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eISSN 2317-6377

Teacher involvement in the use of digital tools in conservatory, municipal music school and university classrooms

Envolvimento docente na utilização de ferramentas digitais em salas de aula de conservatórios, escolas municipais e universidades

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SCIENTIFIC ARTICLE
Section Editor: Fernando Chaib
Layout Editor: Edinaldo Medina

Submitted date: 08 jun 2023
Final approval date: 13 oct 2023
Publication date: 26 oct 2023
DOI: https://doi.org/10.35699/2317-6377.2023.46441

ABSTRACT: The paper's objective is to depict the current situation regarding the use of digital tools on the part of musical education teachers and students to teach and learn music. The research tool used is a questionnaire designed and validated psychometrically by the authors, focusing on eight types of technological musical tools. The questionnaire was distributed through social networks, providing a valid sample of 274 participants in Spain. The analysis of the results reveals very little knowledge regarding digital tools for present-day musical education. It also highlights that the age of the participants does not correlate with the type of technological resources used in classrooms, leading to the conclusion that said resources are not a factor that impede acquisition of digital competence. However, substantial differences are observed depending on the sample's professional profile. This study intensifies the need to provide training solutions in order to improve the quality of music education systems.
KEYWORDS: Digital tools; Musical education; Technological resources; Digital competence; Professional profile.

RESUMO: O objetivo do artigo é descrever a situação atual no que diz respeito à utilização de ferramentas digitais por parte de professores e alunos de educação musical para ensinar e aprender música. O instrumento de investigação utilizado é um questionário concebido e validado psicometricamente pelos autores, que incide sobre oito tipos de instrumentos musicais tecnológicos. O questionário foi distribuído através das redes sociais, o que permitiu obter uma amostra válida de 274 participantes em Espanha. A análise dos resultados revela um conhecimento muito reduzido das ferramentas digitais para a educação musical atual. Salienta também que a idade dos participantes não está correlacionada com o tipo de recursos tecnológicos utilizados nas salas de aula, o que permite concluir que esses recursos não são um fator que impeça a aquisição de competências digitais. No entanto, observam-se diferenças substanciais em função do perfil profissional da amostra. Este estudo reforça a necessidade de encontrar soluções de formação para melhorar a qualidade dos sistemas de ensino da música.
PALAVRAS-CHAVE: Ferramentas digitais; Educação musical; Recursos tecnológicos; Competência digital; Perfil profissional.

1. Introduction

The presence of digital technology in musical education entails opening up learning (Dammers 2019) and research (Marín-Suelves, Garbada, and Cuevas 2022) possibilities. Teachers in all educational levels use mobile devices as an alternative resource (Calderón-Garrido *et al.* 2019). Starting in the intermediate years of Primary Education, and then in Secondary Schools, in conservatories and at the University, students also use them with digital applications to create, record and edit sound (Stephenson and Limbrick 2015; Baratè and Ludovico 2020; Chen 2020; Murillo, Trvae, and Sales 2020). Hence, it seems logical to consider digital surroundings as part of the reality of musical-educational contexts (Giráldez 2015). These reasons accentuate the need to increase knowledge about the use of digital tools to teach and learn music, and to encourage research on the pedagogical use of musical technology.

The intervention programs of the Technology Institute for Music Education (TIME 1995), online musical education models (Syroyid 2021), the integration of computational thinking in musical education (Zhan and Yi 2021) and musical teaching practices during the pandemic (Daubney and Fautley 2020; Domínguez-Lloria and Pino-Juste 2021) are some of the lines of action that highlight the changes in the traditional musical education paradigm (Spieker and Koren 2021).These forms of considering teaching based on the use of technology require constant updating of the resources (Gorgoretti 2019) and of the teaching strategies used (Riaño, Murillo, and Tejada 2022). It is essential that music teachers, during their initial training (Tejada and Thayer 2019) as well as subsequently with ongoing training (Stronge 2018), explore new horizons to improve their digital competence and increase their level of motivation to learn and know more about digital tools (Wan 2022).

