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## Hybrid education in Catalan secondary schools: digital competence as a key factor

La educación híbrida en centros de secundaria catalanes: la competencia digital como variable clave

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### Abstract

*The COVID-19 pandemic had an impact on compulsory formal education and various responses were given to the lack of face-to-face attendance: from the most improvised (emergency remote teaching model) to more informed practices of digital education, such as the hybrid educational model. This non-experimental, descriptive-inferential study aims to investigate whether the self-perceived digital teaching skills (SDTS) by teachers (n=346) and the self-perceived digital skills (SDS) by students (n=1322) and families (n=531) from 15 secondary education schools in Catalonia are related to variables of virtual/online education in the model of hybrid education: teaching and learning activities; assessment proposals; aid provided and received to promote learning. A specific online questionnaire was prepared for each group of participants. The results indicate that a high level of SDTC by teachers is related to more innovative methodological and assessment proposals, and, in the case of students, their SDS are related with a better predisposition to learn online, while in families we found no relationship*

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*between the SDS and the help received and provided to their children. The conclusions point to the need to promote a higher level of digital teaching skills in teachers to guarantee more suitable hybrid education practices and to foster digital competences in students.*

*Keywords:* blended learning; educational innovation; instruction; assessment; digital competences.

## Resumen

*La pandemia de COVID-19 impactó en la educación formal obligatoria y se dieron diversas respuestas a la privación de presencialidad, desde improvisadas (modelo de enseñanza remota de emergencia) hasta prácticas más informadas de educación digital, como el modelo de educación híbrida. Este estudio no experimental, descriptivo-inferencial pretende indagar si la Competencia Digital Docente Autopercebida (CDDA) del profesorado (n=346) y la Competencia Digital Autopercebida (CDA) del alumnado (n=1322) y de las familias (n=531) de 15 centros de educación secundaria de Cataluña está relacionada con aspectos relevantes de la educación online en el modelo de educación híbrida: actividades de enseñanza y aprendizaje; propuestas de evaluación, y ayudas al aprendizaje. Se elaboró un cuestionario online para cada colectivo. Los resultados indican que una alta CDDA está relacionada con propuestas metodológicas y evaluativas innovadoras y, en el caso del alumnado, su CDA se relaciona con una mejor predisposición a aprender online, mientras que no encontramos relación entre la CDA de las familias y las ayudas recibidas y proporcionadas a sus hijos e hijas. Las conclusiones señalan la necesidad de fomentar la competencia digital entre el profesorado para contribuir a la propuesta de prácticas educativas híbridas más adecuadas que, a su vez, fomenten las competencias digitales del alumnado.*

*Palabras clave:* enseñanza a distancia, innovación pedagógica, práctica pedagógica, evaluación, competencias digitales.

## Introduction and objectives

The health emergency caused by COVID-19 led to the closure of schools during the period of mandatory confinement, where emergency remote teaching (ERT) was used. The aim was to maintain teaching and learning processes by providing temporary access to teaching materials. Once controlled face-to-face delivery was initiated, what has been referred to interchangeably as "hybrid education (HE)" or "hybrid learning" and "blended learning" was used, combining face-to-face delivery with varying degrees of virtual delivery using digital technologies (Hodges et al., 2020; Hrastinski, 2019). Usually part of the class is in the classroom while the other part participates remotely and online (Raes et al., 2020). In HD, virtuality can take place both inside and outside the educational institution (e.g. in a different classroom, at home, in municipal facilities) (Prats and Sintés, 2021), although it must be ensured that all participants can interact in the course of the sessions. For Arias et al. (2020), HD consists of taking advantage of the positive aspects of face-to-face and virtual teaching, using didactic and technological tools that encourage the learning process. Thus, HD would favour the use of active methodologies, such as

collaborative learning, projects or gamification (Arias et al., 2020). Although it is considered a model that contributes to improving student learning in the university context (Raes et al., 2020), we wonder to what extent its deployment is related to the self-perceived digital competence (SDC) of secondary education teachers and students, given that studies conducted during the pandemic (under the ERT methodology) highlighted shortcomings in digital competence (DC) on the part of both groups (Tarabini and Jacovkis, 2020). This is one of the gaps that Fernández-Enguita (2020) identifies as fundamental in educational situations, together with the access gap (to electronic devices and/or Internet connection), and the usage gap (time of use and its quality), because despite having devices at home, these are shared among family members. For this reason, it seems appropriate to also ask about families, since their role in HE becomes key from the moment in which they assume part of the teaching and learning process.

Digital technology is an integral part of our lives, both for teachers and for students and their families (Garzón-Artacho et al., 2021). Thus, different competence frameworks have been emerging, such as DigCompEdu in its version 2.0 (Punie and Redecker, 2017), which inspired the digital competence framework for teachers (CDD) of the National Institute of Educational Technology and Teacher Training of Spain (INTEF, 2022), and of the government of Catalonia (Generalitat de Catalunya, 2018), where the present study is framed.

They define DL as a set of skills required when using digital technologies and media (Ferrari, 2012). The CDD, on the other hand, aims at the deep understanding and development of digital skills, capabilities and attitudes for professional development in teaching (Esteve et al., 2018). It also integrates the transfer of these skills to learners (DL), and the positive impact they have on the teaching-learning process (Colás-Bravo et al., 2019). It is about understanding the CDD as a capacity that goes beyond transmitting technical knowledge, but also encompasses pedagogical knowledge that pursues the digital *Bildung* (training) of students (Krumsvik et al., 2016).

