

Artículo monográfico “Educational Technology and Functional Diversity: Teaching Skills and Digital Resources to Assist Students with Educational Needs”

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**Knowledge of university teachers on the use of digital resources to assist people with disabilities. The case of Spain**

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**Abstract:**

The integration of Information and Communication Technologies (ICT) in the context of higher education and in the framework of an education in equality and equity requires a competent teaching staff both from a technological and pedagogical point of view. In this context, and with the aim of going deeper into one of these theoretical premises, this study aimed to identify the degree of training and technological knowledge of university teaching staff in the faculties of education in Spain with regard to the use of ICT to support people with disabilities. A cross-sectional research design with a descriptive and predictive approach was used, in which the sample consisted of 2072 university teachers. An ad-hoc questionnaire was used as a data collection instrument. The results revealed the low level of competences of teachers regarding the use of ICT with students with disabilities, where gender and age variables are not relevant to predict the level of digital competence.

*Keywords:* Information and Communication Technologies, teacher training, higher education, disability.

**Introduction**

The digital revolution is leading companies, institutions and professionals to a profound transformation and a radical change in their ways of doing, acting and training. This technological revolution has affected all sectors of our society, including education. The European Commission (2012, 10) considers that "the digital revolution has opened up great opportunities to improve the quality, accessibility and equity of education" by making it possible to learn anytime, anywhere and to reduce social barriers.

The 2017 Horizon Report on Higher Education (NMC, 2017) stresses the idea that digital competence is not just about understanding how to use technologies, but inevitably involves the need to understand the profound impact of technologies in a digital world and to promote collaboration to integrate them effectively. It also insists again on the trend observed in previous years, which is the progressive implementation of different teaching models that will make our higher education system more flexible (blended-learning, e-learning, m-learning, adaptive learning, etc.). Higher education institutions do not escape this reality and must adapt to this scenario derived from technological advances. To do so, they must develop training policies and projects in order not to leave aside the possibilities of technologies and to work on the training of digital competence. University institutions are currently facing the challenge of finding new ways of developing teaching-learning processes, considering the technological, economic and social changes that are taking place (Ruíz Mezcua, 2019), without leaving anyone behind. In this sense, teachers must have significant digital training for the mastery of ICT and their integration into teaching-learning processes (Hatlevik et al., 2018), empowering them not only to support existing practices but rather to transform them (Uerz, Volman and Kral, 2018) and respond to the diversity of the student body, facilitating their inclusion (Fernández Batanero, 2020).

In the university context, classroom diversity is increasing. Students from diverse cultural and social backgrounds, of different ages, a variety of personal and work situations, student mobility, different interests, and resources, together with the scarce, but ever-increasing, presence of students with disabilities in university classrooms, highlight the need for the university to articulate new proposals that allow it to respond to the variability of profiles and situations.

In the framework of the European Higher Education Area, a more inclusive character is being demanded from the University, as is made clear in different international declarations (European Union 2020 Strategy, 2010; United Nations Agenda 2030, 2015). Furthermore, Sustainable Development Goal (SDG) 4 on education of the European Agenda 2030 calls for ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all by 2030. It emphasises the importance of inclusion and equity as the foundation for quality education and learning.

## **University teacher training in ICT and students with disabilities**

The use of technology as a means to promote learning and to address student diversity in the classroom has been the subject of numerous studies and educational experiences. Emphasising inclusion and equity as the foundation for quality education and learning requires not only the need to remove architectural barriers, but also virtual spaces and processes. Thus, university systems need to review their practices to ensure learning and participation for all students (Valee, 2017). In the special case of students with disabilities, many authors have identified the obstacles they face at university (O'Byrne, Jagoe and Lawler, 2019; Odame, Opoku, Nketsia and Nanor, 2019), where classroom practices are identified as the main difficulty of permanence.

Authors such as Zubillaga and Alba (2013) argue that this means redefining not only policies and actions in terms of attention to diversity, but also those pertaining to technology and communication, in order to guarantee access for the entire university community to the digital resources and processes promoted by the university. In this line, ICTs generate many expectations due to their potential to provide magnificent support to collaborate and promote learning in the face of student diversity, both as a motivating and activating element for learning itself, and as a didactic medium that opens up a wide range of possibilities for intervention for any student. In the case of students with disabilities, technologies can constitute the scaffolding that will allow them to carry out tasks adapted to their possibilities and interests, providing university students with disabilities with greater opportunities for employment and autonomy. Thus, the University, as an educational institution, has training as its main mission, where one of the objectives must be aimed at serving the whole of society with equal opportunities, without discrimination and, therefore, respecting human diversity.

