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Teachers' digital competence to assist students with functional diversity: Identification of factors through logistic regression methods

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Abstract

We are experiencing a serious health crisis due to COVID-19 that has a major impact on the field of education. The educational system therefore needs to be updated and innovated, with the addition of digital resources, to adapt the teaching and learning processes to students with disabilities. To meet the goal of high-quality education, teachers must have adequate digital competence to face the educational demands that are placed on them. Therefore, the purposes of this study are: to know the teachers' knowledge about digital resources to support students with disabilities (O1); at each educational stage (O2), identify the variables that have a significant impact on the acquisition of teacher competence (O3); propose a selection of useful ICT resources for each type of disability (O4). An ex post facto design was used with 1194 teachers from Andalusia (Spain). The results showed the medium-low level of the teaching staff, especially in the higher education stage. In addition, gender, motivation, attitude and having students with special needs are determining factors in the development of teacher knowledge. The results highlight the urgent need for teachers to be trained in digital resources. We hope that the range of resources proposed in this study will help teachers enhance their teaching practice.

KEYWORDS
binary regression, digital resources, disability, ICT, inclusive education, research methods, teachers

Practitioner notes

What we already know about this topic

- Teachers have to find and adapt educational technology to achieve a higher level of success in students with disabilities.
- The use of ICT resources by teachers acts as a bridge to promote learning in students with disabilities.

What this paper adds

- Identification of those predictors that significantly influence the acquisition of digital competence in teaching staff at various stages of education: gender, educational stage, motivation, attitude towards technologies and having students with specific educational support needs.
- A proposal of didactic applications is provided to address the different types of functional diversity.

Implications for practice and/or policy

- It is essential that training plans on digital competence are established to assist students with functional diversity in their different learning stages. In this sense, personalised training itineraries or TMOOCs can be of major assistance.
- Expansion of the study sample (macro level) to identify digital factors, which affect the acquisition of the digital competence of the teaching staff to support their students' disabilities.
- Change regarding the type of diagnosis through self-perception tests, such as those presented by these models, and subsequent work in other fields such as e-portfolios of evidence or instruments in the form of problem solving.

INTRODUCTION

Our information and communication society is evolving at a dizzying pace, and education is evolving in the same way. Regardless of the educational stage in which the students develop their teaching-learning process, there are always students with specific educational support needs (SEN). Thanks to ICT support and various other resources, these students are capable of making considerable progress (Alexopoulou et al., 2019; Budnyk & Kotyk, 2020; Mendoza-González et al., 2019).

Against this background, the use of digital resources by teachers can be seen as a bridge in the promotion of learning of any type of student, regardless of its limitation to improve access to information (Adam & Tatnall, 2008; Heiman et al., 2017). In other words, the use of ICT in various educational contexts will contribute to the development of learning environments, new teaching methodologies and strategies, taking into account the heterogeneity of the students and working from the basis of inclusive education (Hersh, 2017). Inclusive education is ‘a permanent process, the objective of which is to offer quality education for all, respecting diversity and the different needs and abilities, characteristics and learning expectations of students and communities, eliminating all forms of discrimination’ (UNESCO, 2009, p. 3).

To achieve an inclusive environment, the teacher has to teach all their students regardless of their abilities and capacities, intrinsic, structural or cultural (Juárez & Comboni, 2016). In a digital context, Ott and Pozzi (2009) state that the teacher must have the ability to evaluate and select ICT resources for each student with a specific functional diversity (including assistive devices), paying special attention to related problems related to the accessibility of software and hardware. Therefore, this substantial change in the transmission of knowledge requires a teacher with competence built by educational technology, which truly allows an inclusive education for all students with or without disabilities (Fernández-Batanero et al., 2019).

When we refer to inclusive education, we emphasise the right of everyone to be educated within the same context and to the maximum of their capabilities. This implies the acceptance that students will have different cognitive and physiological characteristics, learning styles and different attitudes towards a range of digital technologies. Therefore, it is essential that teachers have not only the necessary resources to serve all students, but also specific training of a technological and pedagogical nature (Cabero-Almenara, Romero-Tena, et al., 2020).