The assessment of self-perceived digital competence through questionnaires suggests that the level of CDD is linked to contextual factors such as digital infrastructure and access to technology, but above all to personal variables such as, for example, the number of digital tools used for teaching and learning (Lucas et al., 2021) or the frequency of educational activities using digital technologies and a positive attitude towards them (Paz-Saavedra et al., 2022). As for the variables gender and age, they do not seem to have a significant influence on the level of CDDA (Pozo et al., 2021; Usart-Rodríguez et al., 2021). Similarly, levels of confidence in technology use are related to higher levels of CDDA (Paz-Saavedra et al., 2022; Portillo et al., 2020; Tondeur et al., 2018), although several studies have highlighted that a high level of perceived CDD is not sufficient. According to TALIS 2018, 39% of EU teachers felt they had good or very good levels of digital skills, but during the pandemic, more than 88% reflected the need for increased digital training (Asenjo and Asenjo, 2021; MEFP, 2019).

Pozo et al. (2021) note that, during the pandemic, primary and secondary school teachers carried out significantly more reproductive and verbal activities than constructive and procedural ones, and cooperative activities occurred less frequently. However, Hortigüela-Alcalá et al. (2020) indicate that teachers who used a competency-based teaching model felt more skilled in the digital teaching mode than those who based

their teaching on the reproduction of content. The use of digital technology, and therefore a higher degree of CDD, is related to a higher frequency of constructive activities, which are more complex and potentially promote more meaningful learning than reproductive ones. Within this framework, it seems relevant to delve deeper into the relationships between the CDD and the type of teaching and learning and assessment proposals that teachers propose to their students.

As for students, according to Colás-Bravo et al. (2017), they have a high level of CDA in terms of instrumental skills in handling digital tools. However, this CDA is lower in more complex tasks such as those related to the evaluation of information. Despite its importance, the level of students' DC has not improved because, in general, the levels of DC have not been accompanied by changes in teaching methodologies that promote students' DC (Valverde-Crespo et al., 2020).

On the other hand, family-teacher coordination has been a transcendental element in the achievement of educational objectives. Families have had to assume a large part of the responsibility for their children's education.

According to Seabra et al. (2021), families experienced digital education as something new and their level of CDA correlated with how complex they considered the transition to RTE to have been. Families with higher levels of CDA perceived a significant increase in workload because they had to help their children more. It seems relevant, therefore, to ask whether families perceived that they were helped by the schools and to what extent they helped their children in the virtual teaching of the HD model.

Thus, the purpose of this study was to analyse the response of the participating schools in relation to the virtuality elements of the EH process, from the three perspectives: teachers, students and families, in order to respond to some of the challenges posed by Colás-Bravo (2021):

1. To identify the level of self-perceived teaching digital competence (SDC) and self-perceived digital competence (SPC) of students and families, as well as the assessment that teachers, according to their level of SDC, make of their students' DC and of the impact of the implementation of HD on their learning.
2. To establish to what extent the CDDA is related to the use of active methodologies and diversified assessment proposals, and to describe the students' perception of the activities and assessment proposals put forward by the teaching teams.
3. To find out how the three participating groups perceive the support provided and received during the HD process, and whether there are differences according to the level of CDA of each of the groups.

## **Method**

This research has a non-experimental, descriptive-inferential and cross-sectional design which, through the quantitative treatment of the data obtained by means of questionnaires addressed to the three participating groups, aims to investigate the relationship between CDA and the implementation of HD.

## Population and Sample

The participants were from 15 schools in Catalonia. Sampling was done by convenience (Cohen et al., 2007), as the schools were part of the Catalan Digital Education Plan 2020-23, promoted by the Catalan Ministry of Education. The schools agreed to participate voluntarily in the research, distributing the questionnaires and collecting the pupils' permissions. Table 1 shows the characteristics of the three samples.

Table 1.

*Sample characteristics.*

Teachers (n=346)												
Centre complexity (%)			Gender (%)			Teaching experience in years (%)				Level (%)		
High	Media	Baja	M.	F.	Other	Less than 5	Between 6- 10	More than 11	More than 20	ESO	Baccalaureate and CCFF	
40	20	40	37.3	61.6	1.2	26.3	13.6	32.4	27.7	53	40	

Students (n=1322)						
Gender (%)			Level (%)			
M.	F.	Other	ESO	CCFF	Bach	
47.1	47.9	5	62	23	15	

Families (n=531)								
Gender (%)			Structure (%)			Level of education (%)		
M.	F.	Other	Monkey	Bi	Other	Univ.	ESO/FP	
26.7	73.8	1.1	17.5	76.6	5.8	52.6	29.4	

## Instruments

To achieve the objectives, three online questionnaires were developed, one for each group (Buxarrais et al., 2023).

The first version was drafted by the authors and subsequently reviewed by 16 researchers from the Faculties of Psychology and Education who were part of the team, and who assessed the fit of the items to the research objectives, their degree of relevance and the clarity of the wording, offering, when they considered it necessary, alternative proposals for wording. A pilot test was also carried out with teachers from three schools, and with secondary school students and their families to adjust the language. All suggestions were incorporated into the final version of the questionnaires, which were entered into the Qualtrics Operating System<sup>XM</sup> (see Table 2).

Table 2.