In the pedagogical field, learning with ICT as support for people with disabilities has been the subject of research for several decades, but it has only been in recent years that it has become an important part of supporting the learning of this type of student. Most studies have been conducted in the non-university context and have focused on ICT support for learning in different areas (access to ICT, teaching and learning methods, assessments, digital games, etc.) (Liu, Wu & Chen, 2013; Perelmutter, McGregor & Gordon, 2016). Another area of action of ICT as support for disability has revolved around the "professional development of teachers" to prepare them in the use of ICT and educational inclusion (Fernández Batanero, Cabero & López Meneses, 2018).

At university level, although studies on ICT (teaching technology skills, student technology skills, technologies as a support for learning, etc.) are abundant (Cabero-Almenara, Guillen-Gámez, Ruiz-Palmero & Palacios-Rodríguez, 2021), studies in relation to technology and disability in higher education are very limited. Thus, and by

way of example, in the latest international congresses of relevance in the Spanish-American sphere: International Congress on Inclusive Education (Burgos, 2020), where all Spanish universities participate, no contribution was presented in relation to ICT and disability in the university context. Similarly, at the 8th International Congress of Good Practices with ICT (Malaga, 2021) and the international congress EDUTECH 2021 (Buenos Aires, Argentina).

In a recent literature review study on the impact of ICT on students with disabilities in higher education (Fernández-Batanero, Román-Graván, Montenegro-Rueda, & Fernández-Cerero, 2021), the findings show that there is great concern about teacher education and training to improve the experiences of these students through ICT. The lack of availability and accessibility of resources, as well as the need for teacher training in this field, is one of the great challenges facing university institutions today in order to promote education for all. Hence, the need for higher education institutions to invest in ICT-supported services for students with disabilities, as well as in teacher training (Kurt, et al., 2017).

Despite the few studies carried out, most show the need for training in digital competences of university faculty as one of the main barriers that hinder the integration of ICT to support people with disabilities (Ortiz Colón & Colmenero Ruiz, 2019; Sánchez, Duran Encinas, Zuniga Arce & De Casso Verdugo, 2019). Increased teacher training supports the development of experiences of learners with disabilities (Kim, Son & Vance, 2012). Thus, although accessible, in most cases, these tools are not being effective or are not being used adequately (Seale, Georgeson, Mamas & Sawin, 2014; Seale, 2013).

Studies on the level of digital teaching competence in higher education institutions from a gender perspective offer disparate results: the works of Marcelo, Yot & Mayor (2015) and Martínez-Cantos & Castaño (2017) show that the use of digital technologies for teaching purposes is more common among male teachers, while for Mercader & Duran-Bellonch (2021) it is women who make more use of them and therefore have a higher level of competence.

On the other hand, technological teacher training played an important role in the COVID-19 health crisis, as the ability to use ICT was one of the challenges faced by university teachers during the pandemic. Faculty had to cope with the demands of online education without the necessary training (Said Hung, Marcano & Garzón-Clemente, 2021). In this context, several studies highlight the relationship between poor training in technology and its influence on the mental health of teachers, creating anxiety, anguish and stress (Navarro-Espinosa, et al. 2021; Gyampoh et al., 2020).

Likewise, the University is aware of the positive impact that an effective integration of these tools can have as support for students with disabilities (Perera-Rodríguez & Moriña

Díez, 2019), but there are other limitations, among which are the scarcity of resources (Alsalem & Abu Doush, 2018; Seale, 2013) or the lack of funding and economic problems (Ahmed, 2018; Fitchen et al., 2012).

### **Purpose and research questions**

The objectives of this study are:

- O1. To find out the level of knowledge of university teaching staff about the use of digital resources to assist people with disabilities.
- O2. To identify academic and demographic variables that significantly explain the development of digital competence in teaching.

