



Received: 2019-02-28
Reviewed: 2019-04-01
Accepted: 2019-05-10



RECYT Code: 71108
Preprint: 2019-07-15
Published: 2019-10-01

DOI: <https://doi.org/10.3916/C61-2019-02>

The development of the digital teaching competence from a sociocultural approach

El desarrollo de la competencia digital docente desde un enfoque sociocultural

Dr. Pilar Colás-Bravo

Full Professor in the Education Department at the University of Seville (Spain)
(pcolas@us.es) (<https://orcid.org/0000-0003-3000-075X>)

Dr. Jesús Conde-Jiménez

Assistant Professor in the Social and Human Sciences Department at Loyola University
of Andalusia (Spain) (jconde@uloyola.es) (<https://orcid.org/0000-0002-4471-5089>)

Dr. Salvador Reyes-de-Cózar

Associate Professor in the Department of Education at Nebrija University (Spain)
(sreyescozar@nebrija.es) (<https://orcid.org/0000-0001-9602-8988>)

Abstract

Many Nowadays, digital teaching competence transcends the individual training of teachers in ICT. The European framework DigCompEdu, highlights that teachers must train students in the application of digital technologies in a critical and responsible way, in terms of information, communication, content generation, wellbeing and problem solving. Despite the good intentions to systematize a common model of development of digital competence, it is detected that the proposals lack a pedagogical approach that serves as a theoretical framework for them. This paper proposes a development model of the digital teaching competence based on the sociocultural approach through four constructs: Command, Preference, Reintegration and Appropriation. For this study, an ad hoc scale is created to record the digital teaching competence through the development of this in their students and empirical evidences are provided. A survey type design is proposed. The sample consists of 1,881 students of compulsory education in Andalusia (Spain). SPSS is used to analyse data. The average general results for each of the dimensions studied reveal a medium level of development of digital competence. It is concluded that there is still too much to be done in terms of teacher training in ICT, being necessary to provide them strategies for the development of this in their students.

Resumen

En la actualidad, la competencia digital docente trasciende de la formación individual del profesorado en materia TIC. El marco europeo DigCompEdu incide en que el profesorado tiene que capacitar al alumnado en la aplicación de las tecnologías digitales de forma crítica y responsable en cuanto a información, comunicación, generación de contenido, bienestar y resolución de problemas. Pese a las buenas intenciones para sistematizar un modelo común de desarrollo de la competencia digital, se detecta que las propuestas carecen de un enfoque pedagógico que sirva de base teórica de los mismos. Este trabajo propone un modelo



de desarrollo de la competencia digital docente basado en el enfoque sociocultural mediante cuatro constructos: Dominio, Preferencia, Reintegración y Apropiación. Para ello, se elaboró una escala ad hoc para registrar la competencia digital docente a través del desarrollo de esta en sus estudiantes, aportando evidencias empíricas. Se plantea un diseño de tipo cuestionario. La muestra se compone de 1.881 estudiantes de educación obligatoria de Andalucía. Para el análisis de datos se utilizó SPSS. Los resultados promedios generales por cada una de las dimensiones estudiadas revelan un nivel medio de desarrollo de la competencia digital. Se concluye que aún existe mucho por hacer en cuanto a la formación del profesorado en materia TIC, siendo necesario facilitarles estrategias para el desarrollo de esta en sus estudiantes.

Keywords / Palabras clave

Digital competence, teachers, sociocultural approach, ICT, education, training, students, survey.

Competencia digital, profesorado, enfoque sociocultural, TIC, educación, formación, estudiantes, encuesta.

1. Introduction and state of the art

In recent years, a paradigm shift has occurred in the understanding of what it means to be a teacher with a high level of digital competence. Nowadays, it is no longer the one who uses the technologies best or has the most knowledge of them, but rather one who is able to take advantage of this background for the development of his/her own students' digital competence. This is, in our view, the novel contribution of the "European framework for the digital competence of educators. DigCompEdu" (Redecker, 2017).

Under this view, teachers, through their practice and intervention in the classroom, become key players responsible for the overall development of their students, both personally and professionally, in a cultural scenario dominated by digital technologies.

By analyzing the scientific literature on digital competence development models, this evolution can be observed (Ferrari, 2013; INTEF, 2017a; Carretero, Vuorikari, & Punie, 2017; Redecker, 2017). From the first moment, where importance was placed on the particular training of teachers to now, where the development of teachers' digital competence is expected to go further, achieving its development and transfer among their students.

In this sense, two proposals are particularly important and worthy of mention. One is the Common Framework of Digital Competence for Teachers (INTEF, 2017a) developed within the School's Digital Culture Plan by the National Institute of Educational Technologies and Teacher Training (INTEF for its Spanish initials) of Spain, which is articulated through major proposals of international teaching frameworks, such as those by UNESCO (2008) and ISTE (2008). There is also the European DigCompEdu framework, drawn up by the Joint Research Centre (JRC) of the European Commission, which has precedents for several European projects, such as the "DigEULit: A European framework for digital literacy" (Martin & Grudzlecki, 2006) and the "DIGCOMP: A framework for developing and understanding digital competence in Europe" (Ala-Mutka, 2011; Ferrari, 2013).