*Dimensions, scales and questions of the three HD questionnaires considered in the study.*

Scales and questions questionnaires			
Dimensions	Teachers	Students	Families
Sociodemographic	Gender, teaching experience, university degree, type of school.	Gender, level of education.	Gender, structure, level of education.
Assessment of DC and the impact of hybridisation on students (Carretero et al., 2018; Punie and Redecker, 2017).	CDDA level: novice-explorer; integrator-expert; leader-pioneer  Rating of the CD and impact of HD on the students: 5 items* ( $\alpha = .82$ )	CDA level: beginner; intermediate; advanced-specialised  Perception of feeling competent when learning virtually: 12 items* ( $\alpha = .91$ )	CDA level: beginner; intermediate; advanced-specialised
Methodologies or strategies for teaching-learning and assessment (Arias et al., 2020; Prats et al., 2020).	Question on e-learning methodology with 12 answer options (enquiry; projects -ABP-, flipped classroom; recording of sessions; gamification; learning portfolio; textbook; lecture class; collaborative/cooperative work; personalisation of learning; use of sequential and self-corrective activities; dossiers) dichotomous (yes/no).  Methodological approach: 5 items* ( $\alpha = .71$ )  Question on the type of virtual assessment with 7 response options (initial or diagnostic; formative; summative; self-assessment; self-corrective assessment; peer co-assessment; heteroassessment) dichotomous (yes/no).	Activities that teachers offer them online: 14 items* ( $\alpha = .90$ )  Proposals by which teachers evaluate them online: 7 items* ( $\alpha = .78$ )	

Perception of aid received/ provided in the HD model	Primary role as a teacher in the HD model: 1 item*.  Perception that families have played an active role: 2 items*.	Perception of having received online help from teachers: 6 items* ( $\alpha = .76$ )  Perception of having had favourable conditions at home for learning: 6 items* ( $\alpha = .74$ )	Perception that teachers have helped them during HD: 6 items* ( $\alpha = .91$ )  Perception of having helped their children during HD: 7 items* ( $\alpha = .90$ )
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Note: \* Items on a 10-point Likert scale: 1 "strongly disagree" to 10 "strongly agree"; or 1 "never" to 10 "always".

As can be seen, the reliability of the scales ranges between .71 and .91 and is therefore considered acceptable.

The question about CDA was adapted for each group of participants. Teachers were asked "what digital competence they thought they had", families were asked "what their digital competence would be", and pupils were asked "what their ability with digital technologies would be". They were offered three response options, of which only one could be chosen. For teachers, following Punie and Redecker (2017): Novel-explorer (I have had little contact with tools and need guidance to integrate them into my teaching practice); Integrator-expert (I experiment with digital technologies in my teaching, including creatively and critically, with the aim of improving these practices); Leader-pioneer (I have a wide repertoire of practices with digital technologies, continually reviewing them critically and inspiring other teaching colleagues in their use). While, for families and students, the proposal of Carretero et al. (2018) was followed: Initial (I remember how to perform simple tasks autonomously. Sometimes, I ask for help to do some action); Intermediate (I understand how to perform specific and new tasks; I develop them on my own, according to my needs); Advanced-specialised (I use technology to perform different tasks and solve problems. I support others and use technology creatively).

### Data collection and analysis procedure

Once permission was obtained from the education administration, the final version of the questionnaires was sent to schools telematically at the beginning of March 2021, and two reminders were made, closing the collection in mid-April 2021. Management teams were asked to forward the questionnaires to teachers, students and families. At the beginning of each questionnaire, the objectives of the research, the confidential treatment of the data and consent was requested.

Using IBM SPSS Statistics 25, descriptive statistics were calculated for each of the questions, assessing the normality of the data, as well as percentages for those questions

that included different response options. To identify possible relationships between the CDDA and CDA and the dimensions studied, chi-square tests, univariate ANOVAs and Tukey's HSD contrast tests were performed (when the condition of homogeneity of variances was not met, the Brown-Forsythe statistic and the Games-Howell contrast test - Field, 2016- were used). The effect size was also calculated in the ANOVAs ( $\eta^2$  and  $V$  in the chi-square (Cramer's  $V$ )).

## Results

The results are presented according to the three research objectives. The first was to identify the level of digital competence perceived by each group and whether the CDDA had an impact on how pupils' CD is perceived.

We recall that the response options to the question on CDDA and CDA were, for teachers (CDDA): novice-explorer (NE), integrator-expert (IE) and leader-pioneer (LP), and for families and students (CDA): initial, intermediate and advanced-specialised.

While 67.5% of teachers are in the IE category, and 11.9% in the LP category, 20.5% consider themselves to have a CDDA at NE level. Families are mostly grouped in the category of intermediate (61.8%) and advanced-specialised (27.8%). On the other hand, students are more confident about their GDA than families, and are divided between intermediate (45%) and advanced-specialised (37.8%), although 17.1% of students consider themselves to be at an initial level.

On the other hand, the level of CDDA conditions the teachers' perception of the students' CD and of the impact that the implementation of HD has had (Appendix, Table A1). Teachers who perceive themselves at the NE level significantly indicate that their students have a poorly adequate CD, below the teachers who are located in IE ( $F(2,342) = 5.071, p = .007; M_{NE} = 5.14; M_{IE} = 6.05$ ). Furthermore, they believe that students have adapted to the organisational changes of the HD model to a lesser extent ( $M = 5.9$ ) than teachers with a CDDA of IE ( $M = 7.24$ ) and LP ( $M = 6.66$ ) ( $F(2,342) = 29.507, p = .004$ ). There are no significant differences in relation to other aspects surveyed. Thus, teachers consider that HD has not had a positive impact on an emotional level, nor has it been positive for the students, and that their learning to learn competence is barely adequate.

On the other hand, students who indicate that they are at an advanced level of CDA significantly agree that they are more skilled with technologies in online classes (Table 3: items 1 and 12), than those who perceive themselves to be at an intermediate and beginner level and, in turn, those at an intermediate level also perceive themselves as more skilled than those at a beginner level.

Also, an advanced level of CDA is significantly related to completing tasks on time, appreciating that time passes quickly when lessons are online, and indicating that they follow them well (items 7, 10 and 11), above an intermediate level of CDA.