Commitment to digital competence in educational contexts has attracted the attention of educational researchers for decades (García-Ruiz, Buenestado-Fernández, and Ramírez Montoya 2023). One can thus infer that the professional development of teachers is marked by constant adjustment and adaptations, not only to attend to their students' needs, but also to enable the latter to develop their digital competence so as to become collaborative, creative and engaged adults (Livari 2020). Digital tools do not on their own change the manner in which teachers teach and students learn (Torrado, Pérez Echeverría, and Pozo 2020), although they evidently favor flexibilizing and adapting resources for students, respecting their specificities (Serrano, Nadal, and López 2022). It is important to bear in mind the relevance of emotional involvement and active participation in the development of projects, given that it all contributes to acquiring competences that promote active methodologies, aspects that are enhanced with the incorporation of technological resources in the classroom (Muntaner-Guasp, Mut-Amengual, and Pinya-Medina 2022; Area, Cepeda, and Feliciano 2018).

In its third version of the ICT Competency Framework for Teachers (UNESCO 2019), UNESCO specifies three phases of development for teachers to integrate digital technology in their own pedagogy. The first one is Knowledge Acquisition, whereby teachers learn the benefits of digital technology in order to be able to use it in their professional development. The second phase is Knowledge Deepening, which proposes that teachers explore and use potential digital tools, and the ones within their reach, to undertake cooperative and collaborative actions centered on students. And the third phase is geared towards Knowledge Creation, where teachers and students are encouraged to reflect on their own practices in order to consider the manner in which they use the digital technology to generate knowledge. These three phases propose that each educational system shape its own educational practices, ensuring flexibility for educators and for

developers of digital applications. The steps are construed as a manner for digital culture to advance, not only in the educational community, but also in society in general. This was the conclusion of the project *A framework for developing and understanding digital competence in Europe* (DigComp), which defines digital competence as transversal (Biel and Álvarez 2019). In consequence, contextualized initiatives continue to appear to address and improve the digital competence of music teachers (Chao-Fernández, Felpeto-Guerrero, and Vázquez-Sánchez 2020; Cuervo, Bonastre, and García 2022; Faure-Carvallo, Calderón-Garrido, and Gustems-Carnicer 2021; Jiménez-Hernández, Muñoz Sánchez, and Sánchez Giménez 2021).

At present, numerous tools can be used in musical education to integrate ICTs in the design of didactic activities (Román Álvarez 2017). The classification of resources employed in this study is one that has been used by Calderón-Garrido, Gustems-Carnicer and Carrera (2020a and 2020b) in their research, and consists of eight types of digital tools: 1) auditory trainers (Buonviri and Paney 2020) that enable extending listening competences; 2) audiovisual editors such as iMovie (Norman 2022) and YouTube (Rahmaturrizki and Sukmayadi 2021), with which to integrate sounds, texts, graphics, images and videos in order to build points of support for each teacher's pedagogical approach; 3) audio editors (Silveira and Gavin 2016), with which it is possible to manipulate audio tracks; 4) offline and online notation editors (Egea 2019) that allow creating or adapting music scores, introducing musical data and connecting the musical notation software to other devices; 5) sound editors and generators, which in addition to creating and manipulating sounds, are ideal tools for collaborative work (Sabet 2020, 6) sound sequencers, for example the digital audio controller (DAW), to explore and create different styles and genres of music (Emo 2021, 7) digital software or resources for instrumental performance (Michałko *et al.* 2022), which enable editing timbres and playing over previously recorded bases; 8) software to develop vocal expression. Although in the current program these compartments are not hermetic, they help draw a map of technology possibilities. With this set of tools, both teachers and students can create new artistic forms and experiment novel pedagogical practices derived from digital cultures to build collaborative spaces, enhancing technological educational environments (Desmurs 2021).

