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Digital teaching competence and ICT usability in highly complex educational centres. Practices and opportunities for an inclusive educational transformation.

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Summary

In recent times, Information and Communication Technologies (ICT) have become an indispensable tool in pedagogical processes. Digital resources have become the vertex of the entire educational framework, which has allowed us to glimpse the existence of a digital divide in the various agents of the educational community. The aim of this study was to analyse teachers' perspectives on digital resources and competences in vulnerable educational settings. This research is part of the Incluedux Project funded by the Ministry of Science and Innovation (Spain). The methodology is qualitative based on focus groups. The main results reveal differences in training in the use of ICT, in the collaboration and involvement of students and families in the educational processes, as well as the need to increase the technological means to ensure effective educational continuity. It concludes by underlining the relevance of the acquisition of digital competences to achieve equitable and quality education in order to take advantage of opportunities to build a resilient and inclusive educational transformation.

Key words

Educational technology; digital competences; inclusive education; teacher training.

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Abstract

In recent times, Information and Communication Technologies (ICT) have become an indispensable tool in educational processes. Digital resources have become the vertex of the entire educational framework, which has allowed us to glimpse the existence of a digital divide in the various agents of the educational community. The aim of this study was to analyse the teachers' perspective on digital resources and competences in vulnerable educational scenarios. This research is part of the Incluedux Project funded by the Ministry of Science and Innovation (Spain). The methodology is qualitative based on focus groups. The main results reveal differences in training in the use of ICT, in the collaboration and involvement of students and families in the educational processes, as well as the need to increase the technological means to ensure effective educational continuity. It concludes by underlining the relevance of the acquisition of digital competences to achieve equitable and quality education in order to take advantage of opportunities to build a resilient and inclusive educational transformation.

Key words

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Introduction

Education in vulnerable school settings faces significant challenges where the digital divide and the lack of technological resources can accentuate educational inequalities. The role of teachers and their digital competences becomes crucial to promote educational transformation in terms of inclusion and equity (González-Benito et al., 2022; Iglesias et al., 2023).

Teachers' digital competences refer to the ability to design, apply and optimally integrate Information and Communication Technologies (ICT) effectively in the teaching-learning process. These competences include technical, pedagogical and ethical skills, which enable teachers to take advantage of the opportunities and positive synergies offered by ICT to improve the quality of education (Alieto et al., 2024). In the context of highly vulnerable school scenarios, the development of these competences together with access to technological educational tools is essential to reduce the digital divide and actively promote educational inclusion (Armas-Alba & Alonso-Rodríguez, 2022).

According to Jordá-Fabra et al. (2023) the technological resources available in educational settings at social risk and/or vulnerability can vary significantly depending on a wide range of situations. In some cases, schools may lack basic technological infrastructure, such as internet access, wifi, electronic devices or educational software (Shutaleva et al., 2023). In other cases, resources may be limited, inaccessible or outdated. The lack of appropriate technological devices can clearly hinder the very inclusion of ICT in the learning processes, thus limiting learners' opportunities to acquire and develop digital competences. The problem in these educational contexts is not so much of a material nature, but of a skills gap in terms of training (Ascencio-Gonzáles et al., 2022).

The lack of digital competences in initial and lifelong learning has been a widely debated issue, especially in periods of social and educational emergency (Ibáñez-Cubillas & Gutiérrez-Esteban, 2022). There is a widespread consensus that points to the need to analyse available

resources and ICT training pedagogical strategies in order to optimise them for the benefit of the educational community (Serrano-Fernández et al., 2022).

One of the most relevant keys in terms of teachers' digital resources and competences is the experimental and innovative character that innovative teaching practices using ICT can adopt in a strategic way, which can have important repercussions for the configuration of new learning patterns, initiatives and situations for the emerging construction of an inclusive educational transformation (Azorín-Abellán & Martínez-Montes, 2023; Martínez-Virto & Azcona-Martínez, 2020). These practices include the design of meaningful learning activities that integrate ICT, the creation of digital educational resources that are open, dynamic and adapted to the personal - and socioemotional - needs of students, the active promotion of cooperative learning and teamwork through technological tools (Ramírez-Montoya et al., 2022).