In this sense, the following research questions have been addressed:

- Q1. What level of training do university lecturers have with respect to the knowledge they possess to incorporate technologies to support students with some type of disability?
- Q2. Do years of teaching experience influence the level of digital competence of university teachers?
- Q3. Does the type of higher education institution determine the level of digital competence of university teachers?
- Q4. Does the gender of university teachers have a significant influence on the level of digital competence of university teachers?
- Q5. Does the age of university teachers have a significant influence on the level of digital competence of university teachers?

### **Method**

#### **Design**

A cross-sectional research design with a descriptive and predictive approach is proposed, taking into account the participation of Spanish university teachers. The reliability, discriminant validity and convergent validity of the questionnaire were calculated using the following coefficients: Cronbach's Alpha, McDonald's Omega, Composite Reliability (CR), Average Variance Extracted (AVE) and Maximum Shared Variance (MSV). The construct validity of the test was obtained by means of an exploratory factor analysis (EFA). The method used for the selection of the factors is the principal components method. The factors obtained are orthogonally rotated using the Varimax method with Kaiser normalisation. Once the number of factors has been determined, a confirmatory factor analysis (CFA) is performed. Confirmatory factor analysis is used to check whether the theoretical measures of the model are consistent through the modelling of diagrams and use of structural equations (Ruiz et al., 2010). That is, the data are tested to see if they

fit the hypothesised measurement model yielded by the exploratory factor analysis. The method used to test the theoretical model was weighted least squares (WLS), which provides consistent estimates in samples that do not conform to normality criteria (Ruiz et al., 2010). For the latter procedure, the AMOS software, capable of revealing hypothetical complex relationships between variables, using structural equation modelling (SEM), was used. In parallel, the non-normal distribution of the data has been checked through a descriptive study taking into account skewness and kurtosis. The Kolmogorov-Smirnov goodness-of-fit test confirmed this finding, with significance (p-value) equal to .000 for all items (non-normal distribution according to Siegel, 1976).

Consequently, to answer the first research objective, the means and standard deviations of the questionnaire items, dimensions and total value are presented. In addition, to achieve the second objective, a logistic regression is performed. According to Peláez (2016), Logistic Regression is a multivariate statistical technique that allows us to estimate the relationship between a dependent variable (digital competence), and a set of independent variables (gender, age, experience, and ownership of the centre). This analysis technique is the most appropriate for finding whether a set of variables explains the level of digital competence of teachers and has been used in other related research (Cabero-Almenara et al., 2021a, 2021b).

### Sample

For the proposed objectives, a non-experimental design (ex post facto) was used with a sample of 2072 active university teachers from higher education institutions from different autonomous communities in Spain. For data collection, non-probabilistic purposive and snowball sampling was used, always maintaining the privacy of the participants. The collection was carried out during the academic year 2020-2021. The sample consisted of 744 men (35.9%) and 1328 (64.1%).

Table 1 shows the percentage of teachers who completed the questionnaire, according to the Autonomous Community of origin.

<b>Autonomous Community where your school is located</b>		
	Frequency	Percentage
Andalusia	456	22,0
Aragon	16	,8
Canary Islands	64	3,1
Cantabria	12	,6
Castile and Leon	328	15,8
Castile-La Mancha	104	5,0
Catalonia	136	6,6

Autonomous City of Ceuta	4	,2
Autonomous City of Melilla	8	,4
Community of Madrid	220	10,6
Autonomous Community of Navarre	68	3,3
Valencian Community	184	8,9
Extremadura	96	4,6
Galicia	68	3,3
La Rioja	40	1,9
Principality of Asturias	108	5,2
Region of Murcia	160	7,7
Total	2072	100,0

Table 1. Percentage of teaching staff by Autonomous Community of origin.

As can be seen, teachers from Andalusia (f=456, 22.0%) completed the questionnaire the most, followed by those from Castilla y León (f=104, 15.8%) and the Autonomous Community of Madrid (f=220, 10.6%).

Figure 1 shows the percentage of teaching staff according to their years of teaching. By age, the results found according to age stand out: less than 30 years (f=116, 5.60%), between 31 and 40 years (f=580, 27.99%), between 41 and 55 years (f=944, 45.56%), and more than 55 years (f=432, 20.85%).