The inclusion of ICT in the curriculum is a complex aspect that is largely dependent on two factors. On the one hand, the attitude of teachers towards the use, integration and adaptation of ICT in teaching, evaluation and research tasks (Fernández & Rodríguez, 2017; Guillén-Gámez & Mayorga-Fernández, 2020a). Most of the studies conducted emphasise a high ranking for ICT but display a large degree of insecurity when incorporating them not so much from a technological-instrumental point of view, but from a didactic and methodological perspective (Arancibia et al., 2020; Prendes & Gutiérrez, 2013). On the other hand, inclusion depends on the attitudes imposed by social norms when accepting students with SEN in general education (Center & Ward, 1987; Pit-ten et al., 2018). These attitudinal barriers are compounded by the stress that a teacher may feel when using technology for which they are not pedagogically trained, as well as their level of motivation about their teaching practice. These phenomena have increased in recent months with the health crisis caused by the COVID-19 pandemic (Alvarado et al., 2020; Hebebci et al., 2020; Rapanta et al., 2020).

A student is considered to present SEN when they have greater difficulties in the teaching-learning process or in their development compared to their peers in their age or class, and consequently, requires specialised support to compensate these difficulties (Barbotte, 2001; Gulliford & Upton, 2002). To achieve this support, a wide range of technological resources and educational experiences is available to improve the inclusion opportunities for students (Fachal et al., 2019; Olugu, 2020; Palomino & Ruíz, 2014; Silman et al., 2017). On the one hand, assistive technologies (AT = devices and software designed specifically for people with disabilities, eg, Tobii DynaVox, Tapit, Picture Exchange Communication System) can have a great impact on many of the educational needs that children present (Al-Dababneh & Al-Zboon, 2020; Alkahtani, 2013). Its importance is such that Tamakloe and Agbenyega (2017, p. 32) stated that ‘Assistive technology is the way of the future for all sorts of children with disabilities’. On the other hand, Mohd et al. (2014) pointed out that augmented reality, game-based software or animation projects could be the response to students' needs. Finally, other types of ICT resources exist to support students' disabilities (eg, touch boards, digital tablets, smartphones, virtual keyboards, specific software), classified for each type of disability: motor, cognitive, visual and/or auditory (Erdem, 2017; López & Valenzuela, 2015). For this reason, it is necessary for teachers to spend time on tracking down and adapting educational technology to achieve a higher level of success in students, avoiding exclusion. To achieve this, the first step is for teachers to have sufficient competence in using technology to adapt the teaching-learning process to the needs of their students.

In this field, this study affects the field of digital competence held by teachers of four educational stages (Early Childhood, Primary, Secondary and Higher) on the use of ICT resources for people with disabilities. It is considered that this study is relevant since, firstly, there are very few studies on the knowledge in ICT resources of teachers to attend to people with functional diversity (on general aspects, visual, auditory, motor and cognitive disabilities); secondly, it offers the analysis of various academic and demographic variables that can influence the development of these competence, and consequently, how successful a teacher will be in developing an acceptable digital skill set; and thirdly, it proposes a range of ICT resources for teachers to use in the classroom, geared towards each type of disability. Therefore, the objectives of this study are:

- O1. Identify the level of knowledge teachers have about the use of digital resources to support people with disabilities (about general aspects, visual, auditory, motor and cognitive disabilities).
- O2. Investigate the level of global knowledge of teachers about the use of digital resources to support people with disabilities, at each educational stage.
- O3. Identify the academic and demographic variables that significantly affect the acquisition of an acceptable digital skill set.
- O4. Propose useful ICT resources for each type of disability in order for teachers to improve their digital competence.

This study is structured as follows: after the contextualisation of the research problem, a thorough review of the scientific literature is presented. The methodology used to achieve the proposed objectives is detailed below. Subsequently, the results obtained are presented together with their interpretation. Finally, the results found are discussed, and both the limitations of the study and the possible ways to continue research are presented.