The appropriate integration of ICT in vulnerable school settings is embodied in the following didactic parameters (Bong and Chen, 2024; Quaicoe et al., 2023; Timotheou et al., 2023):

- Personalisation of learning: ICT allows content and activities to be adapted to the pace and style of learning, thus promoting a more personalised education focused on the interests, expectations and needs of the students.
- Accessibility and usability of open educational resources (OER), which offer a wide range of accessible, interconnected and quality teaching materials that can be appropriately adapted and used by teachers to enrich their pedagogical practices.
- Teacher professional development: ICT facilitates access to teacher professional development opportunities for inclusive education such as *online* courses, virtual communities of practice and continuing education resources, enabling teachers to improve their digital and pedagogical competences.
- Collaboration and support networks: Technological tools promote collaboration between teachers, students and families, strengthening and revitalising support networks and contributing to a more inclusive, open, supportive and participatory education.

Teachers who implement innovative practices contribute to the creation of a school culture that values the effective and inclusive use of ICT in education (Christodoulidou & Sidiropoulou, 2024). The education system has learned very relevant lessons during the stages marked by the social and health crisis, both during the period of confinement and in subsequent academic years, which generated behavioural and didactic planning changes (Huerta-Soto et al., 2022; López-Martín, 2020; Moura-Vieira et al., 2021). However, the increased usability and transferability of ICT has had and continues to have different modulations and differences in current pedagogical debates (Hernaiz-Agreda et al., 2024).

The development of teachers' digital competences and the optimisation of technological resources in schools at risk of vulnerability are fundamental to activate eminently participative and interactive pedagogical actions and initiatives that promote quality education (Carrillo-López & Hernández-Gutiérrez, 2022). ICT offer opportunities for the effective development of innovative teaching practices, helping to reduce the digital divide in order to personalise learning, increase motivation and promote mutual support in schools (Cabellos et al., 2024). The idea of continuing to build inclusive education for all learners and their families, especially in socio-economically challenging contexts, remains a major

challenge beyond restrictive debates about ICT and its impact on students' socialisation and learning processes (Motos & Sarró, 2023).

With all this in mind, this study poses a question: what are the processes of accessibility and didactic usefulness of technological resources by teachers in vulnerable and complex educational contexts in two autonomous communities (Andalusia and Catalonia)? This question is answered with two specific research objectives: (1) to identify the ICT resources used in the teaching-learning processes in vulnerable school contexts, and (2) to analyse teacher training in digital competences in teaching practice during a situation of social alert.

Methodology

The methodology of this research was qualitative in nature and the focus group was used as a technique for collecting information. Primary and Secondary Education teachers from 8 highly complex educational centres belonging to the Autonomous Community of Andalusia and the Region of Catalonia (Spain) participated in the study.

These educational centres are characterised by attending students in vulnerable situations, who present a series of casuistry marked by high rates of school absenteeism, Specific Educational Support Needs (SEN) and come from itinerant families or are at risk of social exclusion. This study was carried out within the framework of an R+D+I project (Incluedux. Resilience strategies for the inclusion of vulnerable students in situations of social emergency. Practices and opportunities for educational transformation (PID2020-118198RB-I00) funded by the State Research Agency, Ministry of Science and Innovation).

Four focus groups were held in each territory, lasting approximately one hour and comprising 32 women and 9 men (Table 1). In order to gain access to the participants, the management team of each educational centre was contacted, and the objective of the research was explained to them and they were given informed consent so that they could declare their voluntary participation in this study. The ethical principles of confidentiality were taken into account at all times in the recording of the different sessions. This study was carried out during the third term of the 2022-2023 academic year.

Table 1.

Distribution of teachers participating in the focus groups.

Focus groups Catalonia	**Focus groups Andalusia**
Focus group CEIP teachers. 6 women	Focus group CEIP teachers. 1 woman and 3 men.
Focus group of primary school teachers. 7 women and 2 men.	Focus group CEIP teachers. 6 women
Focus group of primary school teachers. 4 women and 1 man.	Focus group of IES teachers. 3 men and 2 women
Focus group of IES teachers. 4 women and 1 man	Focus group teachers IES (Seville) 2 women and 2 men

To analyse the documentary content of the transcripts, the qualitative data analysis software ATLAS.ti was used. Different groups, subgroups, categories (*Accessibility and ICT Use* and *ICT Training)* and subcategories were established inductively (Table 2) to enable the analysis of the information and the organisation of the discourses provided by the participating teachers.

Table 2.

