

Teachers' digital competence and inclusive education at school: An analysis of teacher attitudes

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Abstract

Inclusive education and the implementation of Information and Communication Technologies in the 21st century classroom are priority objectives in global agendas. However, few studies focus on and combine the following areas of study: Inclusive education and Digital Competence (IE and DC). This research gathers the opinion of 221 active teachers on these two variables through a sample composed of participants from Spain and 10 Latin American countries. These educational professionals responded to a questionnaire created *ad hoc*, tested by a group of experts, and based on instruments previously validated by the scientific community. There were 30 items scored on a scale of 1-7 for the areas of study. The results indicate that the participating teachers attach high importance to the study variables, although they lack the training and competence necessary for their performance. Furthermore, basic and advanced levels of perception regarding the importance of inclusive education and digital competence are identified, which are similar in the basic levels and increasingly disparate at the advanced levels due to specialization.

Keywords: Compulsory Education; Digital Competences; Inclusive Education; Technology; Teachers.

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1. Introduction

The situation generated because of COVID-19 has shown that for the continuity of the formative learning process, Information and Communication Technologies (ICT) have played a key role, with digital competencies (DC) being a relevant factor for the sustainability of education (Betancourt-Odio et al., 2021). Technology-mediated learning has had an impact and has increased the social divide. Given that this virtual learning mode is here to stay, the focus should be on engagement, efficacy, and empowerment of reflective practice (Cabero & Valencia, 2021). Previous studies show that even teachers with high digital competencies do not effectively employ these skills in their teaching performance, so training models based on collaborative, open, and networked models are proposed (Beneyto-Seoane & Collet-Sabé, 2018). After having provided an emergency response in a remote teaching format, various scenarios and background questions arise, such as those raised by Williamson & Hogan (2020, cited in Castañeda & Williamson, 2021, p. 1): "One immediate tension likely to shape *edtech* use in the immediate post-pandemic context is between tech-utopian enthusiasts that saw the pandemic as a great experiment and an opportunity to accelerate the digital transformation."

In this regard, Castañeda and Williamson (2021) are committed to creating a survival model or kit that responds to the challenges and opportunities that have arisen. However, the debate has a greater depth, and we must reflect on the contemporary vision of Educational Technology (ET) and the need to rethink its conceptualization, moving towards a place that is more independent of markets and opportunism linked to the acquisition of objects (Castañeda et al., 2020). ICT can contribute to the construction of critical and effective models to which Mertala (2021) also refers.

From our point of view, the study by Pittman et al. (2021) makes a significant contribution by highlighting the need to design holistic policies and consistent training plans that seek accessibility and inclusion in education and adds that "This is an excellent time to reflect on how education can address the cultural, economic and social barriers that impact student learning globally for all learners" (Pittman et al., 2021, p. 69).

Given that teacher training is therefore, a key factor, we have found numerous efforts to define the levels of teacher digital competence necessary for the school to offer an effective and quality response to the educational community. The digital competence frameworks of the United Nations Educational, Scientific and Cultural Organization (UNESCO) are notable, as well as the European frameworks DIGCOMP 2.0 (Vuokari et al., 2016), DIGCOMPEdu (Punie et al., 2017), and, as Pedró (2019) points out, these form the basis from which the scientific community and governments of many countries in the world roll out policies and frameworks adjusted to their environments. Furthermore, the inclusive approach of the latest frameworks is worth mentioning since it refers to the need to incorporate strategies that respond to all students. Thus, the 2030 agenda and the approach to fulfilling the Sustainable Development Goals require important actions in Digital Competence in Education (Portillo et al., 2020).

Several empirical studies (Betancourt-Odio et al., 2021 and Gómez et al., 2019) that evaluate teachers' perceptions regarding their digital competencies point out that their level of knowledge is insufficient, generating uncertainty and insecurity. For example, when we refer to integrating ICT with students with disabilities, the level of self-perception of digital competencies is even lower (López & Fernández, 2020). Cabero & Valencia (2021) go further, stressing the need to address digital

competencies training for teachers and students. Chupakhina et al. (2019) point to the opportunities digital environments provide for teacher training on inclusive education. However, once again, the lack of digital competence and awareness of the impact it has on the attention to diversity means that it is still necessary to influence the management and effectiveness in the use of this medium as a source of teacher training.