Considering both proposals and the key areas on which they are structured, it can be observed that the European proposal, DigCompEdu (Redecker, 2017), contains many of the findings of the Spanish proposal, which could be considered as an evolution and natural continuation of the latter (Table 1). The main advance lies in the last points of the European model, in which teachers are seen as capable of empowering their students through the development of students' digital competence while focusing on subjective aspects, such as student well-being.

However, and despite good intentions to systematize a common model for the development of digital competence in a measurable way, in both cases, these proposals lack an underlying pedagogical approach as their theoretical basis.



Table 1. Areas of teachers' digital competence development proposed by INTEF and DigCompEdu

INTEF		DigCompEdu
Information and information literacy	1	Professional commitment
Communication and collaboration	2	Digital Resources
Digital content creation	3	Teaching and learning
Safety	4	Assessment
Problem solving	5	Student Empowerment
-	6	Enabling students' digital competence

Based on the foregoing, this study aims to propose a model for the development of teachers' digital competence based on the Vygotskian sociocultural approach. Specifically, a proposal will be developed for indicators to record whether teachers are succeeding in enabling the development of their students' digital competence, which corresponds to the sixth and final development area proposed by the DigCompEdu framework (Redecker, 2017).

This contribution is interesting, in line with the Erasmus+ project "Developing ICT in Teacher Education" (DiCTE, 2017), since, in order to propose different teacher training programs or plans for the development of digital competence, these must be based on a theoretical pedagogical model or approach. We understand that the sociocultural approach, due to its particular characteristics and constructs, is an ideal frame of reference to generate items that measure the impact of teachers' digital competence development through its development in their students.

1.1. The evolution of teachers' digital competence

In the first decade of the 21st century, international organizations, such as UNESCO (2008) and the International Society for Technology in Education (ISTE, 2008), developed ICT competence standards for teachers, which marked the beginning of an exploration of models for the development of digital competence in teachers.

In Spain, the ideas proposed by these sources are included in the project "Common Framework of Digital Competence for Teachers" (INTEF, 2017b). This framework is also influenced by two models of compression of digital competence: the European project DIGCOMP and the one developed by the Basque Government's Department of Education (2012), which sought to develop a theoretical framework for the conceptualization of digital competence. Broadly speaking, this proposal, developed by INTEF, was intended to provide a descriptive framework to guide both the training and assessment processes of digital competence. This model is linked to reductionist approaches to digital competence (Van-Deursen & Van-Dijk, 2009), since this competence is broken down into basic technical skills in the use of technology (Søby, 2013) and into formal skills that allow subjects to improve their personal and/or social development, offering them divergent opportunities (Kwan, 2001; Correia & Teixeira, 2003).

This conception was systematized in the DIGCOMP project for the creation of a model for the "Common European Framework of Digital Competence", in which the levels of acquisition of competence development range from a technical and instrumental command, to deep levels of development where other skills and advanced knowledge are incorporated, as well as attitudes linked to the use of digital technologies (Ferrari, 2012), conceived strictly from an internal and individual perspective, focused on teaching staff.

However, in recent years, the development of digital competence has involved going beyond the particular knowledge, skills and attitudes that teachers must develop for individual improvement, requiring them to develop the digital competence of their students. In other words, the proposal is to move from individual teacher empowerment in a technological world to proposals for transferring the development of competence to students.



This is where the European framework DigCompEdu (Redecker, 2017) is situated, indicating that teachers need to enable students to apply digital technologies critically and responsibly in terms of information, communication, content generation, well-being and problem solving.

The inclusion of this facet in the development of teaching competence implies a conception of digital competencies as transforming and empowering skills. Recent studies, aligned with the research line on new literacies (New Literacies Studies), advocate, from sociocultural approaches, a conception of digital competence that contemplates subjective aspects (Area & Ribeiro, 2012; Van-Deursen & Van-Dijk, 2016; De-Pablos, Colás, Conde, & Reyes, 2017). In this line, Van-Deursen & Van-Dijk (2016) conclude that, through communicative skills and content creation, subjects can transfer their own competencies in an expansive way. Teachers must therefore be able to generate educational interventions in their praxis to transform their students through the development of digital competence.

Once the previous points have been laid out, it is troubling that, from an educational standpoint, no theoretical support has been provided to the approaches developed. In other words, a gap has been identified in terms of the pedagogical basis for these proposals. However, in order to establish educational training suggestions for the development of this competence, it would be advisable that these be developed on a theoretical pedagogical framework. In the following section, the sociocultural approach is discussed as a possible solution to the identified deficiencies.