RELATED WORK

In the Spanish context, the volume of production of related works on teaching digital competence is abundant in each of the educational stages: Early Childhood Education (Casillas et al., 2020; Romero-Tena et al., 2020), Primary Education (Cabero-Almenara, Gutiérrez-Castillo, et al., 2020; Escoda & Conde, 2016; Palomino, 2017), Secondary Education (Napal et al., 2018), Higher Education (Cabero-Almenara, Romero-Tena, et al., 2020; Calderón-Garrido et al., 2020; Guillén-Gámez & Mayorga-Fernández, 2020b; Ruiz et al., 2020). Most of these studies conclude that, although teachers are favourably disposed towards ICT, the knowledge acquired about these technologies has been largely self-taught, which means that they usually need to be trained in integrating them. In addition, some studies confirm that factors such as age (Hinojo-Lucena et al., 2019; Moreno et al., 2020), gender (Roussinos & Jimoyiannis, 2019; Yazar & Keskin, 2016), teacher anxiety about using technology for which no proper training has been received (Mac Callum & Jeffrey, 2014) or motivation about teaching practice influence the acquisition and development of these competence (Guillén-Gámez et al., 2018).

We carried out a search for related studies on the ability of teachers to use digital resources with students with some type of disability. Fernández-Batanero et al. (2019) analysed the knowledge held by 777 Primary Education teachers in relation to this topic. The results revealed the low numbers of teachers who were able to assist people with visual, auditory, motoric and cognitive disabilities. In addition, the variables of age, years of teaching experience and gender significantly influenced the results, where the female sex had a greater knowledge than the male sex. However, Fernández (2017) found contradictory results in respect of gender, finding significant differences in favour of the male gender. Yovkova and Peytcheva-Forsyth (2019) did not find significant differences for either the gender or the age variable.

In another study carried out by Fernández-Batanero (2018) with 34 Primary Education teachers, he again uncovered the little knowledge they had regarding the application of ICT for people with some type of disability. However, this study did not analyse the gender variable. In the same context, Morales and Llorente (2016) analysed the knowledge held by 154 future teachers of the Primary Education Degree, finding low to very low values in the different dimensions analysed (hearing, motor, cognitive and accessibility disabilities), while in other dimensions (visual disabilities and general aspects) the participants' level was said to be medium. As a nuance, the 'accessibility disabilities' dimension includes those skills that a teacher has related to the creation and adaptation of digital materials for those students with educational needs. In this way, students will be able to use these materials without difficulty. This term is closely related to Universal Learning Design (Fernández-Batanero, 2018). By general aspects, we mean everything related to having knowledge about the possibilities of ICT to attend to diversity, the ability to select them and feel prepared to use them in the classroom.

In the Early Childhood Education stage, Arouri et al. (2020) analysed the perceptions of 83 teachers on the use of assistive technology with children with disabilities. The study showed that teachers had a high level of use, and that, in addition, no significant differences were found between teachers of different specialties (General Education vs. Special Education) or in the variable years of experience. With the same objectives and comparing two stages (Early Childhood Education and Primary Education), Fernández et al. (2017) found significant differences between the participants of both stages, in favour of those in Primary Education. Furthermore, the authors showed that years of experience negatively influence the knowledge they claim to have for the use of ICT.

METHOD

Sample

For the proposed objectives, a non-experimental design (ex post facto) was used with a sample of 1194 active teachers from Andalusia from four educational stages: 14% (n = 167) work in the Early Childhood Education Stage with an average age of 37 years; 37.6% (n = 449) taught in Primary Education with an average age of 38 years; 24.7% (n = 295) were of Secondary Education with an average age of 42 years. Finally, 23.7% (n = 283) were of Higher Education with an average age of 41 years. Regarding the gender of the teaching staff, 63.9% (n = 763) were female, whereas 36.1% (n = 431) were male. Finally, 23.79% (n = 284) worked in private centres, whereas 76.21% (n = 910) worked in public centres. For the data collection, a non-probability sampling was used intentionally, as well as by snowball, maintaining the privacy of the participants at all times. The data collection was carried out during the academic year 2019–20.

