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Music Education Teachers' Knowledge and Use of ICT at Spanish Universities[1]

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Knowledge and use of information and communication technology (ICT) are especially important for teachers since, in addition to ICT being a key element of the teaching and learning process, how teacher use it influences whether students use it inside and outside the classroom. This article identifies the knowledge of ICT that teachers from the area of music education at Spanish universities have and how they use it, as well as their training and their views on its advantages and disadvantages in teaching and learning processes. To do this, we used an ad hoc questionnaire with a valid sample of 112 teachers. The results indicate that teachers are aware of the benefits of ICT in their own teaching and in the professional future of the students. They kept the educational needs of the students very much in mind when choosing each resource. Despite knowing the benefits, the teachers did not train their students to learn how to use ICT. The biggest concern was the technological and gender gap identified.

Keywords: ICT, digital competence, music education, universities, music teacher

INTRODUCTION

Information and communication technology (ICT) has been the focus of many pedagogical debates since the last decade (Adelsberger et al., 2013). Knowledge and use of it is especially important among teachers (Carrera et al., 2018). This is because, as UNESCO notes (2012), it is not just a vital part of the teaching–learning process, but using it in class also influences how students use it outside class.

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Regard to music education, the technology has resulted in advances and, as Webster (2002) predicted, has sought to transcend cultures and reach a mass audience by adapting and by optimising the cost/benefit relationship. This optimization has been a constant concern among music education teachers, as it requires a lot of prior planning. Byrne & Macdonald, 2002). Consequently, there are ever more suggestions and voices calling for different curricula to be modified and for digital technologies to be included in music teaching-learning processes (Southcott & Crawford, 2011), reconstructing music education through ICT (Savage, 2007). In particular when compared with other areas of knowledge, which are more aware of the need for ICT (Chen, 2012). The application of digital technologies to music education is based on the use of computers and mobile devices, both for reproducing audio and video and for carrying out simulations and presentations or searching for information (Gorgoretti, 2019). In this sense, the scientific literature has been in charge of supporting the different proposals required for music education and the inclusion of digital technologies in the different educational stages (Calderón-Garrido et al., 2019). In addition, an emerging subculture was detected of music and ICT in schools (Gall & Breeze, 2007). In this subculture, Waddell and Williamon (2019) observed a positive attitude of students towards the use of ICT and the adaptation of traditional resources.

On the other hand, in the case of higher education, many studies have aimed to identify particular important aspects that favour the adoption of digital technologies, such as digital training and literacy provision for teachers (Oca et al., 2015), teachers' beliefs about ICT-mediated teaching–learning (Prestridge, 2012), the cultural and functional characteristics of the educational environment (Tondeur et al., 2009), and even studies focussing on the categorisation and classification of teaching staff depending on the use of digital technologies in their teaching (Arancibia et al., 2017).

Therefore, when we refer to ICT-mediated university-level educational contexts, it is easy to think of expanding educational scenarios, applying what has been learnt to different contexts, increased possibilities for teacher–student interaction, creating individualised learning environments, involving students in their own learning, and creating virtual environments that decentralise information (Arancibia, et al., 2017). In essence, ICT presents a spatial and temporal break with more traditional educational scenarios (Barrios & Fajardo, 2016). This, in turn, means that teachers need ever more knowledge of a range of digital technology-based focusses so that they can transmit knowledge, support students, and carry out evaluation (Adams, et al, 2017). However, when implementing this, it is necessary to consider each educator's attitude, training, and level of acceptance of ICT (Ju et al., 2016; UNESCO, 2016).

With regards to the initial training of childhood and primary school teachers, this need increases greatly as university teachers must make their students understand that they will decide what their own students' reality and, by extension, future will be like (Esteban, 2013). In other words, this training is obliged to communicate the desire and even need to use ICT to people who will become part of an educational system which, in many cases, still has a "traditional" outlook (Tello & Ruiz, 2016). These students are future educators who must react to the overall imperative of relieving digital divides and

deficiencies in competences through appropriate digital literacy training (Casebourne & Armstrong, 2014; Carrera et al., 2019). Despite this, many of the proposals made do not pay sufficient attention to the objective of understanding ICT as a mediating factor in the educational process (Prendes & Gutiérrez, 2013). For this reason the now classical TPACK model ("Technological Pedagogical Content Knowledge") proposed by Mishra and Koehler (2006) is becoming even more popular. It identifies three types of knowledge: content, pedagogical, and technological. All three aspects must interact without neglecting any of them as they all influence one another. This model is equally adaptable to music education (Gall, 2016). Consequently, it is necessary to study university teachers according to their area of knowledge if we are to make accurate findings about how they use ICT in education. In other words, in the case that interests us, we must study university teachers from the area of music teaching, with their particular features, to establish this group's level of knowledge and use of ICT. Previous studies in other countries have shown how beneficial it is to establish this professional profile (Gorgoretti, 2019).