1.2. The sociocultural approach as a framework for the development of digital competence

As mentioned earlier, the DigCompEdu framework (Redecker, 2017) states that teachers must train students to apply digital technologies through their teaching-learning praxis. For the sociocultural approach, learning is an interactive process between the subject and the context, understanding both the social and cultural aspects. These coordinates fit with the approaches introduced by the DigCompEdu framework, which promotes a phenomenon of transfer of digital competence development from teacher to student. It is precisely through social interaction that the teacher has the capacity to generate the ideal setting for technological learning.

According to this, the teacher becomes a key element for the development of students' digital competence. The actions of teachers in classrooms (inter-psychological plane, external to subjects) modify their students (intra-psychological plane, internal to subjects). For Martínez (1999), the internalization, meaning the reconstruction of an inter-psychological operation in an intra-psychological one, should not be understood as a reproduction of the social behaviors that occur in the environment, but rather it implies transformations in structures and learning that are internalized. Therefore, from the uses and applications made by teachers due to their level of digital competence, students will internalize methods of digital competence development.

In this way, ICTs are conceived as artifacts or mediating tools located between the inter- and intra-psychological processes created in the teaching-learning processes (Onrubia, 2005; Coll, Rochera & Colomina, 2010), so it is up to teachers, depending on their own level of digital competence, to offer different training opportunities that allow their learners to increase their potential to develop and become active agents in society. From this perspective, the construct of agentiality (Zinchenko, 1985), also makes sense, as the capacity that people have to carry out actions after the influence of their different referents (Giddens & Turner, 1990).

Establishing a connection between the sociocultural Vygotskian approach and the theory of activity (Leontiev, 1978), considered as the evolution of one's own approach (De-Pablos, 2006), the observation of the activities that are carried out in classrooms becomes a key indicator to analyze the internal development of subjects. Therefore, through the analysis of manifest and explicit actions related to the digital uses and applications proposed by teachers in the classroom, it would be possible to record the levels of digital competence development for both teachers and students (Conde, 2017).

After exposing the coordinates through which new trends in teachers' digital competence connect to the sociocultural approach, in the following part, a theoretical model is presented to enable the



assessment of the development of the aforementioned competence. This model intends to set the theoretical basis to generate indicators that assess whether teachers enable the development of digital competence in their students through daily ICT activity in the classroom. This is done using four constructs derived from the sociocultural approach, specifically: Command, Preference, Reintegration and Appropriation.

1.3. Sociocultural model for the development of teachers' digital competence

Firstly, for the development of digital competence at an instrumental level, the Command construct is of special interest, alluding to the frequent practices carried out by people through mediating instruments as a consequence of their adaptation to the contexts in which they develop (De-Pablos, 2006). Within this level, basic instrumental skills would be found, such as access to or operation of ICTs at the user level (Colás, Rodríguez, & Jiménez, 2005). Therefore, in order to ensure the development of digital competence at the instrumental level, teachers need to include in their teaching, practice activities that enable their students to use digital tools at a basic and technical level.

Secondly, on a strategic and operational level linked to the activation of digital competence for problem solving, the constructs of Preference and Reintegration emerge. Preference is linked to those situations where subjects prefer to use digital resources, as opposed to other solutions, when giving answers to daily problems (Colás, Rodríguez, & Jiménez, 2005). For Wertsch (1994), this reveals a subjective and implicit process of decision making that evidences the level of internalization of competence, considering technological tools as the most appropriate. In this sense, in order for students to prioritize the use of ICT tools in the classroom, teachers have to generate scenarios in which the use of such tools is required until students spontaneously activate their choice.

This level also includes the development of skills and strategies that allow subjects to establish new uses, spaces and practices through ICT. This manifestation is clearly divergent from the technologies. Here lies the sociocultural construct of Reintegration, which refers to the transfer of valid cultural artefacts from one context to another, completely different scenario (De-Pablos, 2006). This involves a more complex process than that of Preference, as it implies the ability to expand individual and social capital through technologies. In this sense, teachers have to activate their ability to innovate and design activities where their students are able to implement their digital competence to perform tasks beyond the context where they have developed or learned, transferring them to their environment and, ultimately, generating social impact.

Finally, at an even more expansive level of digital competence, Appropriation is found. It is associated to the activity of subjects when they go beyond dominating a practice, making it their own; internalizing it and making it part of themselves (Bajtín, 1981; Wertsch, 1994). At this level, subjects have appropriated the digital culture by assuming its rules, identifying its characteristics and being part of it. Therefore, competence goes beyond the instrumental and requires skills that manifest the interpretation they make of reality through ICT, constructing its meaning and internalizing its narratives. Thus, in order to ensure that students appropriate the digital culture, teachers must generate training scenarios in which technologies are naturally included, and emotional aspects such as the well-being of students within ICT learning environments become especially significant. Next (Figure 1), the theoretical model for the development of digital competence in students, proposed by teachers from a sociocultural perspective, is presented graphically, detailing the constructs that operationalize it.