Instrument

To measure the level of digital competence of teachers, a range of criteria from the Cabero-Almenara et al. (2016) instrument was used. It measures the use of ICT resources intended to support students with disabilities. The selection comprised a total of 31 items, which sought to collect information on general aspects of the application of ICT for people with disabilities (GA), application of ICT for people with motor (M), cognitive (C), visual (V), auditory (A) disabilities, and general accessibility awareness (AC). The scale of measurement was ordinal (Likert scale of 5 points) from 1 (*you feel completely ineffective*) to 5 (*you dominate it completely*).

The instrument lacked analysis that confirmed the exploratory and confirmatory validity, because this was carried out and verified. Exploratory factor analysis was used under the method of maximum likelihood with Oblimin rotation. The KMO test (Kaiser–Meyer–Olkin) was 0.926 and the Bartlett test was significant ($\chi^2 = 4345.710$, $p < 0.05$). All those items that obtained correlations lower than 0.3 or that saturated in other factors were eliminated, finding a final instrument of 18 items classified in the six dimensions of the instrument. The final version explained 87.603% of the true variance of it. On the other hand, the confirmatory factor analysis (CFA) showed that the teachers' data were correctly adjusted to the theoretical model proposed by Cabero-Almenara et al. (2016). The coefficients were correct, which respected the thresholds established by Bentler (1989) and Schumacker and Lomax (2004). This model supported the factorial structure formulated in the CFA, made up of six correlated latent variables. The structural equation model was carried out using the AMOS V.24 software. In addition, the reliability of the selected items was examined using Cronbach's alpha and McDonald's omega coefficient for each of the instrument's scales. Both coefficients obtained very satisfactory values. All coefficients are shown in Table 1. The structural design through the analysis of structural equations with AMOS can be seen in Appendix.

Finally, the Likert scale of five points which measured the teacher's global level of digital competence was recoded with two categorical values: acceptable level of digital competence (3 points or more) and unacceptable level of digital competence (below 3 points). The characterisation of the variables used in the study is shown in Table 2.

RESULTS

Descriptive results for each dimension of the instrument

Table 3 shows the means and standard deviations of the questionnaire items, organised by dimensions.

An observation is made that most items have scores means close to 2, indicating a medium-low level of ability. These results are contrasted with the mean scores of the dimensions, represented in Figure 1.

TABLE 1 Exploratory and confirmatory factorial results and reliability of the instrument

	χ^2	p	CFI	TLI	IFI	NFI	RMR	RMSEA
Model fit summary	**3.006**	**0.001**	**0.941**	**0.916**	**0.923**	**0.915**	**0.046**	**0.072**
Validity	Dimensions	GA	M	C	V	A		AC
	CR	0.916	0.919	0.878	0.955	0.939		0.911
	AVE	0.785	0.791	0.708	0.875	0.836		0.774
	MSV	0.768	0.788	0.834	0.772	0.834		0.622
Exploratory	Variance (%)	68.313	2.583	2.159	3.640	6.668		3.455
Reliability	Alpha	0.917	0.902	0.875	0.946	0.925		0.911
	Omega	0.911	0.896	0.863	0.944	0.920		0.904

TABLE 2 Description of variables

Variable	Type	Measurement scale	Categories
Digital competence level (dependent variable)	Qualitative	Nominal	0: Low 1: High
Gender	Qualitative	Nominal	0: Male 1: Female
Educational stage	Qualitative	Nominal	0: Early Childhood 1: Primary 2: Secondary 3: University
Do you have students with disabilities in your class?	Qualitative	Nominal	0: No 1: Yes
Do you consider yourself an entrepreneur in ICT?	Qualitative	Nominal	0: No 1: Yes
Percentage of time to ICT	Qualitative	Nominal	0:0%–25% 1:25%–50% 2:50%–75% 3:75%–100%
How motivated are you in your teaching practice?	Quantitative	Ordinal	Likert 10 points
What is your stress level when you have to use ICT?	Quantitative	Ordinal	Likert 10 points
Attitude: I think that ICT is a resource to support people with disabilities	Quantitative	Ordinal	Likert 10 points
Number of social networks	Qualitative	Ordinal	–
Years of teaching experience	Quantitative	Reason	–
Age	Quantitative	Reason	–

Prediction of variables that significantly affect the level of digital competence

The assumptions that allow the logistic regression to be carried out were verified. The assumption of *Independence of the observations* was not significant (sig. = 0.887), so the observations are independent of each other. The Hosmer–Lemeshow test (assumption *Monotony*) correctly fitted the data (χ^2 = 4.020; gl = 8; sig. = 0.855). Finally, the assumption of *Multicollinearity* found values lower than 0.6 in the variables age, teaching experience and ICT entrepreneur, for which they were eliminated from subsequent analyses.