These tools are increasingly positioned close to the core of present day musical education, and their use in educational contexts must be a continuum. The idea is provide an update in the communicative action, a necessary renovation of the educational panorama, which became essential following the global COVID-19 pandemic (Morales-Urrutia *et al.* 2021). In the decade of the sixties Bloom proposed an approach, known as Bloom's Taxonomy, geared at facilitating comprehension of the teaching-learning process. This resource provided a sequenced structure from lower to higher cognitive levels (Cuenca *et al.* 2021). Four decades later, some authors revised his approach, separating cognitive processes from knowledge, which entails remembering, understanding, applying, analyzing, evaluating and creating (Churches 2009). Later, actions linked to the technological sphere were incorporated, such as searching in browsers, uploading files to the cloud and posting on social networks. This way, these learning processes are complemented with digital resources, and curricular terminology incorporates capacities, attitudes and cognitive command obtained from the virtual world for application in the real world (Hargreaves 2003).

In consequence, it is essential to observe how these digital resources are applied and to enhance users' capacity to use them to ensure successful learning. In this direction, note should be made of the educational technology assessment model proposed by Puentedura (2012), with which he evaluates, by means of the four levels of Substitution, Augmentation, Modification and Redefinition (SAMR), the use of technology in different educational processes. Mention should also be made of the proposal of Marcano, Íñigo and Sánchez

Ramírez (2020) to assess the digital competence of teachers by means of validated rubrics. Going back to Bloom, the highest level of his cognitive taxonomy is based on the capacity to understand, apply, analyze, synthesize and evaluate. In music, like in technological training, learning must be hierarchical and cumulative, since one level must be passed to go on to the next (Barcia Menendez *et al.* 2017).

The incorporation of technological resources in classrooms has led to a considerable increase of motivation (Amores-Valencia and De Casas-Moreno 2019; Churches 2009). Amongst other benefits, the use of technology facilitates autonomous learning (Ribeiro and Silva 2022), and also allows students to address the resolution of problems with real applications (Hargreaves 2003). Individual development is stimulated by favoring self-knowledge, emotional self-regulation and the capacity for empathy, all of which enhances social interaction and reinforces bonds between the members of a group (Gustau-Olcina and Ferreira 2020; Hernández 2017; Area, Cepeda, and Feliciano 2018). Technological resources reinforce communication between peers and with teachers as well, enabling bidirectional and dual communication (dialogue and technological exchange) that strengthens the process of learning content, procedures and skills (Bates 2015). The incorporation of technological tools also reinforces the process of tutorial action and individual attention (García Aretio 2021).

The teacher becomes a guide, an expert facilitator in their subject matter, capable of supporting their students' learning process by adapting the communication and the content (Bates 2015). A noteworthy aspect of ICT resources is that they enable dealing with multiple levels in the classroom, bearing in mind that one of the current challenges teachers face is to attend to the diversity of their students. Teachers must be committed to providing quality education based on equity, as students must have access to equal learning opportunities. The use of ICTs provides learning environments that are respectful of student diversity (Fernández-Batanero and Rodríguez-Martín 2017). The technological adaptation of instruments and resources contributes to facilitating the musical perception and expression of different students, as well as their creative development (Frid 2019). The idea is to optimize the possibilities that ICT resources provide in order to improve the teaching-learning process, using in a pedagogical manner the new resources and their updates (Monteagudo, Gómez, and Miralles 2017).

The idea is to not only acquire digital competence through the use of technological tools, but to also know said tools so that teachers can transfer their use to other persons. Teachers' attitude in respect to the incorporation of ICT resources and their educational use is conditioned by their training and their skills with said resources (Suárez *et al.* 2013). In this sense, assessment of every teacher's digital competence subject matter, pedagogy and technological knowledge is of maximum importance (Mishra 2019). Knowing how the teaching-technological integration process occurs in the classroom will make it possible to analyze and decide regarding relevant aspects of educational legislation (Suárez *et al.* 2013). In respect to this theoretical context, the objective of this study is to describe the situation regarding the knowledge and use of digital tools of music teachers and students of musical pedagogy in Spain for teaching and learning music.

2. Methodology

To achieve this objective, a study was carried out based on a descriptive online ad hoc explanatory, correlational and transversal questionnaire (Williamon *et al.* 2021) distributed through different social networks to teachers and students involved in musical education.