Categories and subcategories of the focus group analysis

Accessibility and ICT Use (AIU)	**ICT Training (IT)**
Technical Support Administration (TSA)	Training Technologies (TT)
ICT Resources (IR)	ICT Projects (IP)
Use of Technology (UT)	Expectation Digital Competence (EDC)
Positioning Technologies (PT)	Digital Divide (DD)

The co-occurrence index between the two categories (Figure 1) gave the result of C=0.65 (close to 1), with the rootedness of AIU being 131 and the rootedness of IT 97. This indicates that both AIU and IT categories are closely related with a co-occurrence equal to 90 according to ATLAS.ti. All of the above made it possible to analyse the processes of accessibility and didactic usefulness of technological tools by teachers in the aforementioned educational contexts.

Figure 1.

Co-occurrence index

	Accessibility and ICT Use (AIU) "131
ICT Training (IT) " 97	90 (0,65)

In the *Accessibility and ICT Use (AIU)* category, *four subcategories were included relating to: Technical Support Administration (TSA), which is defined as the technical support provided to educational centre professionals by the local, regional or state administration; ICT Resources (IR), understood as the set of digital tools, methods and platforms used by teachers in their teaching activities; Use of Technology (UT), referring to the use of technological resources according to the activities and educational level;* Positioning Technologies (PT), *which is related to the acceptance, rejection or indifference towards digital tools on the part of the teaching staff.*

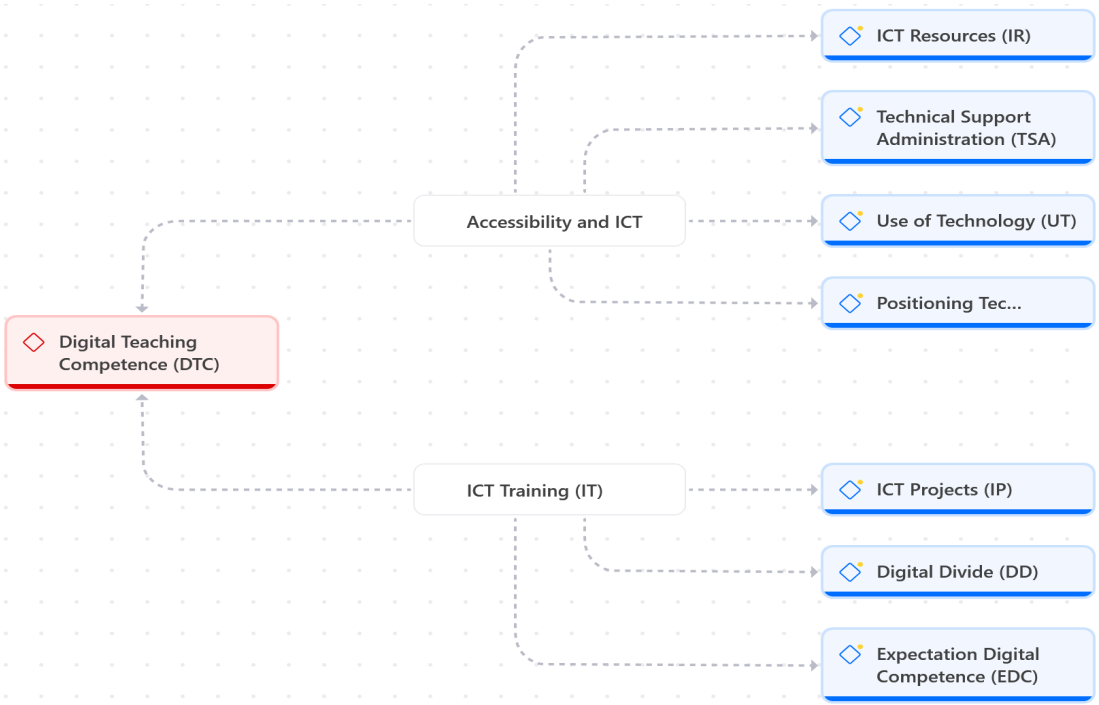
The *ICT Training (IT)* category is made up of the following subcategories: *Training Technologies (TT), which* refers to the specific training in technologies that teachers have received according to age, specialisation, responsibility and gender; *ICT Projects (IP)*, refers

to specific educational projects linked to the pedagogical use of ICT; *Expectation Digital Competence (EDC)*, relating to teachers' expectations in relation to ICT in training processes and the *Digital Divide (DD)* defined as the absence of digital competences for the efficient use of ICT in educational processes.

Based on the analysis carried out with the ATLAS.ti application, a semantic network was formed for the category *"Digital Teaching Competence (DTC)"*, which is directly related to the different emerging inductive subcategories (Figure 2).

Figure 2.

Semantic network of the category and subcategories of "Digital Teaching Competence (DTC)".