Furthermore, to develop correctly the knowledge and use that interest us here requires properly equipped classrooms and educational policies that match any needs that arise in music education (Eyles, 2018). The UNIVERSITIC 2017 report by the Association of Rectors of Spanish Universities (Conferencia de Rectores de Universidades Españolas) stated that the commitment to ICT as a tool and support for teaching had reached saturation, with a small reduction in this commitment being observed. In any event, it provided data that reflected the healthy status of its use: 91% of teachers used virtual campuses, 83% of teaching rooms had a multimedia projector and internet connection, and universities allocated 3.48% of their total budget on average to ICT, etc. (Gómez, 2017).

However, in the case of the initial training of music teachers and the university teaching staff of teaching subjects related to music education, there is a current lack of research that does not allow to advance in the knowledge of this area.

Consequently, the aims of this research are: (1) to identify the level of knowledge of ICT among teaching staff from the area of music education in Spanish universities; (2) to identify how they use ICT; and (3) to discover their training and their opinion about the advantages and disadvantages of ICT for teaching and learning processes.

METHOD

In order to achieve the proposed aims, we designed and validated an *ad hoc* questionnaire covering the specific features of university-level music teachers who work on degree programs in childhood education and primary education and the double major degree in early years and primary education at Spanish universities. These different grades enable students to teach in childhood education (students aged 0 to 6) or in primary education (students aged 6 to 12), with the differences that this entails. To prepare and validate the questionnaire, we used a panel of 16 experts. A reliability and validity study of the questionnaire was subsequently performed. The result obtained was .933 in Cronbach's Alpha and .824 in Kayser, Meyer and Olkin (KMO) adequacy in the

different proposed sub-dimensions (the questionnaire can be viewed at https://reunir.unir.net/handle/123456789/6965).

We administered it online using the Formsite platform, allowing a period of one month for responses. The teachers who participated gave free, prior and informed consent which was set out in the questionnaire itself. They were informed that they could withdraw from the study at any moment.

A total of 112 teachers completed the questionnaire (the potential sample was 427 teachers, and so a response rate of 26.23% was achieved). Of the respondents, 50 were women (44.6%) and 62 men (55.4%). The mean age was 47.5 years (*SD* = 9.03) with a range of between 27 and 74 years.

As for how long they had been delivering classes at university, 17 (15.2%) had been doing so for under 5 years, 31 between 5 and 10 years (27.7%), 25 (22.3%) between 11 and 15 years, 15 (13.4%) between 16 and 20 years, 20 (17.9%) between 21 and 30 years, and 4 (3.6) for more than 30 years.

Regarding their employment status at the universities, 70 teachers (62.5%) worked full-time, while 42 (37.5%) worked part time. The sample was distributed across 54 different universities.

The questionnaire showed excellent internal reliability (Cronbach's alpha = .933). We used the IBM Statistic Package for Social Science (SPSS) program, version 21.0 to calculate and statistically analyse the results. In all cases, a minimum confidence interval of 95% was established. We used the Mann–Whitney and Kuskal–Wallis statistics, having first carried out the Kolmogorov–Smirnov or Shapiro–Wilk normality tests as needed.

FINDINGS AND DISCUSSION

The results shown here can be consulted in more detail at https://reunir.unir.net/handle/123456789/9528.

Regarding the potential of ICT for improving their own teaching practice, most of the teachers (n = 74; 66.1%) said they had extensive knowledge. In fact, a majority (n = 63; 56.3%) said they knew about educational "good practices". This concurs with the data obtained in recent research focussing on other areas of knowledge (Bond, Marin et al., 2018; Islam et al., 2019; Miralles et al., 2019).

Furthermore, in both cases we found statistically significant differences (Z = -2.108; p = .035 and Z = -2.73; p = .006 respectively) with men scoring higher. This difference supports the postulates of Armstrong (2011) in the area of music education and digital technology. However, this does not match similar studies such as Kılıç (2017) or, in other areas of knowledge, such as those by Romero-Martin et al. (2017). However, the data concur with research by Flores and Roig (2017), who concluded that future male teachers found ICT more appealing. There is no question that it is important to pay attention to this aspect to avoid the already existing gender-based digital divide from becoming wider (Gil-Juarez et al., 2011).

