárez, Jornet, & Orellana, 2011; Law & Chow, 2008; Tejedor & García-Valcárcel, 2006; Vargas-D'Uniam, Chumpitaz-Campos, Suárez-Díaz, & Badia, 2014). Thus, exploratory studies such as those by Law and Chow (2008) and Tejedor and García-Valcárcel (2006) have found that teachers' knowledge of technologies is a significant predictor of technology use in schools. Along the same lines, Puentes, Roig, Sanhueza and Friz (2010) have reported the existence of a causal relationship between teachers' digital knowledge and the use of technologies in education, while Condie, Munro, Muir and Collins (2005) found that a low level of digital competence in teachers was associated with scant use of technologies.

However, teachers' use of technologies in education is a complex process that involves many factors besides their level of digital competence. Hence, there is a need to adopt a multivariate approach in research on information and communication technologies, viewing this phenomenon as the result of a series of personal and contextual factors with potentially complex inter-relationships (Almerich, Suárez, Jornet & Orellana, 2011).

Teachers' adoption of technologies in the educational process may be influenced by personal factors such as age, sex, professional experience and experience in the use of technologies for educational purposes, and by their attitudes and beliefs regarding technologies (Schiller, 2003). Research such as that by Huang and Liaw (2005) has found that teachers' attitudes to technologies influence acceptance of their usefulness and integration in the teaching-learning process. Other studies have reported that younger teachers with a higher educational level —doctoral studies— are more likely to use technologies in teaching (Meyer & Xu, 2009), and that male teachers have more positive attitudes towards technologies and use them more frequently in the educational process than female teachers (Yanti, Setiawan, Nurhabibah & Yannuar, 2018).

Contextual factors that affect the use of technologies may be related to the institution, the area of knowledge, the support provided for the use of technologies and the artefacts that help or hinder such use (Christ, Arya & Chiu, 2017). Institutions with a culture of supporting the design of courses that integrate technologies have a higher number of teachers that use them in the educational process (Ahmadpour & Mirdamadi, 2010; Meyer & Xu, 2009).

Technologies such as blogs, wikis, the Google search engine, YouTube audio and video files and WhatsApp instant messaging have been the subject of numerous studies that have sought to identify the potential of these digital tools when used by teachers. Some have found that blogs encourage self-regulated learning through continuous reflection (Cano & Cabrera, 2013); that they extend the classic limitations of space and time in traditional education (Roselló & Pinya, 2017); and that they increase student satisfaction with learning, improve academic achievement and facilitate comprehension of the subject matter studied (Biberman-Shalev, 2018; Fernández & Pérez, 2015).

Wikis have gone from being a heavily used tool for sharing knowledge outside of schools to also being used by teachers in academic environments in order to support collaborative learning or as a tool for teaching and learning in general (Gómez, 2017). Meanwhile, Google and YouTube have been used for teaching in various areas and educational stages. Tools such as Google Earth and Google Maps have proved especially useful to teach subjects such as Earth Science in secondary education (Jiménez, Pérez & Carrillo-Rosúa, 2014), while YouTube audio and video files have proved useful in teaching arts at professional levels (DeWitt, Alias, Siraj, Yaakub, Ayob & Ishak, 2013).

Lastly, studies on the use of instant messaging applications such as WhatsApp or Voxer have demonstrated both opportunities and challenges. Instant messaging helps improve social connections and professional learning (Carpenter & Green, 2017), but the amount of time spent using this tool does not appear to contribute positively to the completion of teaching tasks (Junco & Cotten, 2011).

These conflicting results underscore the need to conduct new studies to analyse teachers' patterns of technology use and determine the impact of various teacher variables on such use. Consequently, the aim of the present study was to analyse teachers' use of five digital tools (blogs, wikis, Google, YouTube and WhatsApp) and determine the impact of socio-occupational variables on such use. We expected to find differential patterns of use, establishing relations between the use of different digital tools and the variables of sex, age, teaching experience, type of school and academic post.

### **a. Research questions**

In line with the general aim of the study and a literature review conducted on teachers' use of technologies, we selected five technology tools. To determine whether teachers' personal and contextual factors influenced their use of technologies, we analysed: i) secondary school teachers' patterns of use of five digital tools (Google, YouTube, wikis, blogs and WhatsApp); and ii) the influence of their personal and contextual factors on their use of digital tools.