The supra-category *Digital Teaching Competence (DTC)* correlates with the categories *ICT Training (IT)* and *Accessibility and ICT Use (AIU) taking* into account that *Training Technologies (TT)* enables the acquisition of digital competences in teaching. Likewise, the subcategory *Digital Divide (DD)* is conditioned by *ICT Training (IT)*, *Accessibility and ICT Use (AIU) and the* availability of *ICT Resources (IR)* in the educational institutions together with the technical support provided by the educational administrations.

Results

The results of this study are presented below, in which the most significant contributions of the participating teachers have been considered together with the categorisation process and the objectives formulated

With regard to the category *Accessibility and ICT Use (AIU)* and specifically to the subcategory *Technical Support Administration (TSA*), the teachers in Andalusia mentioned that the continuity of academic training initially depended on the resources available to the teachers themselves, given that the educational administration was not able, at the beginning of the health emergency, to provide the necessary digital resources with which to teach in virtual learning spaces. Furthermore, during the confinement there was a significant shortage of these resources, given that there were families who did not have any computers or tablets to guarantee continuity of education, although, over time, a surplus of electronic devices was detected in the educational centres.

ProfM2: Delegation, it didn't provide us with anything. You had your computer, you had your webcam and you had your printer, or you were practically sold out. So, well, I have seen colleagues who were answering the phone because they didn't have the possibility of having computer support (Andalusia).

ProfH2: The ones we have lent this year are laptops from the administration. I don't know if it was the year of the health alert situation or the year after. In principle, they were for teachers and for the cycles, and well, we have a few of them stored there and we give them out, in that way (Andalusia).

In the region of Catalonia, teachers referred to the lack of time to implement strategic plans, action protocols and bureaucratic procedures in the face of the social emergency on the part of the competent administrations. They also verbalised the lack of support to be able to respond to the emotional and academic needs of the students generated during the confinement. All of this resulted in greater complexity in vulnerable educational contexts.

ProfM3: We had very little time to implement strategic plans, it was very stressful. I think this year is a bit more relaxed, I think, but it was two years with a lot of changes. From the administration, we detected too many demands. People were very tense (Catalonia).

ProfM4: And I would add that after all the difficulty of finding out about new measures on TV, instead of being told about them, it was a feeling that the administration didn't take us (Catalonia) into account.

With regard to the subcategory *ICT Resources (IR)* and *Use of Technology (UT)*, the participants from both Catalonia and Andalusia expressed that technological resources in vulnerable educational scenarios played a greater role both at times of confinement and afterwards, becoming essential elements in the teaching processes. They also commented on the use they made of these tools in communicating with families, monitoring pupils, sending curricular material and holding meetings with the rest of the members of the teaching team. The use of these resources was aimed at informing families about the personal and academic situation of their children, as well as to report any incidents. The most widely used tools in Catalonia were the *Dinantia* application and in Andalusia, *Meet* and *Classroom.* However, in both territories, the *WhatsApp* instant messaging application was more relevant in the communication processes with pupils and families. In the specific case of Andalusia, teachers expressed the need to homogenise *Moodle-type* platforms in order to simplify the task of both students and teachers in terms of access to and knowledge of information in order to extract the maximum benefits from them.

ProfM1: The Dinantia application was the closest thing to talking on the phone, it saved our , because in the end everything via email, the families didn't have the resources or the necessary knowledge. Before the health crisis, Dinantia was only used by the teacher to send information in a unidirectional way, but after the crisis, everything changed and communication became bidirectional (Catalonia).

ProfM5: We now have more meetings in a virtual format, except for the occasional cloister, which we hold in person. This is a legacy left to us after the social emergency situation (Andalusia).

In relation to the subcategory *Positioning Technologies (PT)*, the participants from Andalusia and Catalonia stated that the use of ICT contributes to improving educational relations with both pupils and families and constitutes a support for dealing with any language barriers they may present. The teachers from Catalonia also expressed their concern about the high number of hours that Secondary Education students spend on social networks or downloading content from the Internet on mobile devices, with the resulting repercussions on attention, concentration and reading comprehension.

ProfH1: And I think this affects not only reading comprehension, which is already very serious, but it also affects how they are as people, that they have no patience, that they are constantly distracted, that they are incapable of being attentive. Even if you propose something super motivating, super didactic, super functional, they are incapable of doing anything for more than five minutes without getting bored (Catalonia).

ProfH2: We relate more and more with students thanks to ICT and we use it more with them, because they see it as more attractive than a book... it is an incentive for the educational relationship... (Andalusia).