However, despite the fact that students with advanced GDA mention that they agree significantly more than intermediate and beginner level students that when lessons are online they are better organised (item 2), look for information on the internet (item 3), interact online with their peers (item 4), and are clear about what to do (item 9), their level of agreement for these items is low (only advanced level students have an  $M$  around 5, while the other levels are below this value).



It is also found that students, regardless of their level of CDA, agree that when classes are online, their concentration is lower (item 5).

Table 3.

*Descriptive variables, ANOVA and Tukey's HSD contrast for each item referring to online learning, as a function of the students' CDA.*

Item	VI	ANOVA					<i>p</i> Tukey HSD contrast			
		M	SD	F	dl	p	n <sub>2</sub>	a-b	a-c	b-c
1. I know how to use the programmes proposed by the teaching staff.	a. Initial	6.41	2.78	47.76 <sup>1</sup>	2, 754.5	<.001	.07	<.001 <sup>2</sup>	<.001	<.001
	b. Intermediate	7.48	2.54							
	c. Advanced	8.40	2.27							
2. I organise myself better in online classes.	a. Initial	4.91	2.89	7.99 <sup>1</sup>	2, 928.8	<.001	.01	.99 <sup>2</sup>	.017	<.001
	b. Intermediate	4.88	2.86							
	c. Advanced	5.56	3.05							
3. In online classes, I look for more information on the internet.	a. Initial	4.17	3.19	5.92 <sup>1</sup>	2, 884.2	.003	.01	.80 <sup>2</sup>	.015	.009
	b. Intermediate	4.5	3.04							
	c. Advanced	5.01	3.3							
4. In online classes, I interact more with classmates online.	a. Initial	4.17	3.19	6.36 <sup>1</sup>	2, 896.9	.002	.01	.38 <sup>2</sup>	.004	.022
	b. Intermediate	4.5	3.04							
	c. Advanced	5.01	3.30							
5. In online classes, I concentrate more	a. Initial	4.73	3.13	2.70 <sup>1</sup>	2, 951.6	.067				
	b. Intermediate	4.38	3.03							
	c. Advanced	4.82	3.31							
6. In online classes, I understand better the materials that are proposed to me to solve the tasks.	a. Initial	4.41	2.75	4.62 <sup>1</sup>	2, 951.6	.010	.00	.68 <sup>2</sup>	.29	.009
	b. Intermediate	4.23	2.73							
	c. Advanced	4.758	3.04							

7. I follow online classes well	a. Initial	5.33	2.9	6.13 <sup>1</sup>	2,964.1	.002	.01	.98 <sup>2</sup>	.027	.005
	b. Intermediat e	5.37	2.96							
	c. Advanced	5.96	3.19							
8. In online classes, I find it easier to solve my doubts.	a. Initial	4.2	2.73	5.27 <sup>1</sup>	2,945.1	.005	.00	.62 <sup>2</sup>	.26	.004
	b. Intermediat e	4.0	2.68							
	c. Advanced	4.56	3.03							
9. In online classes, I am clear about what I have to do	a. Initial	4.95	2.89	11.50 <sup>1</sup>	2,932.4	<.001	.02	.22 <sup>2</sup>	<.001	<.001
	b. Intermediat e	5.33	2.85							
	c. Advanced	5.98	3.07							
10. In online classes, the time passes more quickly.	a. Initial	5.44	3.40	6.85	2,1300	.001	.01	.93	.049	.001
	b. Intermediat e	5.34	3.26							
	c. Advanced	6.07	3.42							
11. In online classes, I finish my homework on time.	a. Initial	5.47	2.96	20.80	2,1300	<.001	.03	.003	<.001	<.001
	b. Intermediat e	6.25	2.96							
	c. Advanced	6.98	3.01							
12. In online classes, I use the computer tools that interest me.	a. Initial	6.04	3.09	28.51 <sup>1</sup>	2,785.9	<.001	.04	.024 <sup>2</sup>	<.001	<.001
	b. Intermediat e	6.67	2.86							
	c. Advanced	7.66	2.62							

Notes:<sup>1</sup> Brown-Forsythe Statistician;<sup>2</sup> Games-Howell Statistician

In response to the second objective, we investigated whether CDDA was related to the use of certain methodologies or teaching strategies and assessment proposals, and the students' perception of these.

Regarding the teaching strategies that teachers did (or did not) carry out online, the chi-square results show that the percentages for each CDDA level were different for the following activities:

- Projects (PBL):  $X^2(2, 345) = 7.15, p = .028$ , Cramer's  $V = .14$ . Of the teachers who placed themselves in NE, only 25.4% of the teachers who did this activity at the virtual level compared to the IE (42.5%) and the LP (43.9%).
- Inverted classroom:  $X^2(2, 345) = 6.45, p = .04$ , Cramer's  $V = .13$ , similar to the previous activity: NE: 23.9%; IE: 39.1%; LP: 43.9%.

The ANOVAs show significant differences on three items (Table A2 in the Appendix). Thus, it is the NEs who indicate the least agreement in following

competence-based teaching ( $M = 6.9$ ), compared to the IEs ( $M = 7.69$ ) and the LPs ( $M = 7.92$ ) ( $F(2,342) = 6.171, p = .002$ ). They also show less agreement that they help students to attribute meaning by connecting learning to their reality ( $F(2,342) = 5.129, p = .006$ ;  $M$  NE = 7.95;  $M$  IE = 8.49;  $M$  LP = 8.8). They also differ from the IEs in that they agree slightly that they enhance teamwork and collaboration ( $F(2,342) = 4.256, p = .015$ ;  $M$  NE = 4.25;  $M$  IE = 5.14), although this significant difference is not observed when compared to the LPs ( $M = 4.34$ ).