The Omnibus test checked a correct and significant estimate of the proposed model (χ^2 = 60.087; gl = 10; $p < 0.05$), among the independent variables (gender, educational stage, students with disabilities, being an ICT entrepreneur, commitment to ICT, motivation, stress, beliefs and number of social networks) and the dependent variable (acceptable level of digital competence/unacceptable level of digital competence). The goodness of fit of the model was carried out through the regression coefficients of Nagelkerke (0.374) and Cox and Snell (0.266); it is inferred that the model explains approximately between 26% and 37% of the total variability. Likewise, it was found that it was capable of making correct predictions

TABLE 3 Average knowledge of teachers in each dimension of the instrument

	M ± *SD*
General aspects	
I have knowledge of the possibilities that ICT offers to people with disabilities	2.89 ± 1.11
I am able to select specific ICT resources based on the physical, sensory and cognitive capabilities of different students	2.51 ± 1.11
In general, I feel prepared to help students with certain disabilities with the use of technical aids and the use of ICT	2.44 ± 1.08
Visual	
I am aware of different computer software programs that are targeted at people with visual disabilities	2.28 ± 1.25
I know how to create a document on a word processor and eliminate those aspects that may make it difficult to view for people with visual disabilities	2.27 ± 1.34
In general, I know the possibilities offered by ICT to students with visual deficits	2.43 ± 1.23
Hearing	
I am able to adjust the curriculum with the support of ICT for students with hearing disabilities	2.23 ± 1.21
I know how sign language works	2.08 ± 1.23
I am able to apply teaching strategies supported by ICT to facilitate the integration of students with hearing disabilities	2.32 ± 1.20
Cognitive	
I am able to apply didactic strategies supported by ICT to facilitate the inclusion of students with cognitive disabilities	2.45 ± 1.15
In general, I am aware of the possibilities that ICT offers to students with cognitive disabilities (C)	2.49 ± 1.19
I am able to adjust the curriculum with the support of ICT for students with cognitive disabilities.	2.30 ± 1.15
Motor	
I know different types of keyboards for people with different types of mobility limitations	2.29 ± 1.32
In general, I know the possibilities that ICT offers to students with motor disabilities	2.31 ± 1.25
I am capable of making curricular adaptations supported by ICT for students with motor limitations	2.23 ± 1.17
Accessibility	
I am able to create web pages with high accessibility parameters	1.81 ± 1.12
I can point out different institutions, national and international, that are related to the study and research of the accessibility of the sites	1.98 ± 1.11
I am able to explain the principles that the Center for Design for All recommends are followed, in order to create websites that serve to achieve a 'design for all'	1.87 ± 1.13

in 76.8% of cases, which made the model acceptable. In addition, the specificity and sensitivity of the model were verified, resulting in very satisfactory percentages (Table 4).

Table 5 shows those significant predictors with regard to having an acceptable level of digital competence (sig. < 0.05).

With regard to the gender of the teaching staff, it is observed that the odds ratio of male teachers is 0.42 times lower than that of female teachers, with an odds ratio lower than 1, indicating that their relationship is negative. The educational stage has an important and significant effect, and in addition, it shows a clear negative relationship between the educational stage and the level of competence: the higher the educational stage, the lower the