There is a current of research that has sought to develop ICT-based tools and instruments to provide a more inclusive response at school. In this regard, the development of educational software or early childhood apps shows significant gaps in terms of accessibility (Crescenzi-Lanna et al., 2019; Gogiberidze et al., 2020; Cranmer, 2020). Along the same lines, specific applications for groups with disabilities are not very motivating and can be stigmatizing (Crammer, 2020). This same author indicates that "Subject teachers need guidance to develop further awareness, and skill to develop inclusive digital pedagogy, supported by further research." (Cranmer, 2020, p.2). Another study (O' Sullivan, 2020) that combined ICT models and students with special educational needs (SEN), found that through the adaptation and permeability of technological media, there were improvements to inclusion beyond participation, also affecting the perception that teachers have towards these students. Through innovative projects that allow communication and participation in a diverse way, it was possible to identify abilities that had not been visible until then. Finally, it was also perceived that students with SEN who successfully participate in programs related to technology feel more confident and with greater leadership capacity.

Inclusive education, still sometimes confused in the educational community itself as integration (Reyes-Chavez, 2020), must be understood "as a process of constant reflection and reconstruction, which is, therefore, a complex task" (Gallegos and López, 2017, cited in Reyes-Chávez, 2020, p.5). In this process, the DC must play a crucial role in developing students' welfare, and success understood as participation and academic achievement.

When future teachers are asked about the focus variables of this study (DC and IE), the results point in the same direction. The effectiveness of technology for the design and implementation of inclusive practices is highlighted, and a lack of preparation is felt in both areas of knowledge: inclusive practices, and information and communication technologies in education (Pinto-Llorente et al., 2020). A similar study conducted by Pegalajar (2018) with future teachers has revealed a sense of optimism and opportunity about the involvement of Educational Technology in school, giving more importance to this for students of a Primary Education degree versus those of Early Childhood Education.

There is an important emphasis on re-designing teaching-learning models that opt for the personalization of processes and methodologies (Major et al., 2021; Gogiberidze et al., 2020). These authors maintain that the opportunities provided by these automation-supported models are very attractive because of the immense scalability that could be implied in the levels of learning improvement. However, at present, empirical research results suggest that these personalized programs result in significantly greater learning gains when they have been tailored to the learner (e.g., to their level and pace). This indicates, in our view, a great emerging opportunity that has certainly only just begun. What is clear to Gogiberidze et al. (2020) is that to design more effective personalized learning and time management that provides a more inclusive response to learners, it is necessary to incorporate ICT into the school. Therefore, an innovative and sustainable pedagogical

approach is essential for ICT to be efficient since merely introducing certain technical tools, programs, or applications is not enough (Betancourt-Odio et al., 2021; Castro et al., 2019).

Technological adaptations should focus on accessibility and universal learning design (Goncalvez, 2020; Stenman, 2020). In this regard, the review of the situation of non-attendance to class or remote education carried out by these authors found significant advances in videoconferencing systems and specific adaptations to disabilities to make the participation of students in vulnerable situations more viable. And while there is still much to be done, there are projects and actions that are responding to students who, without these resources, would otherwise be isolated. Reyes-Chavez (2020) also concluded the need to focus on Universal Learning Design as a methodological strategy with infinite opportunities to create inclusive school communities. That teachers can employ technological resources in the school is "a matter of social justice, of a society that cares about welcoming and caring for the most disadvantaged" (Ochoa et al., 2019, p. 18). It is in this connection of variables on DC and IE where the concept of digital citizenship converges, and although it is integrated into most frameworks and models of digital teaching competence (Jiménez, 2021), in practice and the studies analyzed, it does not seem that there is a clear relationship between the two variables. Although the focus of this study is on the perceptions of teachers, we should not forget that digital teaching competence should have an impact on the greater success of all students, so we share the idea of Tissenbaum et al. (2021), who give a voice to students, as the protagonists that they are, in the construction of our digital future.

1.1. Research questions

RQ1: How do compulsory education teachers (K-12) perceive educational inclusion and digital competence in teaching?

RQ2: Do K-12 teachers perceive the relationship between educational inclusion and self-perceived digital competence?

2. Method

2.1. Research Model

The quantitative research method (Ramírez & Callejas, 2020) is based on the collection of numerical information based on a survey designed ad hoc from other specific tools validated by the scientific community. Multivariate data analysis is used. The information input for this study was obtained through the opinion of active education professionals.