In the *ICT Training (IT)* category, specifically in the subcategory *Training Technologies (TT)* and *Digital Divide (DD)*, teachers in both territories stated that before the health emergency they had no specific training in the pedagogical use of ICT, which made it necessary to develop self-taught behaviour. This led to a series of difficulties related to the impossibility of extracting the maximum benefits from digital resources applied to teaching. In the same vein, they alluded to the fact that schools were responsible for providing workshops on the responsible use of social networks for all members of the educational community. Following the social alert situation, they recognised the importance of acquiring digital skills, especially in the face of unforeseen situations and the demands of today's society. This led teachers to request, to a greater extent, the development of training courses for the optimal use of ICT in educational environments.

ProfM3: I don't have specific training in the use of ICT. Each one of us has our own resources and way of teaching and we discuss among ourselves the tools we know, the ones we are discovering, their potential, but don't think there is much time for that (Andalusia).

ProfM1: We don't receive any training, nor do they try to train us, for example, in the digital field. And of course, each person has found their own ICT resource and manages it as best they can (Catalonia).

With regard to the *ICT Projects (IP)* category, teachers in both Andalusia and Catalonia stated that digital tools were an essential resource for designing educational projects and facilitating their transfer, especially to families, as they are able to find out what their children are doing at school and even get actively involved.

ProfM1: We went from an analogue to a digital school and we hadn't started to use the Classroom with the older pupils. We used ICT to look for information, to plan projects, at most to watch videos, to summarise what we had read (Catalonia).

ProfM5: This is one of the issues that we have improved a lot, because we do projects and now we have the facility to send the project back home (Andalusia).

In relation to the subcategory Expectation Digital Competence (EDC), the Andalusian participants stated that the use of ICT in teaching processes favours student motivation, increases their active participation, cooperative learning and academic performance. They also highlighted the fact that they offer pupils the possibility of knowing at all times what they are working on in the subjects in those cases in which they have to be absent due to personal circumstances. On the other hand, teachers in Catalonia emphasised that technological advances are key in today's education and that families should be made aware of the responsible use of technology. In family education, attention should be paid to the minimum age at which children should be exposed to mobile screens.

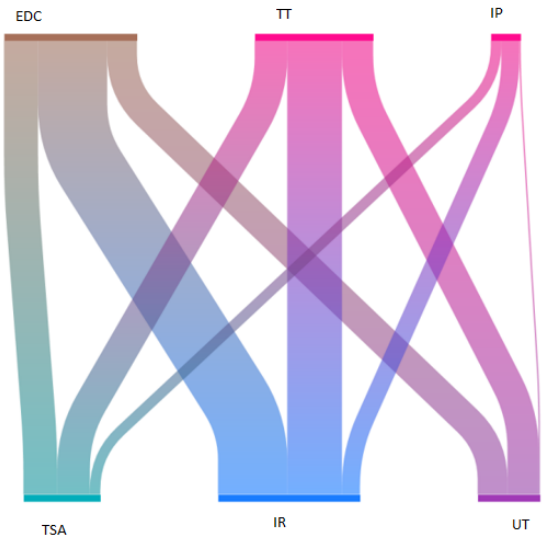
ProfM1: I think technological advances are all very well, I really agree with them, but either we get our act together as a society in relation to the world of children or it gets completely out of control. No, there shouldn't even be a screen in their room, until the first year of ESO (Catalonia).

ProfM2: I still use Classroom, and it helps me to set homework, to know where we are going... if there is a child who can't come to class, then with this platform he or she has the possibility of knowing where we are working (Andalusia).

Figure 3 visualises the various connections of the participants' responses with regard to the subcategories presented.

The *Expectation Digital Competence (EDC)* co-occurs with the subcategories *ICT Resources (IR)* and *Training Technologies (TT)*, which implies that with a greater number of digital tools and ICT training, teachers will have a more favourable attitude towards the acquisition of digital competences.

Figure 3.
Sankey diagram of EDC, TT, PT, TSA, IR and UT codes.



Discussion and conclusions

During the early days of the social and health crisis, the education administration was unable to provide immediate support to schools due to the emergency itself and/or lack of knowledge of how to proceed, which intensified the self-training of teachers. Many teachers had to be trained overnight in digital tools for training processes that adopted a virtual format. They spent extra time, even outside their working day, learning how to use different videoconferencing platforms, manage virtual classrooms or create multimedia content. Interaction with students and families was extremely complex due to social and health events. This study is in line with other research that emphasises the importance of self-taught teacher training, which was key to adapting methodologies and providing an optimal response to the new school reality (Martínez-España et al., 2024; Simón et al., 2023).