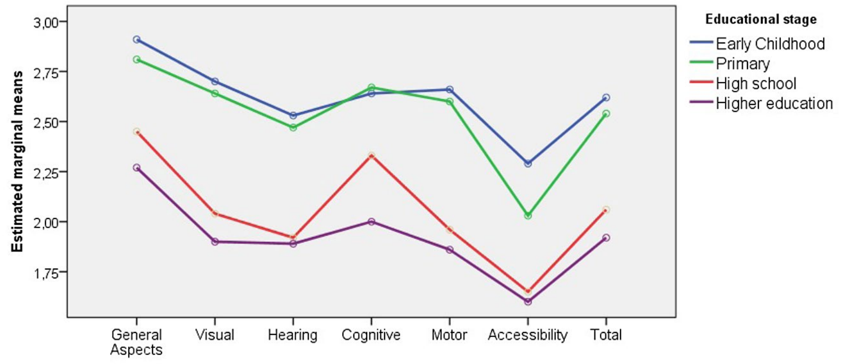

FIGURE 1 Knowledge of the use of ICT resources to assist people with disabilities, at each educational stage

TABLE 4 Percentage of cases correctly classified in the prediction of the teacher's digital competence

Observed	Predicted		
	Unacceptable level of digital competence	Acceptable level of digital competence	% correct cases
Unacceptable level of digital competence	720 (87.97%)**	98	88
Acceptable level of digital competence	178	196 (52.46%)*	52.5
% correct cases			76.8

Note:: The percentages on the main diagonal correspond to sensitivity * and specificity ** of the model.

level of digital competence in caring for people with disabilities, and vice versa. The variable level of motivation presents a positive coefficient and an odds ratio greater than unity - Exp (0.314) = 1.369. This indicates that for each point of increase that teachers had on the motivation scale, their odds were 1.37 times higher compared to those with lower scores. The same interpretation is for the attitude towards ICT variable since both variables were measured with the same type of scale. Finally, the teachers whose classroom comprised students with SEN obtained an odds of 2736 times higher compared to those teachers who did not have students with disabilities in the classroom.

Table 6 presents several examples of probability to acquire an acceptable level of digital competence with those variables that have been significant in the proposed model: for both sexes, each educational stage and, finally, with and without students SEN in class, having the level of motivation (eg, 8/10) and attitude towards ICT (eg, 8/10) on equal terms.

Proposal for ICT resources

In addition to the quantitative analysis of the study, the questionnaire was composed of the following open question: List three digital resources which you use in the classroom with your students with functional diversity, and consequently, they provide good learning results. Based on the responses offered by teachers who had an acceptable level of digital competence (minimum 3 points or more on the Likert scale of the questionnaire), those digital resources with the highest frequency of use were selected. The classification has been made according to the system of categories proposed by Fernández-Batanero (2018), according

TABLE 5 Predictors in the probability of having an acceptable level of digital competence

	B	Standard error	Wald	gl	Sig.	Exp(B)
Sex	−0.873	0.417	4.376	1	0.036	0.418
Educational stage (early childhood)			9.119	3	0.028	
Educational stage (primary)	1.855	0.635	8.541	1	0.003	6.390
Educational stage (secondary)	1.276	0.616	4.290	1	0.038	3.582
Educational stage (university)	0.886	0.651	1.854	1	0.173	2.425
Percentage of time to ICT	0.207	0.208	0.991	1	0.320	1.230
Number of social networks	0.119	0.134	0.786	1	0.375	1.126
Level of motivation in teaching practice	0.314	0.129	5.903	1	0.015	1.369
Stress level in using ICT	−0.035	0.073	0.233	1	0.629	0.966
Attitude towards ICT	0.304	0.154	3.912	1	0.048	1.355
Classroom with students with SEN	1.007	0.473	4.522	1	0.033	2.736
Constant	−7.561	1.748	18.700	1	0.000	0.001

TABLE 6 Percentages of success of having an acceptable digital competence

	Infant		Primary		Secondary		University	
	SEN	No SEN	SEN	No SEN	SEN	No SEN	SEN	No SEN
Women	16.66	6.79	55.97	31.87	41.82	20.75	32.74	15.06
Men	7.72	2.96	34.75	16.25	22.97	9.89	16.80	6.91

to the type of disability for which the resource is most suitable. The results are presented in Table 7.

DISCUSSION

The barriers faced by people with disabilities encompass a broad spectrum; they range from physical access to communication issues, may comprise teaching-learning processes or the social imaginary created around them, all the way to psychological ones. In some of these areas, as borne out by different studies, ICT can provide numerous benefits (Fernández-Batanero et al., 2019; Yovkova & Peytcheva-Forsyth, 2019). In this sense, this study reveals that the majority of the teaching staff has a medium-low level of knowledge about digital resources to serve students with disabilities (O1). These results coincide with those of previous works such as those of Fernández-Batanero (2018), and Morales and Llorente (2016), which calls for enhanced training of ICT teachers with the emphasis on diversity to improve this level.