The chi-square results for the type of assessment that teachers mention doing online show that the proportions between the 3 levels of the CDDA were different for the three levels of the CDDA:

Initial assessment:  $X^2(2, 346) = 10.27, p = .006$ , Cramer's  $V = .17$ . Of the NE only 19.7% virtually propose this activity, followed by IE (32.2%), compared to LP (48.8%).

Co-evaluation:  $X^2(2, 346) = 12.34, p = .002$ , Cramer's  $V = .19$ . Similar to the previous activity: NE: 19.7%; IE: 29.6%; LP: 51.2%.

Formative assessment:  $X^2(2, 346) = 6.45, p = .038$ , Cramer's  $V = .13$ : only 38% of NEs virtually do this activity, while 52.4% of IEs do it, and 61% of LPs do it.

Heteroassessment among teachers:  $X^2(2, 346) = 10.73, p = .005$ , Cramer's  $V = .17$ : of the NE, only 22.5% of teachers carry out this activity, compared to the other two levels (IE: 25.3%; LP: 48.8%).

As far as students are concerned, their view of the tasks that teachers propose to them to carry out is shown in Figure 1.

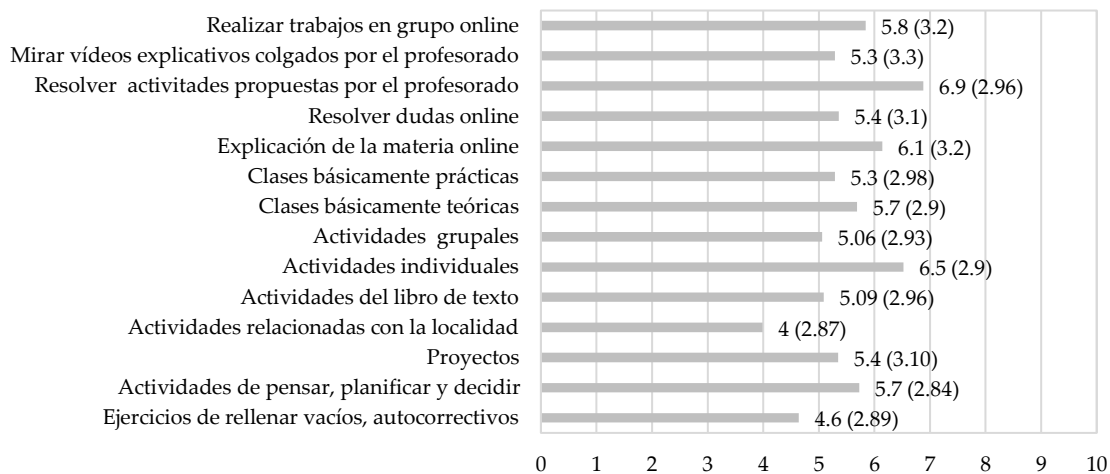


Figure 1. Means (Standard Deviation) of students' responses to the scale: Activities that teachers propose to them to carry out virtually.

When students do virtual classes, the teacher often explains the subject and they do the tasks that are proposed to them. Sometimes they solve doubts, watch videos or do tasks in small groups. On the other hand, they rarely do gap-filling or self-correction exercises, or tasks that are related to their environment. The dispersion of responses is high.

As far as assessment is concerned (Figure 2), students indicate that they often take exams, individual work and group work; sometimes teachers ask them to self-assess or give oral presentations; and to a lesser extent they are asked to make work plans or to co-assess themselves.

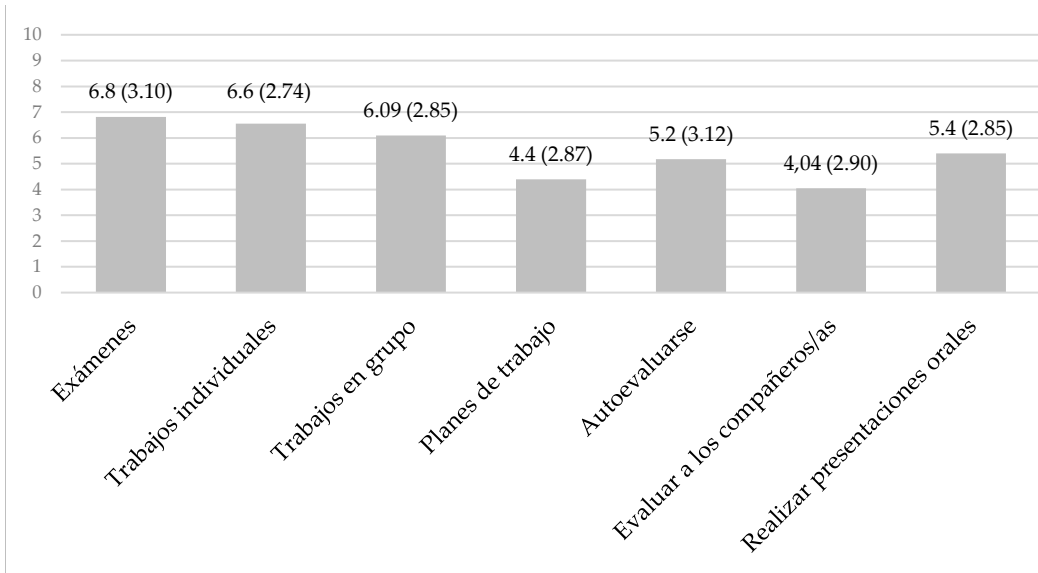


Figure 2. Means (Standard Deviation) of student responses to the scale: Teachers' online assessment proposals.