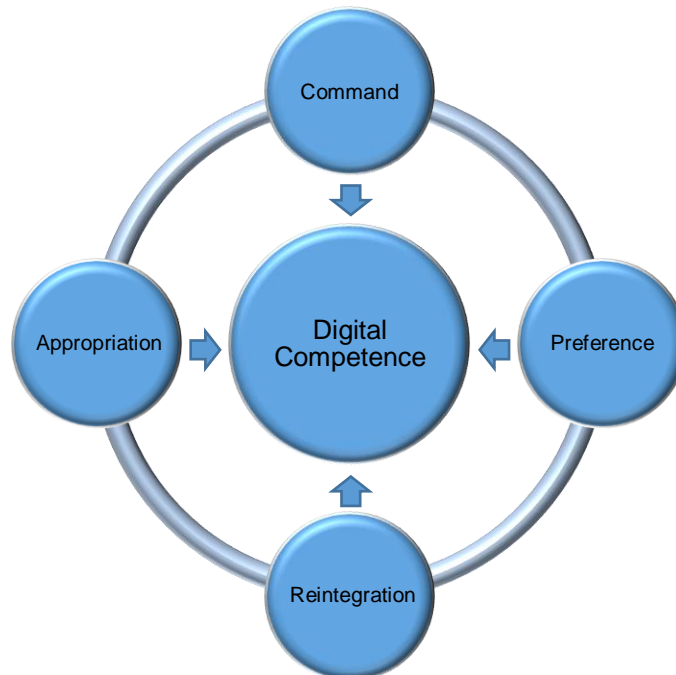


Figure 1. Model for the development of digital competencies based on the sociocultural approach.

Now that this model, based on sociocultural approach constructs, has been proposed to articulate the development of digital competence, it is necessary to transfer it to practice and empirically record levels of digital competence based on the ability of teachers, through their teaching practice, to develop this competence in their students.

2. Materials y methods

2.1. Objectives

This study sets out the following objectives

- To formulate a scale to assess teachers' digital competence through its development in their students from a theoretical model based on the sociocultural approach
- To ascertain the levels of teachers' digital competence development through empirical evidence from the students' viewpoint.

2.2. Method

This quantitative study is non-experimental, ex post facto and cross-sectional in nature. According to Ala-Mutka (2011), survey methods and, specifically, questionnaires, are ideal tools for providing information on the digital uses, knowledge, perceptions and opinions of subjects. In addition, leading agencies such as Eurostat and Ofcom use these data collection techniques when assessing subjects' digital skills. Therefore, a survey design with an ad hoc scale containing subjective perceptions of the students was used in order to approach the proposed scientific objectives.

2.3. Sample

The sample in this study was comprised of a total of 1,881 compulsory education students in the Autonomous Community of Andalusia. Following simple random sampling criteria for infinite samples



(populations greater than 100,000 subjects), this sample is statistically significant with a confidence level of 99.7% (3σ), where the estimated values of p and q (probabilities with which the phenomenon occurs) are 1% and 99%, with a margin of error of $\pm 0.68\%$. In addition, and in order to obtain a sample that is as representative as possible, purposive sampling was conducted, selecting subjects immersed in schools with teachers who have a long history in the use and application of ICTs (more than 10 years). Therefore, the participants belong to sample units that were selected on a non-random basis, but according to characteristics relevant to the study (Hernández, Fernández, & Baptista, 2003).

As for the sociodemographic data of the sample, the average age of the student body is 12 years ($s=2.2$), with an age range between 7 and 17 years. In terms of gender, the sample is balanced, with 51% male and 49% female. A similar proportion is maintained with respect to educational level, with 47% enrolled in Primary Education and 53% in Secondary Education.

2.4. Instrument

In order to collect data that respond to the proposed objectives, an ad hoc scale was prepared with the intention of ascertaining the levels of development of teachers' digital competence through empirical evidence of its progress in the student body. This was designed taking as a reference the four constructs of the sociocultural approach proposed in the theoretical section: Command, Preference, Reintegration and Appropriation. A Likert scale was designed (from 1 to 5, in which 1=Never, 2=Rarely, 3=Sometimes, 4=Often and 5=Always), made up of four dimensions with a total of 27 items that inquire about the knowledge, skills, abilities, attitudes and emotions of students derived from classroom teaching practices in which they are using digital technologies (Table 2). Thus, from the students' perception, empirical evidence is obtained from the development of teachers' digital competence in educational contexts.