TABLE 7 Proposal for ICT resources

Dimension	Resource	Description
Visual	Educational resources ONCE (https://bit.ly/39dJWEB)	Adaptation of materials to the needs of students and teachers carried out by the National Organization of the Spanish Blind (ONCE), through the Specific Attention Teams for people with visual disabilities and the ONCE Bibliographic Service
	Hetah Transcriber (https://bit.ly/38uOVl3)	It is aimed at all those who are visually impaired and need to access information in a format that facilitates their understanding
	Knfb reader (https://bit.ly/3hZV2Ri)	This app is designed for people with visual disabilities and who use their mobile regularly. It aims to normalise their day-to-day life as much as possible to promote integration in their immediate environment
Hearing	Transcriber hetah (https://bit.ly/38uOVl3)	This ICT resource is designed for people with hearing difficulties. Thanks to instant translation, listeners can convey messages more easily without the need to learn sign language
	AMPDA (https://bit.ly/3nvEthm)	This application is aimed at all those who have communication difficulties, whether speaking or hearing related
	Spreadthesign (https://bit.ly/3hV86Yq)	In an educational context, this can be used by Secondary Education students (12–18 years old) with hearing disabilities
Cognitive	ABLE (https://bit.ly/3s66VtT)	This tool allows users to create a communication system based on pictograms in a matter of seconds and also converts text to speech. Therefore, it facilitates the teacher's task to transmit actions or concepts to students with disabilities, since they are reproduced in a clearer and more comprehensible way
	TecnoCom (https://bit.ly/3ow9fbb)	TecnoCom is a customisable communication system. This system can be adapted easily and quickly to fit the user's needs. It comes with other options such as configuring texts and images and also provides a scanning option, scan time, tag reader, categories, text to speech player, etc.
Motor	Accessibility scan (https://bit.ly/3nwqmse)	Technological solution that allows the use of mobile phones for people

In addition, this study predicts through a logistic regression with high levels of specificity and sensitivity those variables that have a significant impact on the acquisition of teaching skills in respect of the use of resources to support students with disabilities (O3), by educational levels (O2). In this sense, the significant predictors have been gender (where males are shown to perform at lower levels than females); level of education (where the higher the educational level, the lower is the degree of digital competence in caring for people with disabilities); motivation (where teachers with high levels of motivation reach the highest levels of digital ability); attitude towards technologies (presenting the same phenomenon as in the motivation variable); and having students with SEN (which directly produces a considerable increase in digital ability). These results are in contrast with studies that confirm that factors such as age (Hinojo-Lucena et al., 2019; Moreno et al., 2020), gender (Roussinos & Jimoyiannis, 2019; Yazar & Keskin, 2016), teacher anxiety about using technology without (proper) training (Mac Callum & Jeffrey, 2014) or motivation about teaching practice influence the acquisition and development of these competences (Guillén-Gámez et al., 2018).

Finally, this paper provides a list of resources and useful tools to meet the educational needs that present themselves in the classroom (O4). In this sense, it is recommended that, every time a new digital technology is incorporated into the training and teaching process, steps must be taken to ensure that students understand the workings of this new technology (Olugu, 2020). The teacher must also be aware that the use of these new technologies can be a great help towards including all their students but could equally well cause a digital divide that separates their class. Designing the subject, the contents, the activities and selecting the means and resources for this should not be done with a standard design in mind, as this can lead to the exclusion of students (Goodyear et al., 2021; Palomino & Ruíz, 2014).