With regard to the last objective, to identify how the three groups perceive the support provided and received during the HD process, the teachers openly agree with the statement "my main role as a teacher in the HD model has been that of accompanier, facilitator and guide" ( $M = 7.77$ ,  $SD = 1.63$ ); they agree somewhat with their role with regard to the families ("it has consisted of accompanying, supporting and monitoring",  $M = 5.89$ ,  $SD = 2.74$ ); they somewhat agree with regard to their role in relation to families ("it has consisted of accompanying, supporting and following up",  $M = 5.89$ ,  $SD = 2.74$ ); and they somewhat agree that "families have played an active role in the organisational adaptation of this model" ( $M = 4.78$ ,  $SD = 2.44$ ).

Learners, on the other hand, have little agreement that they receive help when learning online, and perceive that, when they do receive help, it is usually through e-mails (Figure 3).

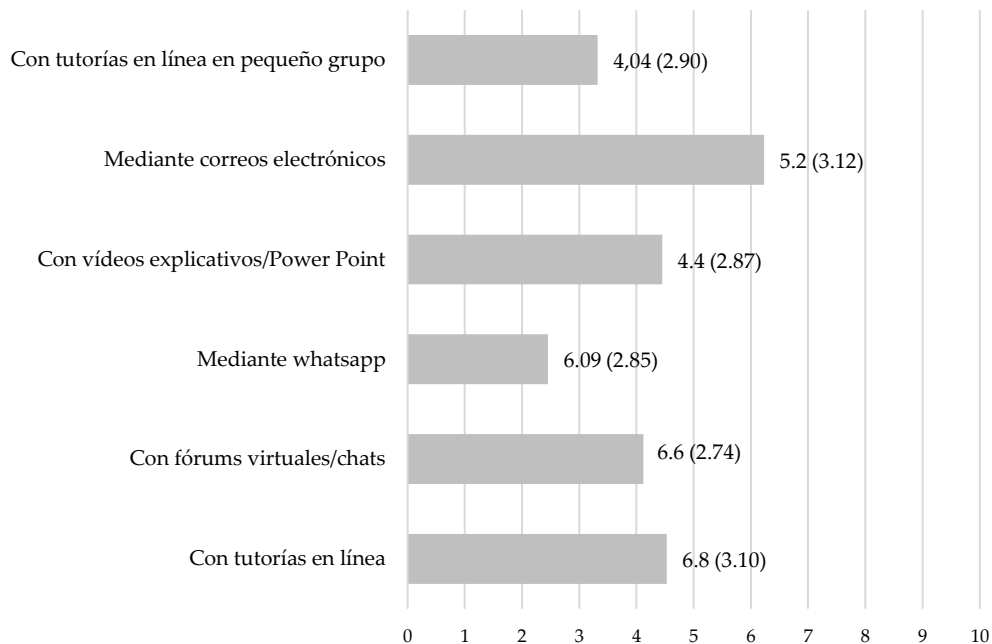


Figure 3. Means (Standard Deviations) of student responses to the scale: Teachers' online help.

On the other hand, students show statistically significant differences in the conditions at home for learning, depending on their CDA (Table 4).

Table 4.

Descriptive variables, ANOVA and Tukey's HSD contrast for the items referring to the students' perception of having had adequate conditions for learning at home according to their SLC.

Item	VI	ANOVA					p HSD Tukey contrasts			
		M	SD	F	dl	p	n <sup>2</sup>	a-b	a-c	b-c
1. At home I have the right conditions for school activities.	a. Initial	7.40	2.64	16.11 <sup>1</sup>	2,580.4	<.001	.026	.10 <sup>2</sup>	<.001	<.001
	b. Intermediate	7.82	2.4							
	c. Advanced	8.43	2.09							

2. At home I have the right conditions to follow the subjects.	a. Initial	7.12	2.75	23.48 <sup>1</sup>	2, 714.7	<.001	.038	<.001 <sup>2</sup>	<.001	<.001
	b. Intermediate	7.89	2.42							
	c. Advanced	8.47	2.11							
3. I like to do school activities at home, during school time.	a. Initial	5.25	2.79	3.24	2, 1302	.039	.005	.976	.226	.038
	b. Intermediate	5.20	2.61							
	c. Advanced	5.61	2.79							
4. When I follow the lessons from home, my family makes it easy for me to make connections.	a. Initial	6.09	3.21	13.56 <sup>1</sup>	2, 890.9	<.001	.021	.011 <sup>2</sup>	<.001	.008
	b. Intermediate	6.83	3.23							
	c. Advanced	7.4	3.07							
5. When I follow the lessons from home, my family helps me with the <i>online</i> activities.	a. Initial	4.68	3.33	9.93	2, 1302	<.001	.015	.06	<.001	.016
	b. Intermediate	5.31	3.48							
	c. Advanced	5.9	3.56							
6. I learn better by doing activities at home, during school hours, than at school.	a. Initial	4.77	2.85	3.98	2, 1302	.019	.006	.76	.06	.04
	b. Intermediate	4.93	2.89							
	c. Advanced	5.34	3.04							

Despite the fact that all students tend to mention that at home they often have the conditions to learn and follow the subjects, and that their families provide them with access to the Internet and, above all, sometimes help them with online activities, students who perceive themselves to be at the advanced level of CDA say this significantly more than those at the other two levels (items 1, 2, 4 and 5). Advanced learners like online activities more than intermediate learners (item 3), and agree more strongly that they learn better by doing activities outside the school (item 6) than intermediate learners, and intermediate learners more strongly than beginners. These differences are significant.