As for the advantages of ICT in the teaching–learning process in the music classroom, the members of the sample could choose up to three options. The one they regarded as most important was undoubtedly access to information (n = 97) followed by the ability to create content (n = 65). This closely relates to the spatial and temporal break in the educational process Barrios and Fajardo describe (2016). This break makes it possible to access and make visible educational work and the work of other teachers and create new learning environments. In the case of music it is also especially interesting to be able to access sound experiences from other cultures, for example.

With regards to limitations, the principal one related to technical faults (n = 65), followed by classroom equipment (n = 49). In this respect, the majority of the participants (n = 70; 62.5%) admitted that they have problems when using ICT in class, primarily because of a lack of resources in their institutions. Accordingly, it appears that the efforts made by various universities and described in the UNIVERSITIC 2017 report (Gómez, 2017) have been insufficient. On these lines, Bauer and Dammers (2016) found similar problems in NASM schools (USA), where teachers regarded a lack of resources and funds as common obstacles for integrating technologies into the music teacher education curriculum. The same is true in Australia, where Eyles (2018) stated that music teachers identified that the most significant barrier to ICT implementation is the need for access to adequate quantities, resources, funding and ICT support. However, in other countries, such as Taiwan, the government has been implementing since the 1990s a series of educational policies and investments in resources that have proven their benefits (Chen, 2012). Nonetheless, we should recall that multiple applications are available through mobile phones, devices whose use is entirely widespread and habitual in Spain, that do not require the use of the tools of the classroom itself (Cho et al., 2019).

When selecting resources to use in music classes, most of the teachers (n = 66; 58.9%) said they had extensive knowledge. Of all of the possibilities suggested, the ones the teachers regarded as very important were: ease of access regardless of the socioeconomic status of students (n = 73; 65.2%); accessibility regardless of possible disabilities (n = 66; 58.9%); the resource being motivational for students (n = 60; 53.6%); its potential in the early years or primary classroom (n = 56; 50%); and that it provides a didactic innovation (n = 53; 47.3%). In this last case, it is notable that there was a greater presence of teaching innovation than technological innovation (n = 28; 25%). Consequently, university music teachers showed that they are aware of their students' learning needs, beyond possible technological "fashions". In fact, the majority of teachers (n =65; 57.1%) said they had extensive knowledge of the role of ICT in their students' professional future, with male teachers reporting greater knowledge (Z = -4.359; p = .000).

Nonetheless, 41.1% (n = 46) never delivered training on the use of ICT and 34.8% (n = 39) only did so occasionally. This is very worrying as teachers do not receive adequate training in each digital resource during their initial training. In this respect, there were statistically significant differences between teachers who provide face-to-face classes and those who provide online classes, with the latter group being more likely to train

their students in how to use ICT (Z = -2.445; p = .014). This is in line with the teaching programmes of each university, with universities that provide online classes making greater efforts to develop their students' digital competences (Calderón-Garrido et al., 2018).

Furthermore, most teachers (n = 58; 51.8%) recognised that they have little ability when it comes to stimulating use of ICT in the education of their students. The teachers who provide online classes believed they had more skill in this sense (Z = -2.350; p = .019). Among the strategies for encouraging this participation, the creation of group projects at home and in class stood out (for example, collaborative music lists) as did the creation of ICT content. This information is very significant, as it calls for the organisation of training, not just in how to use ICT resources but also in how to incentivise their use by students. Only in this way would the concept of the TPACK model described above (Mishra & Koehler, 2006; Gall, 2016)) and the development of teachers' digital competence (Redecker, 2017) make sense.

Furthermore, in the selection of resources for the classroom, it was also noteworthy that ease of use by the teacher was regarded as important (n = 61; 54.5%), as was the time that must be spent to be able to prepare this implementation (n = 65; 58%). These figures also relate to the training of teachers, as the time spent on developing digital competence is inversely proportional to the time subsequently spent learning each resource and preparing ICT-based activities (Vázquez-Cupeiro & López-Penedo, 2016). In other words, an initial effort to learn ICT ensures that much less time is subsequently needed for each new tool.

By the same token, and in reference to knowledge and use of the different resources, as Table 1 shows, and as might seem obvious, use is shaped by knowledge (r = .666; p = .000). In general, search tools are best known (M = 2.47; SD = 0.569) and also most used (M = 2.56; SD = 0.582). The limited use of educational robotics (M = 0.29; SD = 0.548) and of virtual worlds (M = 0.32; SD = 0.557) is noteworthy.