Another important aspect was the strengthening of collaboration and mutual support among teachers in these schools. Different teachers shared their knowledge and experience in digital competences and resources, providing informal training and technological advice, while enriching the inclusive pedagogical commitment and identity of the teaching profession. The creation of support networks among teachers to exchange resources, strategies and solve problems in digital didactic development jointly has been an element widely discussed and converging with other studies similar to the one presented here (Paños-Castro et al., 2022; Torrado, 2021).

In practical terms, and even with the scarce ICT resources that existed in many centres in complex situations, teachers had to adapt their methodologies and teaching materials to a virtual environment, as well as manage planning and educational development times. This result is in line with the findings of Shutaleva et al. (2023) who recognised the effectiveness of teachers' use of digital tools during confinement to favour the acquisition of learning along with students' socialisation processes. Rethinking their didactic strategies to maintain the interaction and active learning of students in vulnerable situations was a dialogical pedagogical exercise, with multiple challenges in terms of creation and/or selection of accessible and inclusive digital resources, such as videos, presentations, infographics, etc.

Teachers experienced little institutional support during the health emergency period along with the emergence of new challenges, such as educational continuity in virtual learning environments, the improvement and updating of competency and/or curricular levels, difficulties in addressing diversity and the personalisation of learning in the case of the most vulnerable students (Quaicoe et al., 2023; Timotheou et al., 2023). Despite the difficulties, teachers tried to maintain a close and empathetic accompaniment with students and families on personal dimensions beyond the academic and management aspects of school communication. The establishment of constant communication channels via email or instant messaging was an element of *emotional attunement* with families that had a great impact on the humanisation of relationships (Alieto et al., 2024). Notwithstanding the elements of academic performance, teachers showed sensitivity and empathy for the situation of many families who were experiencing pain and/or suffering in different spheres of life (economic, family, social isolation, mental health, etc.). Teachers expanded their roles by having to provide personalised feedback, not only on student activities and assessments, but also on the unique circumstances of individual students and families.

Isolation and various problems were not directly linked to the school scenario, but had a personal, social and community projection of the first order. Thus, and taking a constructive view of ICT, it cannot be denied that all these changes have led to greater exposure to technologies, an increase in the need for virtual socialisation or access to information that is

more focused on the consumption of applications and/or entertainment channels. In our study, we have been able to identify a significant concern among teachers about the possible addiction of pupils to screens due to excessive time spent in front of digital devices. This converges with those studies that have highlighted the difficulties in maintaining students' attention as a consequence of an intensely digitalised socialisation in almost all facets and areas of daily life (Bautista, 2024; Tardivo & Cano, 2023; Yana-Salluca et al., 2022; Vidal, 2021).

Digital resources and teachers' ICT skills applied to a more dynamic and motivating education pose a highly complex challenge for schools that must be addressed appropriately. It is essential to guide children and adolescents in the responsible and fruitful use of technologies, avoiding dogmatism or restrictive pedagogical positions that do not take into account the reality of the unstoppable social, cultural, digital and educational changes. Thus, the use of ICT without a critical and reflective perspective hinders the development of optimal digital competences of a more comprehensive nature, missing out on pedagogical opportunities that could be beneficial.

It is becoming increasingly necessary for teaching teams to be aware of the importance of leaving the comfort zone, of merely traditional teaching and incorporating ICT in education in a more systematic and regular way. This requires a methodological change in the way students learn and teachers teach, preferably in these vulnerable contexts where gamification and motivational teaching strategies through the active use of digital resources are very positive. However, excessive use of technology can lead to teacher saturation. We are referring to institutional and/or administrative applications that are becoming increasingly numerous and compulsory, consuming more time and teaching energy, both individually and collectively.

In short, we are facing a new, more inclusive and open education that is committed to the development of digital competences and is based on Universal Design for Learning, with the aim of meeting the learning needs of all students in any classroom and school space, but especially in highly complex scenarios. Deconstructing labels is necessary to drive inclusive educational transformation and ensure that the intercultural and inclusive responsiveness of the school curriculum supports the holistic growth and success of all learners without exception.

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Ethical declaration

The study was conducted in accordance with the Declaration of Helsinki, and was approved by the Ethical Committee on Animal and Human Experimentation (CEEAH) of the Autonomous University of Barcelona (reference number CEEAH6272, date of approval 2/12/2022).

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