Our research questions were as follows:

- 1) What are secondary school teachers' patterns of use of digital tools (wikis, blogs, Google, YouTube and WhatsApp)?
- 2) Are there any significant differences in the use of these digital tools according to personal variables (age, sex and experience) and contextual variables (type of school and academic post)?

## **II. Method**

To answer to our research questions, we designed a quantitative study using a questionnaire to collect data and a descriptive-interpretative approach to elucidate the results obtained.

### **a. Sample**

We administered the questionnaire to 118 teachers (58 men and 60 women) aged between 25 and 60 years old. All of them taught compulsory secondary education and had at least one year of professional teaching experience. Fifty percent of the study sample worked in state-subsidised

private schools, 44% in state schools and 5.9% in private schools, all of which were located in the autonomous region of Castile and León. Tutors accounted for 53.4% of the total number of teachers, while 12.7% held a management post in the school.

**b. Research instrument**

We designed a questionnaire with two clearly distinct parts: (i) the first consisted of six questions to obtain general study sample data (age, sex, years of teaching experience, type of school and tutorial or management post) and (ii) the second part consisted of thirty multiple choice questions on use, frequency, time spent, purpose, place of use and level of satisfaction regarding use of five digital tools (wikis, blogs, Google, YouTube and WhatsApp) in the school.

To facilitate data collection, we created two identical versions of the questionnaire, one for online administration using Google Forms and the other in paper format. However, we prioritised online administration to reduce costs to a minimum.

Subsequently, we conducted a principal components analysis (PCA) of the questionnaire. We obtained a Kaiser-Meyer-Olkin (KMO) score of 0.852, classified as “meritorious” by Kaiser (1974). In addition, Bartlett’s test of sphericity was statistically significant ( $p < 0.0005$ ), indicating that the data were suitable for factor analysis.

Our analysis revealed six components that had eigenvalues greater than one and explained 80.3% of the total variance. Visual inspection of the sedimentation graph indicated that six components should be retained. The solution for six components met the criterion of interpretability. We applied a Varimax orthogonal rotation to facilitate interpretation and the rotated solution exhibited a “simple structure” (Thurstone, 1947).

Data interpretation was consistent to measure patterns of use of digital tools with high loads for the blog items in component 1, wiki items in component 2, WhatsApp in component 3, YouTube in component 4 and Google in components 5 and 6 (see Table 1). In addition, the questionnaire showed a high level of internal consistency, obtaining a Cronbach’s alpha of 0.903.

Nº	Component	% of explained variance	% of cumulative variance	Items	Factor weighing
I	Blog	17.636	17.636	Level of satisfaction with blog	.947
				Use of blog	.945
				Use of blog to plan and to evaluate activities	.938
				Frequency of use of blog	.923
				Use of blog in classroom	.922
				Use of blog in teacher’s room	.919
				Use of blog to search and to select educational content	.909
				Use of blog to contact and to know the work of others	.906
				Use of blog in another places	.893
				Time of use of blog	.883
II	Wiki	17.151	34.787	Use of wikis	.961
				Use of wikis to search and to select educational content	.944
				Level of satisfaction with wikis	.925
				Use of wikis to contact and to know the work of others	.913
				Use of wikis to plan and to evaluate activities	.898

				Use of wikis in teacher's room	.897
				Use of wikis in classroom	.896
				Frequency of use of wikis	.891
				Use of wikis in another places	.875
				Time of use of wikis	.839
III	WhatsApp	17.044	51.830	Use of WhatsApp	.958
				Frequency of use of WhatsApp	.945
				Use of WhatsApp in classroom	.937
				Level of satisfaction with WhatsApp	.931
				Use of WhatsApp to contact and to know the work of others	.917
				Use of WhatsApp in teacher's room	.907
				Use of WhatsApp in another places	.904
				Use of WhatsApp to search and to select educational content	.902
				Use of WhatsApp to plan and to evaluate activities	.884
				Time of use of WhatsApp	.861
IV	YouTube	16.867	68.697	Use of YouTube	.933
				Use of YouTube to search and to select educational content	.931
				Use of YouTube to plan and to evaluate activities	.910
				Level of satisfaction with YouTube	.897
				Use of YouTube in classroom	.896
				Use of YouTube in another places	.895
				Use of YouTube to contact and to know the work of others	.892
				Use of YouTube in teacher's room	.882
				Time of use of YouTube	.867
				Frequency of use of YouTube	.818
V	Google I	7.308	76.005	Use of Google	.816
				Use of Google to search and to select educational content	.781
				Use of Google in teacher's room	.766
				Use of Google to plan and to evaluate activities	.691
				Use of Google in classroom	.633
				Level of satisfaction with Google	.631
VI	Google II	4.306	80.311	Use of Google in another places	.651
				Time of use of Google	.620
				Frequency of use of Google	.603
				Use of Google to contact and to know the work of others	.534

Table 1. Survey construct validity.