CONCLUSIONS

In general terms, the results show that the level of digital competence of teachers is acceptable for the four educational stages analysed. However, these levels should be higher to achieve inclusive and quality education. This entails a necessary structuring of teacher education programmes that allow the digital competence of teachers to be developed at an expert level. In this sense, the analysed model assumes a transformation of the traditional communication, educational and work structures, methods and assumptions. Therefore, the ways in which teacher training is structured to support an authentic competence development in accordance with the Knowledge Society needs a rethink. This needs to be done on all levels and, therefore, as a constant learning process that mobilises different competency dimensions that range from the technical domain to innovation with ICT (Cabero-Almenara, Cabero-Almenara, Gutiérrez-Castillo, et al., 2020; Cabero-Almenara, Romero-Tena, et al., 2020).

The results make it necessary to rethink teacher education programmes. Accordingly, the variables analysed, such as gender, educational level, motivation, attitude and having pupils with SEN should be taken into account when designing training programmes. For example, existing studies show that motivation and attitude towards ICT represent one of the factors that should be worked on before others such as conceptual or pedagogical content (Cabero-Almenara, Barroso-Osuna, et al., 2020; Pit-ten Cate et al., 2018). On the other hand, teacher education programmes should aim for equal opportunities for both men and women, breaking down the already existing digital gender gaps (Roussinos & Jimoyiannis, 2019). Equally, the results obtained reveal that levels are lower as the educational level increases. This is a determining factor for higher education institutions, which are the most vulnerable of all and which need to establish clear lines of action to develop the digital competence of their teaching staff. One of the main reasons for this can be found in the excessive 'technification' of university degrees, as well as in teaching evaluations that focus more on research than on teaching (Rapanta et al., 2020).

In accordance with the above information, ICT integration policies in inclusive contexts must necessarily be one of the main priorities of any policy. However, this should not only involve the presence of ICT in the classroom, but also the development of competences for their design, modification and use of ICT based on the needs of the learners. In this sense, personalised training plans, based on reference models, can be a way to develop teaching competences (Cabero-Almenara, Barroso-Osuna, et al., 2020; Casal et al., 2021). Similarly, TMOOCs have also been found to be very effective for competence development through the benefits of enriched tasks (Harris, 2021). This may be another potential way to work on teachers' digital competence.

With regard to the limitations of this research, we must now reflect on the areas for improvement and the direction any future work should take. The main weakness lies in the type of sample used. For this study, the method of purposive sampling was used, which indicates that the sample is not random. Therefore, the results obtained should not be extrapolated to the general population of all educational stages. This weakness can be improved in future studies through probability samples for each educational stage or, on the contrary, if this is not possible, through purposive samples that allow for the collection of teachers' perceptions of each educational stage from different countries (eg, Europe), as well as from public and private institutions. In this way, it would not only be possible to achieve a larger sample size, but the results would be more representative and able to be extrapolated, both for each educational stage, type of institution and for the whole of Europe.

Another limitation of this study is related to its design. A non-experimental ex post facto design was used for this study, as well as the development of an ICT resource list for each type of disability. It might be interesting for future work to use pre-experimental designs in which the educational resource list is put into practice through teacher training courses. In this way, through pre- and post-test designs, teachers could be trained in those technologies where their digital competence is limited and their results could be evaluated at the end of the training courses. If it is not possible to implement this type of design, this much-needed training for teachers could be effected through MOOC courses, adapted to the teachers at each educational stage and their digital needs. Previously, a teacher self-assessment would have been required with questions such as: What level of digital competence do I have as to digital resources to assist students with different types of functional diversity? Would I know how to adapt each ICT resource for students at different educational stages? Would I have the competence to be an ICT coordinator to teach my fellow teachers how to use and adapt ICT to each context? The research and development of all these aspects would provide an interesting framework for action on training programmes whose implementation would go beyond addressing, in a limited and specific way, teachers' self-perceptions of educational technology.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest.

DATA AVAILABILITY STATEMENT

The results of this research are part of the project financed by the Spanish Ministry of Science, Innovation and Universities, Spain. Once the project is concluded, the data will be published openly on the page of said project: https://grupotecnologiaeducativa.es/dipromooc/.

ETHICS STATEMENT

All the participants of this investigation were informed of the objectives of the same. All participants have signed a confidentiality agreement and data transfer document. Likewise, all data have been anonymised, guaranteeing the privacy of the participants.

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APPENDIX

MODEL OF STRUCTURAL EQUATIONS