The extensive generalised knowledge of mobile phones is worth noting (M = 0.228; SD = 0.819), as is how little they are used (M = 1.65; SD = 0.997). If we consider all of the educational possibilities mobile phones offer, for example, the apps and social networks that can be accessed from them, there is no doubt that a move towards using them in the classroom is necessary (León-Gómez et al., 2019).

Table 1
Knowledge and use of different resources

		Knowledge				Use			
		None	Superficial	Extensive	In depth	Never	Sometimes	Often	Always
University virtual campus	n	2	11	76	23	6	5	35	66
	%	1.8	9.8	67.9	20.5	5.4	4.5	31.3	58.9
Presentations creator	n	2	18	68	24	3	16	55	38
	%	1.8	16.1	60.7	21.4	2.7	14.3	49.1	33.9
Website editor	n	19	54	33	6	39	43	20	10
	%	17	48.2	29.5	5.4	34.8	38.4	17.9	8.9
Forums	n	7	39	49	17	15	56	27	14
	%	6.3	34.8	43.8	15.2	13.4	50	24.1	12.5
Search tools	n	1	1	54	56	0	5	39	68
	%	0.9	0.9	48.2	50		4.5	34.8	60.7
Online publishing tools	n	21	55	32	4	38	56	13	5
	%	18.8	49.1	28.6	3.6	33.9	50	11.6	4.5
Collaborative working tools	n	7	37	59	9	19	50	34	9
	%	6.3	33	52.7	8	17	44.6	30.4	8
RSS readers	n	54	48	9	1	76	28	8	0
	%	48.2	42.9	8	0.9	67.9	25	7.1	
Social bookmarking	n	60	42	9	1	79	28	5	0
	%	53.6	37.5	8	0.9	70.5	25	4.5	
Microblogging	n	33	43	30	6	64	37	6	5
	%	29.5	38.4	26.8	5.4	57.1	33	5.4	4.5
Virtual worlds	n	50	46	14	2	81	26	5	0
	%	44.6	41.1	12.5	1.8	72.3	23.2	4.5	
Social networks	n	10	35	46	21	36	38	25	13
	%	8.9	31.3	41.1	18.8	32.1	33.9	22.3	11.6
Educational robotics	n	65	36	9	2	84	23	5	0
	%	58	32.1	8	1.8	75	20.5	4.5	
Mobile phones	n	5	14	49	44	13	26	38	35
	%	4.5	12.5	43.8	39.3	11.6	23.2	33.9	31.3
Videoconferencing	n	7	22	60	23	26	37	35	14
	%	6.3	19.6	53.6	20.5	23.2	33	31.3	12.5

Furthermore, as Table 2 shows, in some cases, both knowledge and use correlate to age. However, it is most noteworthy that, while not always statistically significantly, age is always inverse to knowledge and use of different resources. This shows that there is still a generational divide in use of ICT (Lamschtein, 2010) and so it is necessary to incentivise its use among people who have already reached educational maturity. This data goes against Kılıç's studies (2017) that found no statistical differences according to age in music teachers working in different regions of Turkey.

Table 2
Correlation of age with knowledge and use of different resources

	Correlation of age with knowledge	Correlation of age with use
University virtual campus	r = -.188; p = .047	r = -.215; p = .023
Presentations creator	r = -.350.; p = .000	r = -.265; p = .005
Website editor	r = -.085; p = .370	r = -.030; p = .753
Forums	r = -.126.; p = .186	r = -.084; p = .379
Search tools	r = -.220.; p = .020	r = -.130; p = .173
Online publishing tools	r = -.222; p = .018	r = -.153; p = .108
Collaborative working tools	r = -.172; p = .069	r = -.018; p = .848
RSS readers	r = -.039; p = .681	r = -.021; p = .827
Social bookmarking	r = -.027; p = .777	r = -.012; p = .897
Microblogging	r = -.205.; p = .030	r = -.006; p = .947
Virtual worlds	r = -.061; p = .523	r = -.122; p = .201
Social networks	r = -.270; p = .004	r = -.015; p = .826
Educational robotics	r = -.026; p = .783	r = -.012; p = .901
Mobile phones	r = -.160; p = .093	r = -.097; p = .311
Videoconferencing	r = -.162; p = .087	r = -.059; p = .536