### c. Procedure

To identify coherent questionnaire variables, we reviewed and analysed the instruments employed in previous international research on the use of digital tools in education. Once designed, our questionnaire was validated by five experts from Spanish universities, reformulating items considered unclear and eliminating those considered irrelevant.

All schools delivering compulsory secondary education in Castile and León were informed of the study and invited to participate. First, school heads were contacted by telephone to request consent, and then the questionnaire was administered in print or online format, depending on participant preference, to teachers who voluntarily agreed to participate.

Once teachers had completed the questionnaires, a matrix was constructed using the data from both questionnaire formats, the pertinent encoding was performed and the corresponding statistical analyses were conducted using SPSS version 24.0 to obtain empirical research results.

### III. Results

To answer our research questions, we performed descriptive analyses, which yielded data on the mean and standard deviation; parametric analyses to test for asymmetry and kurtosis, which revealed that the distribution complied with the assumption of normality; and multivariate analyses of variance using the general linear model. Our results are presented below.

#### a. Descriptive analysis

To answer the first research question about teachers' patterns of use of the five digital tools (wikis, blogs, Google, YouTube and WhatsApp), we performed descriptive statistics of the following variables: *use, frequency, time spent, purpose, place of use and level of satisfaction* (see Figure 1).

In relation to use, virtually all the teachers surveyed (97%) stated that they used the Google search engine. In addition, six out of ten used WhatsApp, YouTube and wikis. In contrast, only four out of ten used blogs.

With regard to frequency of use on a daily basis, 53% reported using Google and 44%, WhatsApp. However, fewer than 10% used wikis, YouTube or blogs. For time spent, 47% reported spending between one and three hours a day using Google, but fewer than 22% spent this amount of time using the rest of the tools analysed.

In relation to place of use, 68% of teachers reported using Google tools in the classroom, followed by 41% who used YouTube. Meanwhile, wikis and blogs were used to a lesser extent in the classroom, by only two out of ten teachers. The most frequently used tool in the staff room was once again Google, used here by 74% of respondents, followed by WhatsApp (41%). Fewer than 30% used any of the other tools in the staff room.

In relation to purpose, nine out of ten teachers reported using Google to search for and select educational content, and eight out of ten, to plan and evaluate activities. YouTube and wikis were used to search for and select content by 52% and 50% of respondents, respectively, whereas WhatsApp was used by 87% of teachers to contact others and find out about their work.

Finally, with regard to satisfaction, teachers showed a high level of satisfaction with use of Google (74%) and WhatsApp (41%), and a medium-high level of satisfaction with use of the rest of the tools analysed.