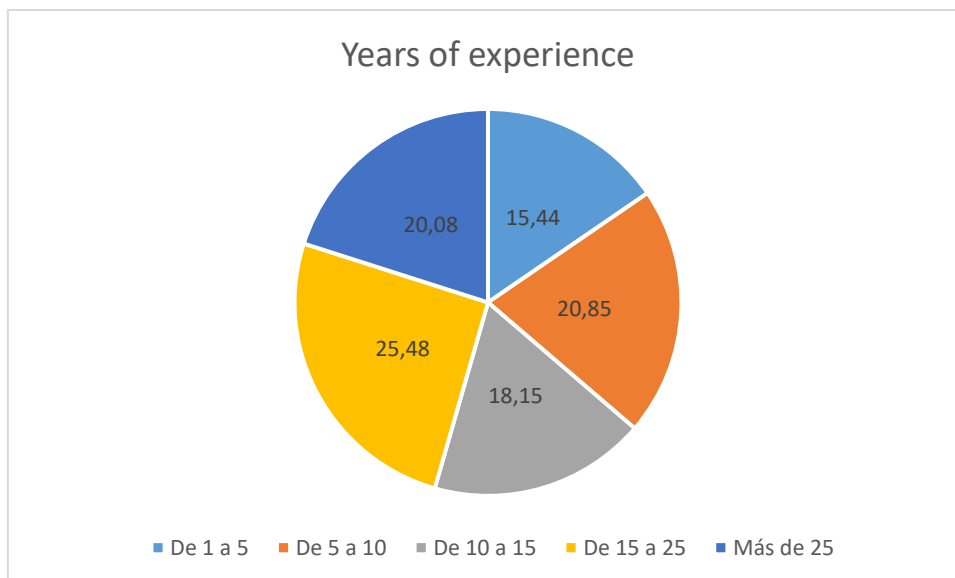


Figure 1. Percentage of teachers by year of experience.

### Instrument

To measure the teachers' level of digital competence, a modification of the battery of items of the instrument developed by Cabero-Almenara et al. (2016) was used, which measured the use of ICT resources to serve students with disabilities. The selection of items consisted of a total of 56 items, which aimed to collect information on general aspects of ICT application for people with disabilities (GA), ICT application for people with motor impairments (M), cognitive impairments (C), visual impairments (V), hearing impairments (A), and accessibility knowledge (ACC). The measurement scale was ordinal (6-point Likert scale) where value 1 referred to "you feel completely ineffective", while value 6 referred to "you are completely proficient".

In addition, the instrument included questions on the gender of the person completing the questionnaire, age, years of teaching experience, and the ownership of the school in which they worked.

The instrument lacked analyses to confirm exploratory and confirmatory validity, because this was carried out and checked. Exploratory factor analysis (EFA) was used under the maximum likelihood method with varimax rotation. The KMO test (Kaiser-Meyer-Olkin) was 0.934 and Bartlett's test was significant ( $\chi^2 = 4213.824$ ,  $p. < 0.05$ ). The final version explained 84.25 % of the true variance of it. On the other hand, confirmatory factor analysis (CFA) showed that the teachers' data fitted correctly to the theoretical model proposed by Cabero-Almenara et al. (2016). The coefficients were correct and respected the thresholds established by Bentler (1989) and Schumacker & Lomax (2004). This model supported the factor structure formulated in the CFA, consisting of six correlated



latent variables. The structural equation modelling was performed with AMOS V.24 software. In addition, the reliability of the selected items was examined through Cronbach's Alpha ( $\alpha=.939$ ) and McDonald's Omega coefficient ( $\Omega=.925$ ), for each of the scales of the instrument. Both coefficients obtained very satisfactory values.

Values were also obtained for the different dimensions analysed through the instrument, presenting the results of both Cronbach's Alpha and McDonald's Omega remained sufficiently high and significant. All coefficients are shown in table 2.