2.2. Participants

The sample is composed of compulsory education teachers from the *conectandoescuelas.org* network in Spain, Guatemala, Ecuador, Venezuela, Peru, Argentina, Bolivia, El Salvador, Dominican Republic, Mexico, and Colombia. Participation in the study was voluntary and anonymous, and the means of contact was through the dissemination of the questionnaire through their schools and professional networks. The criterion for participation was to be an active teacher in compulsory primary and secondary education or K-12. From 824 mailings, 250 completed questionnaires were obtained, although 29 were discarded because they were not fully completed. The final sample was composed of 221 responses.

2.3. Data collection

The data collection technique used was a closed online questionnaire that included 30 items rated on a seven-point Likert scale (1= strongly disagree; 7= strongly agree) concerning teachers' perceptions of their attitude towards educational inclusion and digital competence. The items of this questionnaire were selected from other tools validated in other research studies. Specifically, items concerning the perception of educational inclusion were included from the THEMIS tool (Azorin, 2018). The criterion for the inclusion of these items is based on the protagonism and autonomy granted to the respondent since it focuses on the real and personal perception mostly affecting aspects intrinsic to the practices of each teacher; the perception on areas of Information, Communication, and Content Creation from work Digicomp 2.0 by Vuorikari et al. (2019) and DIGCOMPEDU (Punie & Redecker, 2017); items on ethics and thinking related to the Internet by Choi et al., (2018); and, finally, items on a) digital competence for the Teaching-Learning process, b) digital competence for professional development, and c) ownership of materials and open knowledge, obtained from Lázaro and Gisbert (2018).

The establishment of the topic and the objectives of the study, as well as the final items in the questionnaire was carried out in parallel through consultation on two occasions with an advisory team composed of four professionals with links to teacher training and educational innovation. This team is made up of a (1) Head of Studies of the distance education centers of a Spanish Autonomous Community, a (2) Doctor in Educational Technology and current university professor, the (3) Head of Training and Innovation of an International Federation of Schools in Latin America, and (4) university expert responsible for e-learning platforms of a Spanish university.

Other sociodemographic and professional data included in the questionnaire were age, years of teaching experience, gender, the school to which they belonged, and the level/grade they perform their educational work. Finally, we used the online survey support provided by encuestafacil pro version (<http://encuestafacil.com>) for its accessibility, reliability, and interface compared to others.

The statistical treatment of the data was conducted using the IBM SPSS Statistics 26 program.

2.4. Procedure

To address the research questions, we chose to conduct Exploratory Factor Analysis (EFA from now on) whose "primary purpose is to define the underlying structure among the variables in the analysis" (Hair et al., 2009, p. 124) so that the construct validity of the items used can be established.

3. Results

The preliminary EFA analysis resulted in a determinant ($7.5 \cdot 10^{-15}$), KMO test (0.95), Bartlett's test of sphericity ($\chi^2 = 4825.91$, $p < 0.01$), as well as Measures of Sampling Adequacy (MSA) above 0.95 which indicates that the conditions are met to perform the factor analysis.

The number of factors obtained was four, with a total percentage of explained variance of 73.58%. Based on a Varimax rotation, the composition of the factors made it possible to establish the following dimensions:

3.1. Factor 1: Basic Inclusive Education (BIE)

This factor groups the variables identified as the basic perception of the importance of educational inclusion (BEI, Basic Educational Inclusion), including questions about contexts and ways of doing things that favor attention to student diversity, especially through the variables in which the planning of teaching involves considering all students, as well as the interests of the students themselves.

Table 1. Rotated Component Matrix / Factor 1: Basic Inclusive Education (BIE)

Basic Inclusive Education items	Component			
	1	2	3	4
The diversity of the student body is an aspect that enriches the educational process.	0.675	0.23	0.218	0.301
I plan my teaching with the whole student body in mind.	0.806	0.18	0.218	0.199
I incorporate students' interests into the educational process.	0.780	0.38	0.257	0.154
I frequently review my teaching program to update it and adapt it to the group class.	0.755	0.37	0.305	0.215
Design of curricular reinforcement/support activities.	0.713	0.40	0.275	0.270
Design of curricular extension/enrichment activities.	0.621	0.41	0.363	0.260
During the educational process, I use different methodological strategies (e.g., project-based work, working in corners, research contracts, cooperative learning).	0.695	0.36	0.284	0.281
I form heterogeneous workgroups in the classroom.	0.615	0.14	0.008	0.417
I make flexible groupings with students.	0.609	0.21	0.171	0.571

Source: Author's own

3.2. Factor 2: Basic Digital Competence (BDC)

Factor 2 includes basic and instrumental aspects of teaching digital competence, fundamentally the obtaining of digital content and the use of digital environments for interaction, and the design of activities in digital formats applied to the teaching-learning process. This component also includes the variable "I offer additional time to students who do not complete the task in the established time," which can be considered a transversal aspect in the teachers' evaluations since its mean score is the highest (6.28 out of 7) and its variability or standard deviation the lowest of all (SD=1.27).