With regards to knowledge of different resources, most teachers (n = 51; 45.5%) often participate in training activities, with the ones who deliver online classes being most likely to do this (Z = -2.108; p = .035). Despite this, the majority never share their doubts and concerns about using ICT with their colleagues (n =19; 17%) or only do so sometimes (n = 42; 37.5%). Also, the majority (n = 52; 46.4%) only participate sometimes in forums or spaces for reflection or in innovation and research groups for teaching with ICT (n = 41; 36.6%). In any case, as they reported, self-instruction about specific resources or applications was most common. In this respect, men reported being more inclined to pursue this sort of self-instruction (Z = -2.268; p = .023). Furthermore, younger teachers were most likely to train themselves (r = -.249; p = .008). On the other hand, teachers never (n = 13; 11.6%) or only sometimes (n = 43; 38.4%) published their own teaching materials online. So, despite the training efforts made by universities and the central government, university music teachers are still autonomous in their training and do not share their doubts or their own resources with their colleagues. This is undoubtedly a backwards step, as the advantages of collaborative learning and the great number of resources available, such as "Educ@conTIC" from Spain's Ministry of Education, Culture and Sports, are wasted (http://www.educacontic.es/blog/tags/musica).

Regarding the material they used, the majority often relied on open content (n = 52; 46.4%) and free software (46.4%). This correlated with the teachers' ages, with the youngest ones being the most inclined to do so (r = -.284; p = .002). This leads us directly to reflect on the democratising potential of ICT and how teachers take advantage of it and, as López and Hernández state (2016), ICT must be used to guarantee a university in line with social reality.

With regards to evaluation, the majority (n = 64; 57.1%) use some type of ICT tool. Among these tools, the ones that are part of the virtual campus of each university stood out, as well as others such as Plickers, Kahoot!, and so on. With the European Higher Education Area and the move towards competence-based evaluation, ICT has shown itself to be a great ally, providing solutions for teachers in this change in the evaluation paradigm (Rodríguez, 2005).

Regarding knowledge and maintenance of computer systems, the majority (n = 55; 49.1%) said that they have extensive knowledge of basic hardware and software components. We observed statistically significant differences in this sense, with men believing they had more knowledge (Z = -3.909; p = .000). Equally, the majority (n = 51; 54.6%) believed they have extensive knowledge of aspects such as connections or band width. Statistical differences were again observed, with men being more knowledgeable (Z = -2.580; p = .010). Statistical differences were also observed between teachers who deliver face-to-face classes and those who deliver online classes, with the latter claiming to be more knowledgeable (Z = -2.239; p = .025). The differences by gender shown in both cases is a constant among teachers in all areas of knowledge and all educational stages (Almerich et al., 2005; Rodríguez, et al., 2012). This emphasises the gender-based digital divide described above.

The majority (n = 72; 64.3%) said they use passwords to safeguard the privacy of their machine. Similarly, the majority (n = 54; 48.2%) believed they were able to solve technical issues with their equipment, with men statistically regarding themselves as more capable (Z = -4.557; p = .000).

We should note that years of university teaching were not linked to statistically significant differences in any of the questions asked. Therefore, teaching experience does not affect knowledge and use of different ICT tools. No statistical differences were found in any of the questions asked between full-time and part-time teachers.

CONCLUSION

The results obtained allow us to establish a professional profile relating to ICT for university teachers of music education. They are aware of the benefits of ICT for their own teaching and are also aware of good practices. Access to information and content creation are foremost among these benefits. However, the teachers feel limited by technical faults and their universities' infrastructure, emphasising that the investments described by the Conferencia de Rectores de Universidades Españolas were, in the opinion of the sample analysed, insufficient.

When choosing the resources to use in class, they pay great attention to their students and their needs. Furthermore, university music teachers are aware of the importance of ICT for the professional future of their students. Despite this, they do not train their students in the use of ICT, which, in many cases could be because they lack the necessary skills to incentivise its use. This is a problem for the future and it also incentivises self-instruction by students. This very self-instruction is one of the characteristic features of the teachers in the sample, and it reflects a lack of effectiveness of the training plans proposed by universities and the central government. Furthermore,

a lack of communication between colleagues was apparent. On the other hand, ICT has shown itself to be an ally when evaluating music classes in the university, which is undoubtedly beneficial from a competence-based position.

In any event, the biggest concern was the technological and gender gap identified. Consequently, this study underlines the need for effective training actions to alleviate this situation

Finally, this research opens the way to investigate how music education teachers receive ICT-related training in their initial training, as well as the benefits it has for their future students.

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