Table 2. Exploratory and confirmatory factorial results and reliability of the instrument

Model	$\chi^2$	p.	CFI	TLI	IFI	NFI	RMR	RMSEA
Fit	3.012	0.001	0.924	0.936	0.945	0.925	0.048	0.073
Summary								
	Dimensions	Dim. 1	Dim. 2	Dim. 3	Dim. 4	Dim. 5	Dim. 6	
Validity		1						
Analysis	CR	0.918	0.920	0.896	0.969	0.956	0.923	
	AVE	0.786	0.825	0.785	0.889	0.898	0.789	
	MSV	0.569	0.563	0.522	0.589	0.520	0.621	
Fiabilidad del test	$\alpha$	0.918	0.909	0.885	0.965	0.936	0.969	
	$\Omega$	0.919	0.901	0.886	0.923	0.939	0.925	

The data collection instrument can be consulted at [https://docs.google.com/forms/d/e/1FAIpQLSeTBRvQk1fHLLJyJOwPZ4TVsoLoXvH\\_T6UjVa0zjq5hi6FjTw/viewform](https://docs.google.com/forms/d/e/1FAIpQLSeTBRvQk1fHLLJyJOwPZ4TVsoLoXvH_T6UjVa0zjq5hi6FjTw/viewform)

## Results

With regard to the first research objective (O1), the means and standard deviations achieved in each of the different dimensions analysed in the instrument are presented in table 3.

Table 3. Teachers' mean knowledge in each dimension of the instrument, and in the total of the instrument.

	Half	Desv. Desviation
D1. General	4,45	2,25
D2. Visual	3,16	2,21

D3. Auditory	3,50	2,39
D4. Motor	3,40	2,39
D5. Cognitive	3,51	2,41
D6. Accessibility	2,81	2,39
Total	3,47	2,34

Firstly, it should be noted that the overall mean achieved by teachers in the instrument (3.47) denotes an intermediate level of training with respect to the knowledge they possess for incorporating technologies for subjects with some kind of diversity. On the other hand, the high standard deviation score reflects a high dispersion of the answers given by the teaching staff, which suggests that there are a number of teachers who claim to have a low level of training in their use with people with some kind of disability.

With regard to the different dimensions, it should be noted that except for one dimension, the general dimension (4.45), which could be considered moderately acceptable, in the rest of the dimensions included in the instrument, the scores tend to be centred on an intermediate level, moving towards the intermediate value of 3.5. Only one dimension was found to be below the central level of score 3, that of accessibility (2.81). Again, the standard deviation scores for all dimensions were found to be very high, indicating a strong dispersion of the data.

The second research objective (O2), related to identifying variables that significantly explain the level of teachers' digital competence, is then addressed. To this end, prior to carrying out the logistic regression, the assumptions that allow logistic regression to be carried out (verification tests) were checked. The assumption of independence of observations was not significant (sig. = 0.845), so the observations are independent of each other. The Hosmer and Lemeshow test (Monotonicity assumption) correctly fitted the data (sig. = 0.825).

The Omnibus test checked a correct and significant estimation of the proposed model ( $p < 0.05$ ), between the independent variables (gender, age, years of teaching experience and school ownership) and the dependent variable (level of digital competence). The goodness of fit of the model was carried out through the Nagelkerke (0.365) and Cox and Snell (0.269) regression coefficients, inferring that the model explains approximately 29-39% of the total variability. It was also found to be able to predict correctly in 72.7% of the cases, making the model acceptable. Furthermore, the specificity and sensitivity of the model was tested (Table 4), and the percentages were found to be very satisfactory.

Table 4. Multiple linear regression model

Model	Unstandardised coefficients		Standardised coefficients	t	Sig.
	B	Desv. Error	Beta		
(Constant)	3,574	,302		11,82	,000
Gender	,156	,098	,035	1,59	,111
Age	,033	,057	,013	,58	,565
Years of teaching experience	,124	,036	,780	3,49	,000
Title of school	,457	,112	,890	4,07	,000

As can be seen in the table, the model reveals that years of teaching experience as well as tenure at the school are variables able to explain the level of digital competence (Sig.=.000). Together, the results show that the variables gender and age are not relevant for predicting the level of digital competence.

## Discussion

The advent of ICT has brought about new innovative scenarios in all sectors of society, including in the field of education. Thus, to achieve the objective of our review, the research questions posed above will be answered. In response to the first research question (RQ1), in relation to the level of training of university teaching staff regarding their knowledge of how to incorporate technologies to support students with some kind of disability, we can say that teachers in general have a low level of technological training. These results are in line with other studies carried out in the Spanish context at a general level in higher education teaching staff (Ortiz Colón & Colmenero Ruiz, 2019; Sánchez, Duran Encinas, Zuniga Arce & De Casso Verdugo, 2019; Alonso, Plaza & Orfali, 2019). Increased teacher training favours the development of experiences of students with disabilities (Kim, Son & Vance, 2012). These results invite us to reflect on the existence of technological tools that can improve the teaching and learning processes of students (García Valcárcel & Tejedor, 2010). Likewise, in response to the second and third research questions regarding personal variables (RQ2, RQ3), we can mention that the years of teaching experience influence the level of digital competence of university teachers. In this sense, it should be noted that the experience variable appears as a

reflection of the decrease in the level of competence in the study by Garzón et al. (2020), where younger teachers are more interested in competence training, presenting a greater technological mastery (Cabero et al., 2020).