Table 2. Data collection scale and central tendency descriptive statistics

Construct	Item	\bar{x}	s	s^2	Min.	Max
Command	I do schoolwork assigned to be done with the computer without problems	4.00	1.24	1.54	1	5
	I know how technologies work, and I also use them to do my homework	3.48	1.40	1.96	1	5
	When I can, I do homework assignments on my computer	3.00	1.57	2.46	1	5
	I am familiar with the legal and ethical aspects of computers and the Internet	3.06	1.57	2.46	1	5
	I am familiar with and use basic computer equipment	3.82	1.45	2.11	1	5
	I access and use different digital platforms (Moodle, Helvia, etc.)	2.41	1.55	2.39	1	5
	I often use computers or tablets with my group of friends or classmates	3.13	1.49	2.22	1	5
	I find interesting things on the Internet for learning school content	3.25	1.38	1.90	1	5
Preference	In class we are assigned tasks that I would do better with a computer	3.18	1.49	2.22	1	5
	In class I have felt the need to use the computer to work, even when the teacher does not pose the activity to use computers	2.74	1.52	2.33	1	5
	I learned things at school that I wouldn't be able to do without a computer now	2.83	1.54	2.36	1	5
	For me, digital resources have as much value as non-digital resources	2.92	1.53	2.34	1	5



Reintegration	I use the Internet in very different ways to do things that interest me	3.79	1.37	1.88	1	5
	I need the Internet to do things, even if I am not asked to do them with it	3.07	1.52	2.31	1	5
	I use the computer to do things no one has ever taught me	3.19	1.59	2.52	1	5
	Although no one has taught me, I could use the computer to do classwork more easily	3.38	1.49	2.22	1	5
	I would know how to use the computer and the Internet to learn much more than I learn	3.55	1.41	2.00	1	5
Appropriation	When I use digital technologies in the classroom:					
	I am curious about the new things I learn	3.88	1.25	1.55	1	5
	I feel more support from my teachers	3.12	1.43	2.06	1	5
	I take pride in the things I do	3.81	1.31	1.72	1	5
	I have greater confidence in myself	3.45	1.40	1.96	1	5
	I feel well	3.64	1.34	1.80	1	5
	I have greater confidence. I do not feel as nervous	3.21	1.49	2.22	1	5
	I have fun. I am less bored with the things we do	3.52	1.46	2.13	1	5
	If I were not allowed to use technologies, I would feel very dissatisfied	3.21	1.56	2.42	1	5
	I notice that we, the students, are better friends	2.82	1.48	2.18	1	5
	Overall, I appreciate the diversity of things the Internet has to offer	3.50	1.43	2.05	1	5

In order to guarantee the validity of the instrument's content, in the first stage, an expert validation was performed. Additionally, in order to guarantee the cognitive validity of the questionnaires, i.e. for students to understand the meaning of the items that make up the scale, data were collected in person so that a researcher could explain and clarify each of them. This was fundamental for the students at the Primary Education level. The global questionnaire had good reliability or internal consistency, given that it obtained a Cronbach's Alpha (α) of .892. If a reliability analysis is performed for each sociocultural theoretical construct, for Command, an $\alpha=.714$ was obtained; for Preference, $\alpha=.789$; for Reintegration, $\alpha=.771$; and, finally, for Appropriation, $\alpha=.812$.

2.5. Data Analysis

For data analysis, statistical techniques describing frequencies (%) and central trends (mean, maximum and minimum, standard deviation and variance) were used. The statistical package SPSS v. 24 was used for processing quantitative data.

3. Analysis and results

Results are structured according to the objectives set out in the study. In the previous section, where the data collection instrument is presented, an account is given of the results obtained in connection to the first objective of this work, consisting of the preparation of a scale that enables the recording of the development of teachers' digital competence through the development of this competence in their students from theoretical constructs derived from the sociocultural approach: Command, Preference, Reintegration and Appropriation (Table 2). The construction of this scale allows its applicability to other studies on the development of digital competencies in school classrooms.

As for the second objective, about ascertaining levels of development of teachers' digital competence through empirical evidence from the students' point of view, the descriptive results incorporated in Table 2 reveal that most of the average scores are around 3, the mean value of the scale.



At the instrumental level, where the construct of Command is located, it is worth noting that the item that obtained the highest average score is “I do schoolwork assigned to be done with the computer without problems” ($\bar{x}=4$, see Table 2), which indicates that the completion of the digital activities proposed in the classroom is quite manageable for the learners.

On the opposing side is the item “I access and use different digital platforms” ($\bar{x}=2.41$ see Table 2) so it appears that the use of platforms such as moodle or Helvia is unusual in classrooms.

If we look at Figure 2, the data reveal that more than half of the students recognize that, with a frequency of “often” and “always”, they know and use basic computer equipment in their schools, they know how the technologies work, they apply them to their homework, and they complete their homework without problems.