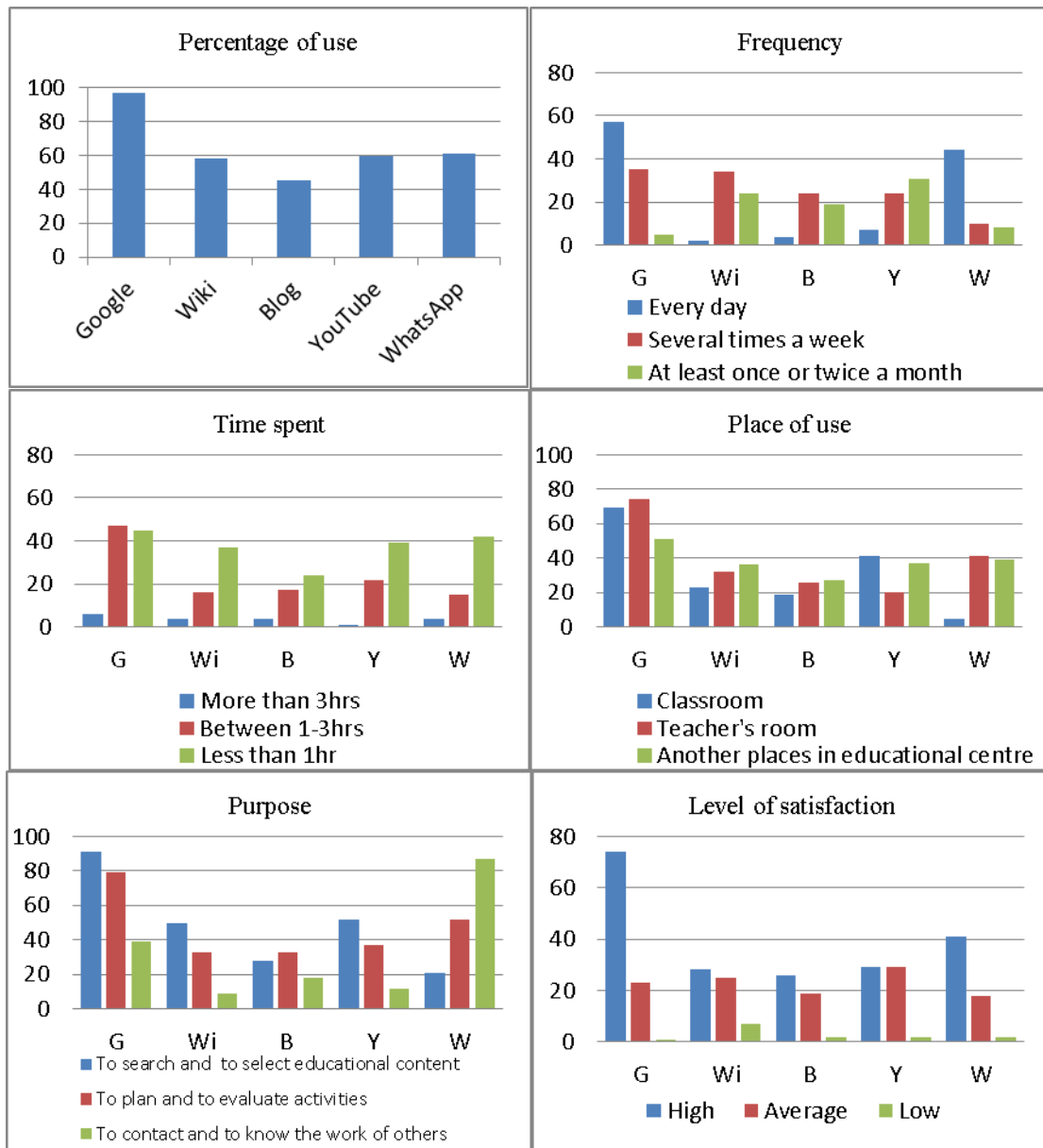


Figure. 1. Results of descriptive statistics. Tools are: G=Google, Wi=Wiki, B= Blog, Y= YouTube y W= WhatsApp.

**b. Multivariate linear analysis (GLM)**

To answer the second research question about the influence of teachers’ personal and contextual variables on the use of digital tools in school, we carried out multivariate analyses taking questionnaire items referring to use of tools as between-subject factors and *age, sex, years of teaching experience, type of school and tutorial or management post* as grouping variables.

Application of the general linear model (GLM) revealed statistically significant multivariate contrasts. Tests of between-subject effects and post hoc tests in each of the following categories: What tools do they use? With what frequency? How much time do they spend? What are their levels of satisfaction with their use? for each of the following grouping variables: *sex, age, years of teaching experience, tutorial post, management post* and *type of school* revealed statistically significant differences (see Tables 2, 3, 4, 5, 6, 7 and 8).

SEX	Males		Females		F	p
	M	σ	M	σ		
Use of blogs	1.34	.479	1.55	.502	4.517	.025
Frequency of use of Google	2.28	.914	2.62	.490	16.522	.013
Time of use of Google	1.41	.650	1.70	.619	.473	.016
Time of use of blogs	.53	.821	.87	.947	.822	.044

Table 2. Test of between-subject effects, considering sex as the grouping variable.