The questionnaire, entitled "Questionnaire of Teacher Digital Competencies and the use of Digital Technology in University Music Classrooms", was designed and psychometrically validated by Calderón-Garrido, Gustems-Carnicer, and Carrera (2020a). It consists of a self-report to evaluate the knowledge and use of different technological resources. The questionnaire established eight types of digital musical tools. It asked participants to show their degree of knowledge of the latter by means of a four level Likert scale (0 being the lowest level), and showed an excellent intern consistency ($\alpha = 0.945$). It was preceded by an informed consent, together with the indications for the participants to enable them to leave the study whenever they wanted.

Once the answers that had not been fully completed were discarded, the validated sample comprised 274 participants, of which 57.66% were women. The average age was 37.16 years (SD = 10.05), and 72.62% were teachers. In respect to the different profiles of the sample, 43.06% were university and primary and secondary school musical education teachers, 29.56% were conservatory and music school teachers, 24.10% were primary and secondary music teacher training students, and 3.28% were conservatory musical pedagogy students.

The R statistical program and RStudio were used for the statistical counting and analysis. A minimum confidence interval of 95% was established in all cases. In addition to the habitual descriptives, the statistics used were Pearson's correlation, Student's t-test, the ANOVA test and the Turkey post hoc test.

3. Results

The results showed that, in general, knowledge of digital resources was very low. In this sense, knowledge of tools such as notation editors and audio editors scored slightly higher. Table 1 shows the results for each one of the tools.

On the other hand, positive correlations between all the variables were reported, as can be seen below. This could indicate that knowledge of technological tools is not disaggregated according to the type of tools, but rather that there are users that are more inclined than others to said use.

In respect to the age of the participants and their knowledge of the respective resources, the latter did not correlate in any of the cases ($p > .05$ in all cases).

Depending on participants' sex, multiple statistical differences were reported in all the variables except in knowledge of audiovisual editors and knowledge of software, for both learning to play an instrument and for developing vocal competences. In the case of auditory trainers ($t_{272} = 2.51$, $p < .001$), audio editors ($t_{272} = 4.09$, $p < .001$), notation editors ($t_{272} = 2.71$, $p = .007$), sound editors and generators ($t_{272} = 4.03$, $p < .001$) and sound sequencers ($t_{272} = 5.98$, $p < .001$) in which differences were reported, in all cases men were the ones who scored the highest.

Concerning the differences between teachers and students, although students always scored the highest, the statistical differences were reported in knowledge of auditory trainers ($t_{272} = 2.11$, $p = .036$), audio editors ($t_{272} = 3.31$, $p = .001$), notation editors ($t_{272} = 6.40$, $p < .001$), sound editors and generators ($t_{272} = 3.05$, $p = .003$) and sound sequencers ($t_{272} = 3.30$, $p = .001$).

Tab. 1 – Measures, standard deviations and correlations with confidence intervals[1]

Variables: Knowledge of …	*M*	*SD*	1	2	3	4	5	6	7
1. Auditory trainers (Lemus, EarMaster, etc.)	0.59	0.75							
2. Audiovisual editors (Imovie, Finalcut, etc.)	1.09	0.92	.31** [.19, .41]						
3. Audio editors (Audacity, Sound Forge, etc.)	1.50	0.84	.35** [.24, .45]	.61** [.53, .68]					
4. Notation editors (Sibelius, Finale, etc.)	1.74	0.94	.33** [.22, .43]	.37** [.26, .46]	.51** [.42, .59]				
5. Sound editors and generators (Garage Band, LMMS, etc.)	0.91	0.95	.34** [.23, .44]	.52** [.43, .60]	.56** [.47, .63]	.45** [.35, .54]			
6. Sound sequencers (Cubase, Logic, etc.)	0.78	0.98	.33** [.22, .43]	.43** [.33, .52]	.55** [.47, .63]	.46** [.36, .55]	.71** [.65, .77]		
7. Software or resources to learn to play an instrument (Yousician, Coachguitar, etc.)	0.63	0.76	.19** [.07, .30]	.29** [.17, .39]	.24** [.12, .35]	.23** [.12, .34]	.41** [.30, .50]	.37** [.26, .47]	
8. Software or resources to develop oral expression (Winkaraoke Creator, Vanabsco, etc.)	0.44	0.69	.30** [.19, .41]	.22** [.11, .33]	.24** [.13, .35]	.14* [.02, .25]	.37** [.27, .47]	.24** [.12, .35]	.52** [.43, .60]