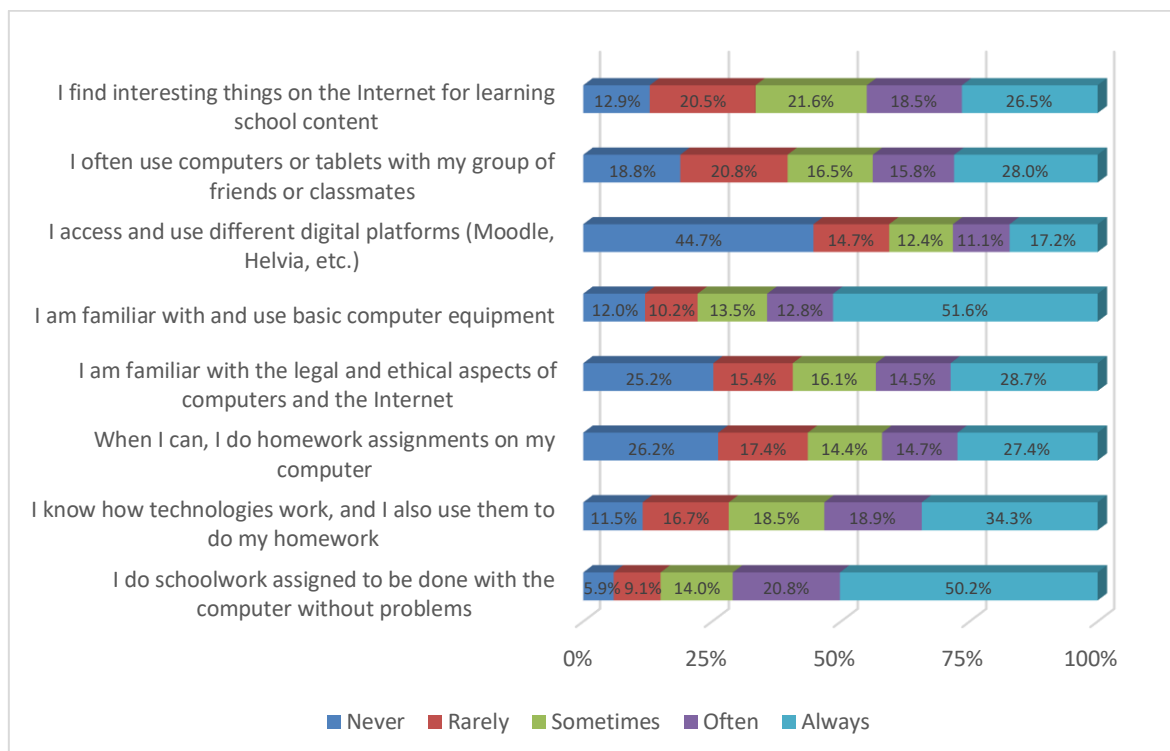


Figure 2. Level of development of digital competence linked to the Command construct in percentage.

Secondly, on a strategic level, broadly speaking, students display a medium-low Preference for the utilization of digital tools (see Table 2). The average score obtained in the item “In class I have felt the need to use the computer to work, even when the teacher does not pose the activity to use computers” ($\bar{x}=2.74$), exemplifies this trend: students sometimes have this need, but it is not very frequent.

Figure 3 below shows how the distribution of students in the items linked to this construct is quite similar in the intermediate values (“rarely”, “sometimes” and “often”) while the majority are accumulated in the extremes (around 50% of the students), 25% in “never” and the other 25% in “always”.

This polarization would indicate that there are teachers who strongly promote this prioritization of digital resources in their teaching practice and others who do not.