Note. Only variables that show statistically significant results are displayed ( $p < .05$ )

AGE	30 or less		31-40 years		41-50 years		51 or more		F	p
	M	σ	M	σ	M	σ	M	σ		
Use of Google	1.80	.447	2.00	.000	2.00	.000	1.94	.242	3.475	.018
Use of wikis	1.00	.000	1.59	.500	1.57	.501	1.67	.479	2.744	.046
Use of WhatsApp	2.00	.000	1.41	.557	1.74	.444	1.55	.506	4.168	.008
Frequency of use of Google	1.60	1.140	2.62	.493	2.54	.657	2.27	.911	3.857	.011
Frequency of use of WhatsApp	2.80	.447	1.18	1.381	1.98	1.291	1.33	1.384	4.222	.007
Time of use of WhatsApp	2.20	.447	.68	.843	1.00	.789	.64	.699	7.095	.001
Level of satisfaction with Google	2.00	1.225	2.82	.387	2.76	.480	2.52	.795	3.850	.011
Level of satisfaction with WhatsApp	2.60	.548	1.38	1.457	1.93	1.289	1.27	1.329	2.862	.040

Table 3. Test of between-subject effects, considering age as the grouping variable.

Note. Only variables that show statistically significant results are displayed ( $p < .05$ )

AGE	30 or less vs 31-40 years	30 or less vs 41-50 years	30 or less vs 51 or more	31-40 years vs 41-50 years
Use of Google	.037	.033	n.s.	n.s.
Use of wikis	n.s.	n.s.	.047	n.s.
Use of WhatsApp	n.s.	n.s.	n.s.	.037
Frequency of use of Google	.038	n.s.	n.s.	n.s.
Time of use of WhatsApp	.001	.015	.001	n.s.
Level of satisfaction with Google	.049	n.s.	n.s.	n.s.

Table 4. Post hoc according to age.

Note. Only variables that show statistically significant results are displayed ( $p < .05$ )



TEACHING EXPERIENCE	From 0 to 5 years		From 6 to 10 years		From 11 to 15 years		More than 15 years		F	p
	M	σ	M	σ	M	σ	M	σ		
Use of WhatsApp	1.77	.439	1.58	.507	1.33	.577	1.66	.477	2.861	.040
Frequency of use of wikis	.54	.660	.74	.933	.81	.928	1.22	1.008	2.894	.038
Time of use of Google	1.46	.660	1.74	.562	1.19	.512	1.65	.672	3.436	.019

Table 5. Test of between-subject effects, considering teaching experience as the grouping variable.  
 Note. Only variables that show statistically significant results are displayed ( $p < .05$ )

TEACHING EXPERIENCE	0-5 years vs 6-10 years	0-5 years vs 11-15 years	0-5 years vs more than 15 years	11-15 years vs more than 15 years
Time of use of Google	n.s.	n.s.	n.s.	.044

Table 6. Post hoc according to teaching experience.

Note. Only variables that show statistically significant results are displayed ( $p < .05$ )

TYPE OF CENTRE	State school		Charter School		Private School		F	p
	M	σ	M	σ	M	σ		
Use of YouTube	1.48	.505	1.68	.471	1.86	.378	1.560	.038
Frequency of use of blogs	.60	.869	1.00	1.017	.43	.535	3.138	.047
Frequency of use YouTube	.67	.810	1.19	.991	1.71	.756	6.847	.002
Frequency of use of WhatsApp	1.25	1.297	1.80	1.399	2.57	1.134	4.237	.017
Level of satisfaction with Google	2.50	.804	2.85	.363	2.57	.535	4.646	.011
Level of satisfaction with wikis	1.08	1.218	1.66	1.295	1.57	1.134	3.073	.050
Level of satisfaction with YouTube	1.10	1.192	1.76	1.291	1.71	1.254	4.101	.019
Level of satisfaction with WhatsApp	1.31	1.292	1.80	1.399	2.43	1.134	3.201	.044

Table 7. Test of between-subject effects, considering the type of centre as the grouping variable.

Note. Only variables that show statistically significant results are displayed ( $p < .05$ )

TYPE OF CENTRE	State School vs Charter School	State School vs Private School	Charter School vs Private School
Frequency of use of YouTube	.014	.019	n.s.
Level of satisfaction with Google	.013	n.s.	n.s.
Level of satisfaction with YouTube	.022	n.s.	n.s.

Table 8. Post hoc according to type of centre.