Having divided the sample into four factors on the basis of participants' role (university professors, primary and secondary school teachers [1]; conservatory and music school teachers [2]; teacher and music teacher training students [3]; and conservatory students of musical pedagogy [4]), statistical differences were reported in knowledge of auditory trainers, audio editors, notation editors, sound editors and generators and sound sequencers. All the results are shown in Table 2. Tukey's post hoc test showed that in all cases differences existed between the roles connected to the conservatory teachers ([2] and [4]) and the others.

[1] *M* and *SD* are used in all the results to represent mean and standard deviation, respectively. The values between brackets indicate a confidence interval of 95% for each correlation.
* indicates $p < .05$. ** indicates $p < 0.01$.

Tab. 2 – Scores according to the different roles and statistical differences

Variables: Knowledge of …	[1]		[2]		[3]		[4]		Statistical differences
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	SD	
Auditory trainers	.53	.75	.83	.83	.39	.58	.78	.67	$F_{(3,270)}$=4.78 p = .003
Audiovisual editors	1.15	.94	1.17	.86	.89	.93	1.11	.98	$F_{(3,270)}$=1.41 p = .239
Audio editors	1.68	.78	1.48	.87	1.20	.83	1.44	1.01	$F_{(3,270)}$=4.80, p = .003
Notation editors	1.86	.82	2.07	.80	1.05	.92	2.22	1.09	$F_{(3,270)}$=20.61 p < .001
Sound editors and generators	.89	.94	1.07	.98	.59	.82	.97	1.36	$F_{(3,270)}$ = 3.53 p = .015
Sound sequencers	.84	.97	.99	1.05	.45	.84	.56	1.01	$F_{(3,270)}$=4.03 p = .008
Software or resources to learn to play an instrument	.71	.73	.54	.76	.62	.84	.33	.55	$F_{(3,270)}$=1.27 p = .285
Software or resources to develop vocal expression	.51	.70	.37	.66	.41	.70	.33	.71	$F_{(3,270)}$=.78 p = .507

4. Discussion

As mentioned earlier in the review of the scientific literature reflected in the introduction, many studies present ICT resources as a beneficial tool in the teaching-learning process (Amores and De Casas 2019; Area, Cepeda, and Feliciano 2018; Chao-Fernández, Felpeto-Guerrero, and Vázquez-Sánchez 2020; Hernández, 2017). In essence, and in particular for musical education, they make it possible to experiment with the parameters of sound and with the elements of musical language, supporting the creation of richer, more diverse and more motivating virtual learning environments (Silva Quiroz 2011). Musical technology provides tools with which to prepare sound and graphic material to be listened to, sung, played, danced and transformed by the user. Moreover, the interaction with different sound realities, the consolidation of knowledge and the acquisition of auditory skills through action are perhaps the greatest advantages of their use in the classroom. In short, they facilitate the comprehension and the reflection of musical phenomena. Hence, this clearly reflects the need to take action in respect to the manner in which every teacher integrates musical technology in his/her own teaching practice, not only by revising methodological aspects, but also by examining the objectives geared at a creative and transversal musical education in schools and educational institutions (Del Barrio Aranda, García-Gil, and Cuervo-Calvo 2022).