Table 2. Rotated Component Matrix / Factor 2: Basic Digital Competence (BDC)

Basic Digital competence items	Component			
	1	2	3	4
I offer additional time to students who do not complete the assigned task within the established	0.452	0.538	0.135	0.423

period.

I am able to search and filter information and digital content appropriately.	0.348	0.656	0.205	0.450
I am able to evaluate the information, data, and digital content I encounter.	0.293	0.705	0.273	0.451
I store and retrieve information, data, and digital content.	0.291	0.712	0.295	0.303
I am able to interact using different tools and devices in digital environments.	0.381	0.737	0.342	0.183
I regularly share information and digital content	0.305	0.554	0.500	0.211
I am able to produce guidelines on the responsible, ethical, and safe use of digital technologies.	0.288	0.628	0.408	0.348
I am able to design and propose methodological strategies supported by ICT in the teaching-learning process.	0.366	0.637	0.490	0.061
I rethink my ideas about a topic when I use the Internet.	0.417	0.566	0.445	0.208
I use and encourage the use of open knowledge materials.	0.373	0.544	0.496	0.220

Source: Authors' own

3.3. Factor 3: Advanced Digital Competence (ADC)

Includes a transformative approach based on digital competence, emphasizing collaboration and participation in the community and the opportunities that digital competencies provide for professional development (ADC, Advanced Digital Competence); that is, it is a vision of the empowerment of digital technology, beyond the simple access and use of such technology.

Table 3. Rotated Component Matrix / Factor 3: Advanced Digital Competence (ADC)

Advanced Digital Competence items	Component			
	1	2	3	4
I use networks for professional development to promote their use and raise awareness of their importance to community members.	0.314	0.460	0.687	0.084
I participate in professional and digital networks	0.119	0.263	0.826	0.141
I collaborate with other teachers and education professionals through digital channels.	0.189	0.069	0.837	0.123
I know and apply the principles of netiquette in my digital work.	0.119	0.208	0.738	0.187
I am aware of my digital identity and act in a way that is consistent with it.	0.344	0.363	0.654	0.245
I believe that participation on the Internet promotes engagement in real life.	0.235	0.383	0.569	0.287

Source: Author's own

Factor 4: Advanced Inclusive Education (AIE)

Groups issues that require a greater effort and commitment to enable support and reinforcement for the diversity of the learning pace of all students. It indicates a more advanced or higher perception of the importance of educational inclusion (AEI, Advanced Educational Inclusion). The distinguishing features of these components are identified in the individual teaching capacity and linked to the subjects in the BIE component (e.g., curricular adaptation) to more global aspects of classroom and center dynamics, such as making furniture more flexible, grouping students, making times more flexible, and using the support function in the classroom as a resource that favors educational inclusion.

Table 4. Rotated Component Matrix / Factor 4: Advanced Inclusive Education (AIE)

Advance Inclusive Education items	Component			
	1	2	3	4
I change the organization of the furniture according to the type of activities.	0.445	0.129	0.284	0.676
I have other complimentary activities available for students who finish the assigned task early.	0.381	0.367	0.127	0.573
The support function prevents potential barriers to learning and student participation	0.411	0.288	0.224	0.517
All students who need it have specific support	0.133	0.140	0.437	0.604
Students preferably receive support within the classroom with their reference group.	0.260	0.388	0.120	0.714

Source: Author's own

Based on the grouping of variables according to factors established by the EFA, four synthetic indicators have been established to measure basic and advanced digital competence and the attitude towards the educational inclusion of students. The result of these indicators, following the pattern established by the factors, has corroborated a strong (0.8) and significant linear correlation between the indicator of Basic Inclusive Education (BIE) and Basic Digital Competence (BDC). However, this correlation is lower (0.63) between BEI and Advanced Digital Competence, and even lower between scores on Advanced Educational Inclusion and Advanced Digital Competence (0.61).

In short, it might be concluded, that the attitude shown by teachers regarding inclusive education depends, to a certain extent, on their degree of digital competence. Thus, advanced levels of digital competence imply a weaker attitude towards inclusive education.