Note. Only variables that show statistically significant results are displayed ( $p < .05$ )

In the previous tables can be observed that it is not uncommon to find what appears to be a conflict between the results of the ANOVA and a Tukey's post hoc test where one finds a statistically significant result for one, but not for the other. For example, a statistically significant ANOVA on the use of WhatsApp, considering teaching experience as the grouping variable (table 5), but no pairwise comparison using the Tukey method was statistically significant (table 6). There can be different reasons for this, such as the conservative or liberal nature of a particular test, but fundamentally it is due to the differences in the distributions used in the ANOVA and Tukey post hoc test (Hsu, 1996).

In relation to **what** tools compulsory secondary education teachers used, we found significant differences by sex and academic post in the *use of blogs* [e.g.  $M_{\text{men}} = 1.34$  versus  $M_{\text{women}} = 1.55$ ;  $p = .025$ ], whereby blogs were used to a greater extent by female teachers and tutors [e.g.  $M_{\text{non-tutor}} = 1.35$  versus  $M_{\text{tutor}} = 1.54$ ;  $p = .035$ ].

We also observed statistically significant differences by age in the *use of Google, wikis and WhatsApp*, whereby WhatsApp was used by the youngest teachers [e.g.  $M_{31-40} = 1.41$  versus  $M_{\leq 30} = 2.00$ ;  $p = .008$ ], Google by teachers aged between 31 and 40 years old [e.g.  $M_{\leq 30} = 1.80$  versus  $M_{31-40} = 2.00$ ;  $p = .018$ ] and wikis by teachers aged over 50 [e.g.  $M_{\leq 30} = 1.00$  versus  $M_{\geq 51} = 1.67$ ;  $p = .046$ ].

We also found statistically significant differences by type of school where teachers worked in the *use of YouTube*, which was used most frequently by teachers working at private schools [e.g.  $M_{\text{state}} = 1.48$  versus  $M_{\text{private}} = 1.86$ ;  $p = .038$ ].

With regard to the category **with what frequency** teachers used digital tools, we observed statistically significant differences by sex and age in the *frequency of use of Google*.

Women used this tool with greater frequency than men [e.g.  $M_{\text{men}} = 2.28$  versus  $M_{\text{women}} = 2.62$ ;  $p = .013$ ], as did teachers aged between 31 and 40 compared with teachers of other ages [e.g.  $M_{\leq 30} = 1.60$  versus  $M_{31-40} = 2.62$ ;  $p = .011$ ].

We also found statistically significant differences by years of teaching experience in the *frequency of use of wikis*, whereby teachers with more years of experience used this tool more often [e.g.  $M_{0-5\text{years}} = 0.54$  versus  $M_{>15\text{years}} = 1.22$ ;  $p = .038$ ]. In addition, we observed differences by academic post in the *frequency of use of blogs*. Blogs were used more frequently by teachers who did not occupy management posts [e.g.  $M_{\text{mgmt}} = 0.33$  versus  $M_{\text{non-mgmt}} = 0.85$ ;  $p = .047$ ].

Lastly, we found statistically significant differences by type of school in the *frequency of use of blogs, YouTube and WhatsApp*. Blogs were used most by teachers in state-subsidised private schools whereas YouTube and WhatsApp were used most by teachers in private schools.

In relation to the category **how much time** was spent using digital tools, we found statistically significant differences by sex in the *time spent using Google and blogs* whereby women spent more time than men [e.g.  $M_{\text{timeGmen}} = 1.41$  versus  $M_{\text{timeGwomen}} = 1.70$ ;  $p = .016$ ]. By age, young teachers spent more time than others *using WhatsApp* [e.g.  $M_{\text{time}\geq 51} = 0.64$  versus  $M_{\text{time}\leq 30} = 2.20$ ;  $p = .007$ ], while by years of teaching experience, teachers with between 6 and 10 years of experience spent more time than others *using Google* [e.g.  $M_{\text{time}11-15\text{years}} = 1.19$  versus  $M_{\text{time}6-10\text{years}} = 1.74$ ;  $p = .019$ ].