However, on the basis of the data, it seems that whilst some participants in the questionnaire know and handle different technological resources, others are less likely to incorporate them to their daily work. Previous research studies on digital knowledge and competence, regarding both the application and the development of ICT resources, have focused on the fact that answers provided through questionnaires show a tendency to frequent ongoing training and a reduced competence for the creation and development of technological resources (Fuentes, López, and Pozo 2019). This study is in line with this trend, which may be one of the reasons why there continues to be a large distance between the development of teachers'

competences and their technological reality. This phenomenon is known as the "digital gap" in the implementation of digital technology in artistic education (Cisneros-Álvarez and De las Heras 2023). A solution to mitigate said distance could be allocating more funds to be used by teachers in order to improve their involvement in their teaching practice by means of musical technology. On the other hand, this matter of funding continues to be seen as a limiting aspect. In other words, in the sphere of education the need to invest economic budgets in the acquisition of resources, their updating and in the logistics that ICT immersion implies is an aspect which might limit the use of technological resources and, in turn, is a reason why a resistance to change can be observed on the part of teachers involved (Sorroza *et al.* 2018).

This situation is headed in the opposite direction of the recently baptized Fourth Industrial Revolution (Schwab, 2017) and its impact on education, which is mainly addressed through two major dimensions, namely robotics and 3D educational printing. Training procedures by means of educational robotics are construed as learning through computer programming. This type of reasoning is acquiring greater presence in classrooms for learning music (Calvillo Castro 2019; Torrejón Martín and Ventura-Campos 2019; Verde Trabada 2021). With the use of this methodology, musical learning contexts could be extended and would enable preparing different artistic performances to enhance creativity, integrating digital tools that have been studied in this paper. On the other hand, educational 3D printing, which consists of manufacturing objects by superimposing different materials –resin, plastic aluminum, sand– place students at the crossroads of the digital and physical worlds (Román González 2018). Scientific evidence suggests that this dialogue between the digital and physical worlds is very attractive in the educational sphere (Sacristán 2018). It could also have applications in teaching music, for example to manufacture musical instruments. There are pioneering experiences that could support the hypothesis that musical education can be satisfactorily inserted for the development of STEAM competences (Pérez Sabio and Calvillo Castro 2022).

Going back to the central subject matter of this study, there is considerable scientific literature that focuses on the positive aspects of technology: the amount of immediacy it provides, the constant updating of the applications, its capacity to adapt to students' individuality and characteristics, and the highly motivating and interdisciplinary component it entails (Cabero and Barroso 2018; De la Horra 2017; Toledo and Sánchez 2017; Videla *et al.* 2017). The objective of contributing to training digital citizens leads us to search for inclusive resources that facilitate the acquisition of skills and competencies that allow eliminating possible barriers (Cabero and Palacios 2019; Silvia and Lázaro 2020). This explanation is backed by theories that uphold empowering people to participate, express themselves and create in present-day digital society. Moreover, we must not lose sight of the educational applications of Artificial Intelligence (Incio Flores *et al.* 2022), which have started to be used, amongst other methodological developments, as a tool to personalize learning (Jara and Ochoa, 2020). Delimiting this matter to musical education, some studies suggest that the hybridization of musical software tools and Artificial Intelligence technology will entail a new path to improve the teaching and learning of music (Bravo *et al.* 2022).

In view of the results obtained, note should be made that the slight increase of knowledge of notation editors may be due to the fact that this is a tool that not only digitizes and edits music, but that it also serves to compose, to develop auditory and music reading skills and to encourage creative musical activities (Galera-Núñez and Mendoza 2011). This highlights the need of software developers to optimize resources, favoring the priority of providing solutions that are increasingly generic. In other words, the objective is to satisfy several technological needs with a single resource. In consequence, these might be the reasons why teachers will become more interested in having training and keeping abreast with certain resources (notation editors).

If said resources provide multiple benefits, and not just one, teachers will be more motivated and will devote more time to learning and using them. Another possible explanation of this result could be that the presence of notation editors is more common in university classrooms and syllabuses (Calderón-Garrido, Gustems Carnicer, and Carrera 2020c).

At present, it is absolutely necessary to make efforts to acquire proficiency in the use of ICT tools, as technological devices are inherent to all daily tasks (Fuentes, López, and Pozo 2019). Educational systems must remain abreast of technological innovations and must incorporate them into the classroom, engaging the agents involved in the educational community in this obligatory transformation. Teachers face the challenge of incorporating ICT resources in educational space (Martínez, Hinojo, and Rodríguez 2017).