The families agree quite strongly that schools and teachers have reacted in an organised way by providing them with information (Figure 4). They are less in agreement that they have been helped to organise study time and space, and that they have received indications on how to help their children.



Figure 4. Means (Standard Deviations) of families' responses to the scale: Perception that teachers have helped them during HD.

The families are quite in agreement that they have provided support to their children during the virtual sessions, highlighting, above all, the use of digital devices (Figure 5).

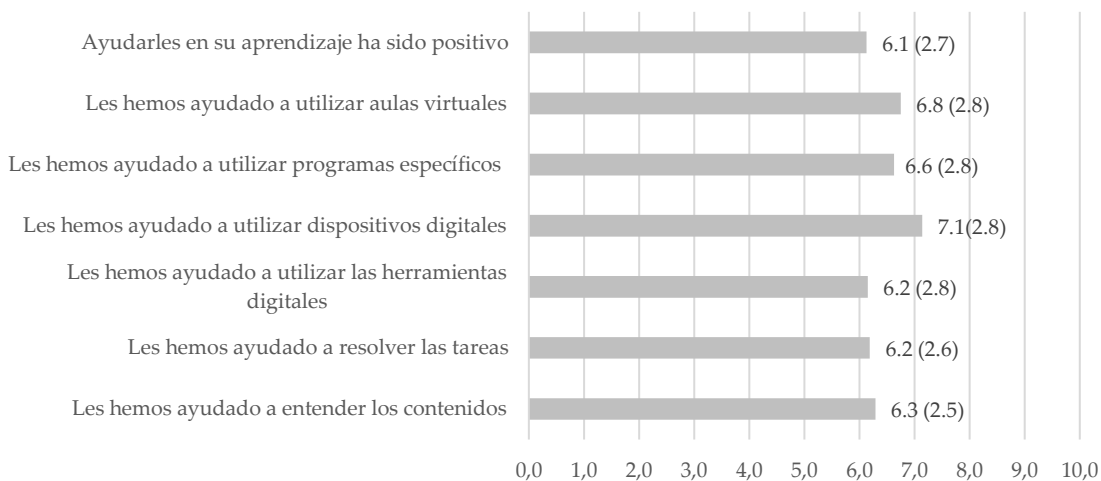


Figure 5. Means (Standard Deviations) of families' responses to the scale: Perception that they have helped their children during HD.

## Discussion and conclusions

In this study we set out three objectives related to the digital competence of the three participating groups, on the one hand, the CDDA and, on the other, the CDA of pupils and families.

Regarding the first objective, although 67.5% of teachers report a CDDA of IE level, 21% are at NE level. NEs, in turn, perceive their students as less digitally competent and digitally literate than teachers with higher levels of CDDA. This points to a potential gap in HD, since, if CDD is low, it will hardly be able to improve that of its students (Colás-Bravo et al., 2019; Fernández-Enguita, 2020), especially in the sense of helping to promote a digital *Bildung* (Krumsvik et al., 2018).

The pupils, for their part, consider themselves to have an intermediate or advanced level of CDA, although 17% of this group are at an initial level. Again, this result is a wake-up call for the education system, which should ensure that these learners, and those at intermediate level, manage to improve their CD.

Also, teachers, irrespective of their CDDA, rate the impact of HD on their students negatively, and consider their learning to learn competence to be inadequate. Students seem to confirm the latter assessment. Thus, although the learners show significant differences in their assessment of different aspects of online learning according to their GLC (those who perceive themselves as more advanced in GLC agree more in following online classes well), on the whole they identify themselves as not being able to organise themselves, to know what they have to do and to understand the materials, when teaching is online. In addition, they perceive that, with HD, they solve their doubts less well and agree that they concentrate less, as other research has also found (Hatzichristou et al., 2021).

With regard to the second objective, a look at the educational practices implemented by the teaching staff according to their level of CDDA suggests a teaching profile that would be located at the NE level, who when teaching virtually would propose few constructive activities (i.e. projects, flipped classroom, collaborative work), who would also not teach by competences, would help students less to see the functionality of learning, and would carry out fewer initial, formative, co-assessment and heteroassessment activities. The practically opposite pattern would be shown by teachers at LP level and, in an intermediate space, by IEs. Thus, and similar to what has been found in other research (Jin et al., 2020; Lucas et al., 2021; Paz-Saavedra et al., 2022), teachers who are positioned at a higher CDDA also suggest carrying out educational practices that would foster more meaningful learning.

Going back to what has been said above in relation to NE teachers, it would be plausible to think that they, feeling that they are not digitally competent, do not propose activities that require CD on the part of their students and, therefore, end up perceiving that students are, in reality, not digitally competent.

When we look at the students' description of the online proposals put forward by the teaching staff, the divergence in teaching methods that can be glimpsed in the teachers is possibly reflected in the high standard deviations that appear in the scales evaluated. With this caveat in mind, students offer a fairly traditional image of the online teaching and assessment proposals in which they participate (solving activities individually, listening



to the teacher's explanation, taking exams, etc.), although, as they perceive, some potentially more interesting proposals emerge to encourage more constructive learning (group activities, activities requiring decision-making and self-assessment).

In reference to the third objective, teachers perceived that their role in HD was that of accompanier and guide, although this role is more typical of constructive activities, in which meaningful and competent learning is sought (Pozo et al., 2021). We detected a possible bias here, because students perceived little help from their teachers when they were at home, receiving it mostly through e-mails. An important result is that students with a higher level of CD perceived that they received more help, perhaps because they were more able to ask teachers for it.