For **level of satisfaction**, we obtained statistically significant differences by age and type of school. The youngest teachers, aged 30 or less, were the most satisfied with the *use of WhatsApp*, while teachers aged between 31 and 40 were the most satisfied with the *use of Google* [e.g.  $M_{\text{satis}\leq 30} = 2.00$  versus  $M_{\text{satis}31-40} = 2.82$ ;  $p = .011$ ]. Lastly, teachers in state-subsidised private schools showed the highest *level of satisfaction when using Google, wikis, YouTube and WhatsApp* [e.g.  $M_{\text{satis-state}} = 1.10$  versus  $M_{\text{satis-subsidised}} = 1.76$ ;  $p = .019$ ].

#### IV. Discussion and conclusions

In recent years, technologies have entered all areas of life, acquiring particular importance and impact in educational and social contexts. In educational contexts, improvements in teaching have been related to the use of technologies in the classroom. Hence, to a greater or lesser extent teachers have had to acquire some level of digital competence in order to respond to current demand for use of these tools in teaching-learning processes (Almerich, Suárez, Jornet & Orellana, 2011; Law & Chow, 2008; Tejedor & García-Valcárcel, 2006; Vargas-D'Uniam, Chumpitaz-Campos, Suárez-Díaz & Badia, 2014).

Our results indicate that virtually all respondents were familiar with and habitually used Google, and to a lesser extent, wikis, YouTube and WhatsApp. Blogs were the tool teachers used least. Bearing in mind the functional characteristics of each of these tools, this finding suggests that our respondents were more often consumers than creators of digital content. However, teachers with a high level of digital competence should be able not only to use technologies to enrich their teaching strategies, but also to propose and develop innovative practices based on the opportunities that digital tools offer (Esteve, Castañeda & Adell, 2018; Gisbert & González, 2016).

The tool that was used most in the classroom was Google, with seven out of ten teachers using it in the teaching-learning process, followed by YouTube, used by four out of ten teachers in the classroom. These results may be related to the technology acceptance model (TAM), in which perceived usefulness and ease of use are the two most influential factors in the adoption of a technology (Fernández, 2016).

We also found that Google, YouTube and wikis were used by teachers to find and select educational content, but Google was also used to plan and evaluate learning activities. This indicates that digital tools are used more for planning and assessment than for creating learning environments in the classroom, confirming the conclusions reached in previous studies such as the one by Almerich *et al.* (2010).

One of the major contributions of the present study is that it has revealed differential patterns in teachers' use of the five digital tools analysed (wikis, blogs, Google, YouTube and WhatsApp) according to their personal and contextual variables.

In relation to the *personal variables* of age, sex and years of teaching experience, our results show that female teachers used blogs more than male teachers. They also used Google more frequently and for more time than male teachers. These findings are at variance with those reported in previous studies, which found that male teachers made greater use of this technology (Roig-Vila, Mengual-Andrés & Quinto-Medrano, 2015).

In relation to age, teachers aged below 30 made the most use of instant messaging tools, spent more time using these than teachers of any other age and were highly satisfied with this use. Meanwhile, teachers aged over 50 and those with most professional experience preferred to work with wikis. These findings corroborate the results reported in previous research, confirming that age is a significant predictor of use of this technology (Almerich, Suárez, Jornet & Orellana, 2011; Meyer & Xu, 2009; Schiller, 2003).

As regards the *contextual variables* of type of school and tutorial or management posts, teachers at private schools used YouTube more than the others, whereas those at state-subsidised private schools used WhatsApp more than the others. Meanwhile, teachers at state schools did not use any of the tools analysed more than teachers at other types of school. These differences by type of school may be the result of school infrastructures such

as internet connection and the type, number and location of available computers (INTEF, 2016).

In relation to academic post, tutors used blogs more than managers, while the latter used digital tools less than other teachers. This coincides with the results obtained by Santiago-Campión, Navaridas-Nalda and Andía-Celaya (2016), who observed that a significant percentage of managers assessed the use of technologies in school positively, but remained far from fully integrating digital tools.

In general, our research presents some limitations. This was a cross-sectional study in which the data were collected at a single point in time using a sole instrument. In the future, it would be desirable to conduct longitudinal research and to include other measures besides self-reported data from the teachers.

In conclusion, teachers comprise one of the key factors in successful digitisation of education, because it is they who are responsible for instilling or not the bases of modernisation (Zhou, Zhao, Hu, Li & Xing, 2010). If teachers were to see and believe in the advantages and possibilities offered by technologies, and received the necessary training and support, the use of digital tools could easily be consolidated in teaching-learning processes.

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