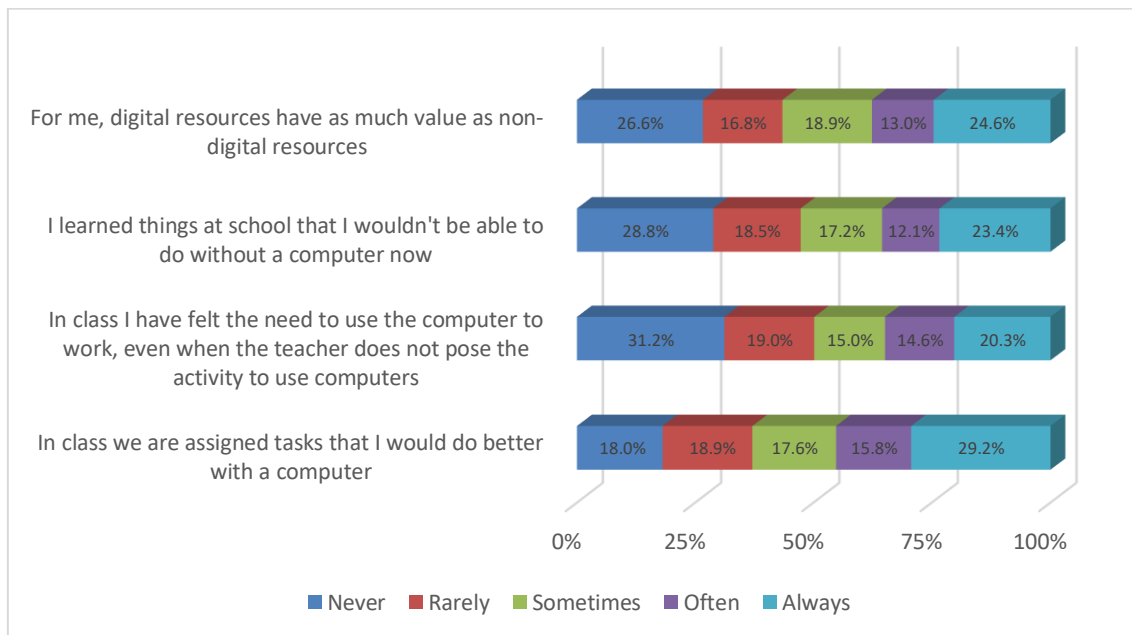


Figure 3. Level of development of digital competence linked to the construct of Preference in percentage.

At this same level, in terms of Reintegration, although the averages are at an intermediate value, more positive values are obtained (Table 2). The “I use the Internet in very different ways to do things that interest me”, with an average near 4 ($\bar{x}=3.79$), affirms that working with interesting content allows students to use the Internet operationally to do new and divergent things. Based on an analysis of frequencies in %, in Figure 4, this positive trend can be confirmed since the majority of the students, around 70%, are somewhere between the mean value of the scale (“sometimes”) and the most positive values (“often” and “always”). It could be argued that teachers offer their students opportunities for the development of digital competence in its most creative and free facet.

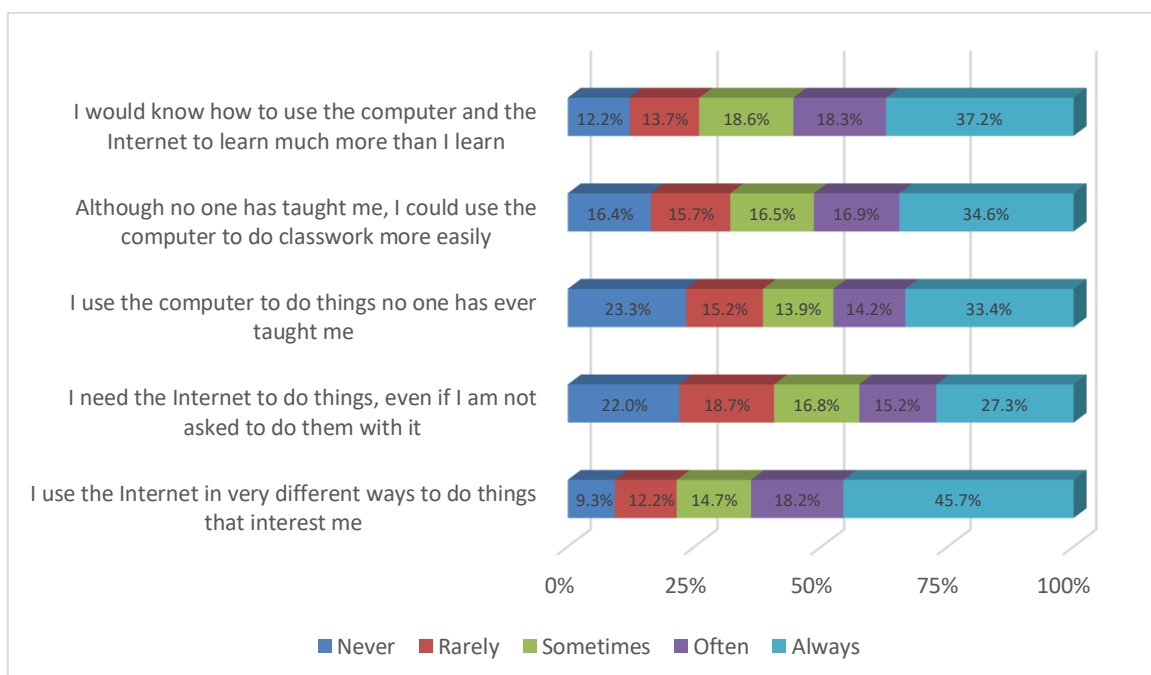


Figure 4. Level of development of digital competence linked to the Reintegration construct in percentage.



Finally, at the expansive level, there is a medium-high trend in the average scores obtained (Table 2). Thus, with regard to Appropriation, students seem to reveal that the teaching practices proposed by teachers have a positive effect on their inclusion in the digital culture. Only, the item “I notice that we, the students, are better friends” ($\bar{x}=2.82$), obtains an average score of less than 3, which would indicate that schoolwork with ICT does little to favor the cohesion of the class group and, perhaps, enhances a more individual dimension. That is to say, through the didactic interventions by teachers, the development of their students’ digital competence is activated at an intermediate level. To complement these central trend statistics, Figure 5 below also shows a positive trend. As it was in the case of Reintegration, in most of the items almost 70% of the students are grouped in the mid and high values of the scale. Only the item with the lowest average score is the exception to this trend. In this way, in general, it could be said that teaching practices encourage students to develop a positive emotional state in learning environments in which ICTs are present.