Teachers have been critical, in general, of the active role of families in the organisation of this model, in contrast to other findings (Hortigüela-Alcalá et al., 2020). Families, on the other hand, reproached the lack of help on how to organise learning spaces and times, and indications on how to help their children in learning, an aspect that coincides with other studies (Hatzichristou et al., 2021). This would point to another possible gap, related to having adequate space and time at home for children to learn and the perception that they would have been able to help more if they had received more support from teachers.

In conclusion, the results obtained constitute a wake-up call for the implementation of the HD model. Firstly, they call for the need to promote training programmes in CDD for secondary education teachers, both in their initial and in-service training (Manca and Delfino, 2021; Portillo et al., 2020), proposing them from the administration, so that it does not depend on individual initiative (Asenjo and Asenjo, 2021). Furthermore, and more clearly, with respect to what other research has found (Asenjo and Asenjo, 2021; Dias-Trindade et al., 2021; García-Peñalvo et al., 2020; Hortigüela-Alcalá et al., 2020; Pozo et al., 2021) show the need to promote training in CDD accompanied by methodological practices appropriate to HD, which favour more constructive, competent, participatory and collaborative learning, with formative assessment, and which require planning, decision-making and self-regulation on the part of the students. This would possibly overcome one of the main problems detected by students, the difficulty of concentrating when learning online, while promoting more meaningful learning in line with the competence needs of the digital society.

Consideration should also be given to how to support families in HD. The fact that students are at home in HD is an extra effort for many families who, despite receiving information from the school, perceived little assistance in how to help their children, as was also the case during confinement (Luengo and Manso, 2020). This task, as other studies also propose, should be supported by the educational administration (Hortigüela-Alcalá et al., 2020; Trujillo-Sáez et al., 2020).

Finally, with regard to the limitations of this study, it should be noted that the use of questionnaires restricts participants' responses to certain options, and the interpretations of the various items may vary among participants. Despite this limitation, complementary results from focus groups (Gràcia et al., 2022) support the conclusions provided. Also, it would have been interesting to have larger samples, especially of teachers and families. In spite of this, our study has allowed us to obtain relevant results for the different objectives we set ourselves, and we hope that future research can delve deeper into the problems identified, such as the mismatch observed between the perceptions of teachers and

students in relation to the support received, or clearly identify the skills that teachers need to develop to teach in an HD model, in order to be able to promote them appropriately. Additionally, it would be interesting to investigate the relationship between different socio-demographic variables (e.g. level of complexity of schools; level of education of families) and the participants' conceptualisation of HD.

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## Appendices

Table A1.

*Descriptive variables, ANOVA and Tukey's HSD contrast for each item referring to student learning, as a function of the teachers' QoL.*

Item	VI	ANOVA					p HSD Tukey contrasts			
		M	SD	F	dl	p	n <sup>2</sup>	a-b	a-c	b-c
1. I consider that pupils' learning has been affected positively	a. Novel-explorer	3.88	1.92	1.606	2,342	.20				
	b. Integrator-expert	4.4	2.35							
	c. Leader-pioneer	4.09	2.18							
2. I consider students' digital competence to be adequate.	a. Novel-explorer	5.14	2.3	5.071	2,342	.007	.03	.007	.706	.288
	b. Integrator-expert	6.05	2.6							
	c. Leader-pioneer	5.48	2.4							
3. I consider that the students' learning to learn competence is adequate.	a. Novel-explorer	4.43	2.02	1.842	2,342	.16				
	b. Integrator-expert	5.0	2.22							
	c. Leader-pioneer	4.85	2.36							
4. I feel that HD has had a positive impact on an emotional level.	a. Novel-explorer	3.78	2.32	.036	2,342	.964				
	b. Integrator-expert	3.76	2.6							
	c. Leader-pioneer	3.75	2.53							
5. The student body has adapted to the organisational changes brought about by HD.	a. Novel-explorer	5.9	2.44	29.507	2,342	.004	.03	.012	.008	.477
	b. Integrator-expert	7.24	2.57							
	c. Leader-pioneer	6.66	2.31							

Table A2.

*Descriptive tests, ANOVA and Tukey's HSD contrast for the items referring to the methodological approach, as a function of the CDA by the teaching staff.*

Item	VI	ANOVA					<i>p</i> HSD Tukey contrasts			
		<i>M</i>	<i>SD</i>	<i>F</i>	<i>dl</i>	<i>p</i>	<i>n</i> <sup>2</sup>	a-b	a-c	b-c
I follow a competence-based approach to teaching.	a. Novice-explorer	6.9	2.06	6.171	2, 342	.002	.03	.004	.011	.721
	b. Integrator-expert	7.69	1.74							
	c. Leader-pioneer	7.92	1.68							
2. I look for students to give meaning to what they learn, connecting them with their previous knowledge.	a. Novice-explorer	7.97	1.51	1.738	2, 341	.177				
	b. Integrator-expert	8.36	1.61							
	c. Leader-pioneer	8.41	1.81							
3. I want students to give meaning to what they learn, connecting them to their own reality.	a. Novice-explorer	7.95	1.48	5.129	2, 342	.006	.03	.023	.010	.418
	b. Integrator-expert	8.49	1.45							
	c. Leader-pioneer	8.8	1.58							
4. I consider that I have taken into account the diversity of learners when adapting teaching.	a. Novice-explorer	6.67	2.14	2.362	2, 342	.096				
	b. Integrator-expert	7.13	2.15							
	c. Leader-pioneer	7.56	2.12							
5. I believe that teamwork and virtual collaboration between students is encouraged.	a. Novice-explorer	4.25	2.35	4.256	2, 342	.015	.01	.029	.983	.156
	b. Integrator-expert	5.14	2.54							
	c. Leader-pioneer	4.34	2.9							