To further explain this conclusion, subsequent analyses of variance were conducted to verify the effect of sociodemographic variables such as gender, the center to which they belong, or level of education at which teaching is provided, but no significant differences were found in any of the synthetic indicators constructed.

Table 5. Correlations

		BIE	BDC	ADC	AIE
BIE	Pearson's correlation	1	,802**	,632**	,807**
	Sig. (two-tailed)		0,000	0,000	0,000

	N	188	177	167	181
BDC	Pearson's correlation	,802**	1	,797**	,778**
	Sig. (two-tailed)	0,000		0,000	0,000
	N	177	194	176	185
ADC	Pearson's correlation	,632**	,797**	1	,616**
	Sig. (two-tailed)	0,000	0,000		0,000
	N	167	176	189	175
AIE	Pearson's correlation	,807**	,778**	,616**	1
	Sig. (two-tailed)	0,000	0,000	0,000	
	N	181	185	175	193

** The correlation is significant at 0,01 level (two-tailed)

Source: Authors' own

4. Discussion

The results of our study show that the self-perceived level of digital competence is higher than that reported by other authors in recent studies (Betancourt-Odio *et al.*, 2021; Gómez *et al.*, 2019).

It seems that attitudes towards educational inclusion and digital competence may depend on other determinant variables possibly associated with teacher training and specialization, which are always developed to a greater extent under holistic policies and consistent training plans (Pittman, 2021). The idea of the need for further training is reinforced by the study of Arnaiz *et al* (2019) with which we agree in light of the results obtained. The results of the study show the correlation between the perception of digital competence and inclusive education, which is a lack that can be reduced to the extent that the models of implementation of educational technology progress from the mercantilism linked to the acquisition of objects to which they are subjected (Castañeda *et al.*, 2020).

The gap between inclusive policies and frameworks for teacher performance and the reality of teachers' opinions is evident, both in this study and in previous works.

Although several studies connect inclusive education and teacher digital competence, the approach in many cases is remedial, focusing on the personalization of learning (Major *et al.*, 2021; Gobjiberidze *et al.*, 2020) or the critical use of technology (Mertala, 2021) without centrally focusing on accessibility, participation and academic success for all students. In this regard, our study highlights the need to rethink technological implementation models by incorporating Universal Design for Learning (UDL) as a flexible model of educational inclusion (Reyes-Chavez *et al.*, 2020; Goncalvez, 2020).

5. Conclusions, recommendations and future directions

The results reported here are consistent; allowing us to create factorials indicating that the instrument designed was effectively used. In addition, the content collected is very useful for informing new areas of study.

It appears that the flexibility and permeability of technology are allies for inclusion. Therefore, the Universal Design for Learning (UDL) is a very appropriate model to lay the foundations for solid

Educational Inclusion that will only be possible to the extent that the teaching staff can handle Educational Technology, that is, by ensuring a sufficient level of Digital Teaching Competence.

The relationship between basic inclusive education with the basic digital competence index worked very well; however, the higher the level of specialization, the weaker the indexes, indicating that there is still a dichotomy between the study variables that must be overcome in the coming years.

Recommendations

Digital competencies and inclusive education are areas of great concern for K-12 teachers, so it is necessary to create spaces for training and reflection that allow the design of solid training itineraries based on collaboration and the creation of contrasting networks.

The irruption of technology in society in general and schools in particular has brought about a revolution for which neither individuals nor institutions are prepared. However, we must continue to build a quality school for all without forgetting the principles and values we pursue when we speak of a quality, inclusive, and equitable school.

Accessibility — understood in the broad sense of the word — must underpin any school project, and the creativity and flexibility offered by ICT are immense when the level of Digital Teaching Competence is sufficient to be able to appreciate these advantages and adjust the teaching to the needs of the students and the educational communities in which we work.

Future Directions

One of the main limitations of the study is that we have the opinion or perception of a sample without knowing the particular context in which each teacher works, so it would be convenient to continue the research through other methods, such as the creation of focus groups that can provide more in-depth results.

There is no doubt that the change in the role of teachers continues with the aim of achieving the convergence of knowledge, integrating DC and IE in a global community project. We know that the teacher's attitude plays a key role in both areas and that advanced DC is linked to commitment and participation. Recognizing that inclusive education is a commitment to human rights reinforces the idea of the need to move forward in both areas as a challenge in the educational field.

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