This research study coincides with previous ones in that it does not find a significant correlation of age in connection with the level of digital competence (Cózar and Roblizo 2014). This aspect seems to be consistent with the theory of digital «visitors and residents», in which the former distinguish themselves from the latter on the basis of the degree of technological involvement in their life in general, without taking into account generational features (White and Le Cornu 2011). However, it differs in respect to these studies (in which no significant findings were obtained regarding sex), since in this present study the scores obtained by men are higher than the ones obtained by women. Other studies suggest that the gender differences in digital competence may correspond to the inherent difference between genders, irrespective of the context, and may be reflected in aspects such as the use of ICT resources (Hernández and Espuny 2022; Acosta and Pedraza 2020). It is also true that limitations are found in the access to and use of digital tools by women as a result of the social order (Apaez and Bernal 2021), resulting in a reduction of the digital competence (Calderón 2019). In this sense, there are sectors with fewer economic resources that also present limitations in respect to said access (Olarte, 2017).

Teachers have declared that they do not feel qualified to use ICT resources (Fernández Cruz, Fernández Díaz, and Rodríguez Mantilla 2018) and require urgent training and updating to improve their digital competence (Murillo and Román, 2016; Passey *et al.* 2018). We know that a greater use of ICT tools does not imply having a better digital competence (Hernández and Espuny, 2022), which may lead us to question the quality of the education that is provided. When considering excellence in education, one of the aspects that is contemplated is the use of varied and novel didactic resources linked to students' close surroundings and which are of interest in their daily lives, enabling them to pass from knowledge to action. (Touriñán 2022).

5. Conclusions

The answers obtained from teachers and students of music reveal the current situation in respect to the presence of technological resources in classrooms, which contribute to the innovation and reorganization of the teaching-learning process (Mañas and Roig-Vila 2019). It is noted that in contrast with what one might assume, age does not have any relation with the use of this type of resources. The findings show that some individuals have a greater predisposition to use technological resources as a learning tool, and show greater technological competence, not only in the use of editors, which seem to be the most generalized resource (Podolak and Schumuckler 2020).

The distance between students' digital competence and technological reality continues to be a source of concern. This situation is the cause of a tension in training that must be resolved, as it seems that music

teachers must increase their digital competence to ensure good teaching praxis. In consequence, this evidences the need to increase training efforts to facilitate both access to and a greater use of technological tools.

The interest for incorporating technologies in the teaching-learning process consists above all in the increase observed in motivational and participation aspects. Significant differences are found between the use of digital tools by teachers at conservatories and teachers in other institutions. Prior studies also reflect this trend, in particular in the case of higher education studies, in which there is a greater presence of these resources (Calderón-Garrido *et al.* 2019).

The data collected show a smaller presence of resources devoted to auditory training, sequencers, and software for instrumental or vocal practice. There is no evidence that this may be due to a reason linked to the allocation of resources to music training centers; it seems more likely that this situation highlights training shortfalls in the area of technology (Ferm, Johansen, and Juntunen 2016). It would also be possible to consider that the technical intensity required in musical training may affect the time that is available to devote to other types of resources. Another aspect that could be considered decisive is the approach regarding the use of digital resources, which in addition to being a supplement could also be incorporated as a tool to generate knowledge (Pozo, Torrado, and Pérez 2020).

This paper reveals that the study and use of digital technology to learn and teach music continues to be one the main areas of focus to understand present day musical education. However, it seems that the contents, uses, resources and training are insufficient to improve the current situation. In consequence, research on the treatment of digital tools by music teachers should continue in the future, focusing on data processing from a comparative perspective in respect to the different roles studied in this paper, or on a triangulation of the results, extending the data collection means in order to better understand the course of 21st century musical education.

6. Funding

This research is part of the project "Conocimiento y uso de la tecnología educativa en maestros y profesores de música" [Knowledge and use of educational technology of music teachers and professors] (ID B0036), which was supported by a grant-in-aid awarded by the Universidad Internacional de La Rioja, UNIR, Spain.

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