In relation to whether the type of higher education institution determines the level of digital competence of university teachers (RQ3), in our study it is not relevant, despite the fact that in other studies teachers show a more favourable perception of the use of ICT if they have the support of the institution, as occurs in private universities compared to public universities or the type of link with the university (Riascos-Erazo, Ávila-Fajardo & Quintero-Calvache, 2009).

The answer to the question of whether the gender of university teachers has a relevant influence on the level of digital competence (RQ4) is that in our study the results show that the gender variable is not relevant in predicting the level of digital competence. Despite the existence of studies in higher education institutions, from a gender perspective they offer contrary results and show the relevance of gender in the level of digital competence (Marcelo, Yot & Mayor, 2015; Martínez-Cantos & Castaño, 2017; Mercader & Duran-Bellonch, 2021).

Finally, and in response to the question of whether the age of university teachers has a relevant influence on the level of digital competence, we can say that in our study it is not relevant, so its influence is very low. This finding contrasts with others carried out on the level of technological competence at a general level and not considering students with disabilities (Cabero et al., 2020) and that teachers under 40 years of age require less training (Rodríguez Espinosa, Restrepo Betancur & Aranzazu, 2014).

## **Conclusion**

The conclusions of the work carried out are mobilised in different directions, the first of which is that the diagnostic instrument used has presented high reliability values, both in terms of its overall reliability and in terms of the different dimensions that make it up. In any case, future research should review the instrument and try to reduce the number of items, as this could lead to fatigue for the person completing it.

Regarding the objectives set out in the study, both have been achieved, as the information obtained allows us to find out the level of knowledge that university teaching staff have regarding the use of digital resources for people with some type of disability, whether general or specific (visual, hearing, motor, cognitive), and their degree of knowledge regarding how to create accessible materials for these people. Furthermore, having

obtained information from university centres in different communities allows us to have a global vision of the country in relation to the subject studied.

The data point to a low level of knowledge among teaching staff regarding the use of materials for people with disability. This aspect is even more pressing about the subject of accessibility.

It was also found that two dimensions do not have an impact on teachers' knowledge of the use of digital technologies for people with disabilities: gender and age. On the other hand, the dimensions of years of experience and ownership of the centre were found to be significant.

### **Limitations**

Among the limitations of the research, it should be pointed out that we are working with self-perceived instruments and, consequently, information is collected on what teachers believe they know, and that we have not received the same number of responses from the different autonomous communities in Spain.

The first of the limitations leads us to propose the need to carry out research, where the type of instrument collects situations that the teacher must resolve to attend to people with different types of disability, being able to determine, depending on the solution adopted, the degree of knowledge shown by the teacher. About the second, it would be proposed to replicate the research in communities with a lower number of responses, and to check whether the data would continue to be similar to the current study carried out, which would facilitate the generalisation of the results.

### **Implications for practice**

The findings of the study have implications for practice and future research. First, there is a need to train university teaching staff in digital competences. This requires universities to establish specific plans for teacher training and advice on the use of technologies that can help people with disabilities. At the same time, it is necessary for universities to create centres to produce digital technological resources to help these students. Centres that are responsible for subtitling videos, incorporating sign language into videos, producing audio podcasts, etc.

Secondly, the teacher's digital competence can have a positive impact on the teacher's perception of technological resources and their subsequent use in their teaching practice with students with disabilities.

Re-directing the technological training of university teachers can be the driving force for progress towards a more inclusive education. Suggestions for the technological improvement of this group include:

- Digital training should not only focus on the use of technology, but on the ability to impact the learning of students with educational needs.
- During their training, both initial and ongoing, they should be exposed to a wide variety of technological resources and tools that support the learning of people with disabilities.

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