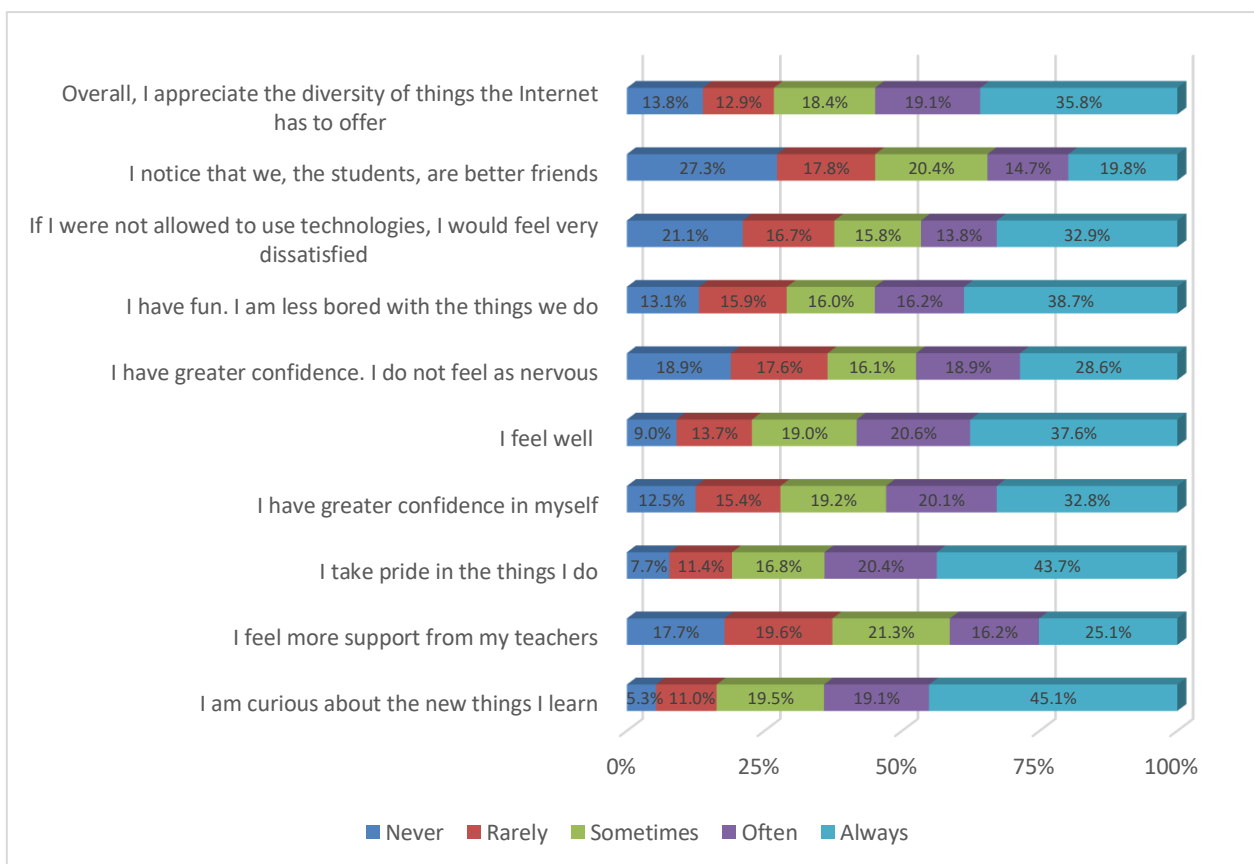


Figure 5. Level of digital competence development linked to the Appropriation construct in percentage.

4. Discussion and conclusions

This study highlights how, at present, teachers’ digital competence transcends beyond the individual teacher training in ICT, requiring the development of teaching practices that generate it in students. The European DigCompEdu framework (Redecker, 2017) emphasizes in particular the need for teachers to enable students to use digital technologies critically and responsibly in terms of information, communication, content generation, well-being and problem solving. Thus, special importance is given to teacher mediation to generate interactive practices with digital technologies in order to develop their students personally, professionally and socially (Martin & Grudziecki, 2006;



Van-Deursen & Van-Dijk, 2016). These ideas are associated with other authors who emphasize that teachers' digital competence would have to go beyond an individual teacher's conception and manifest its agentiality through their students' empowerment (Castañeda, Esteve & Adell, 2018).

This is where the Erasmus+ project "Developing ICT in Teacher Education" is situated, seeking to explore the training dimensions of teachers for the development of their digital competence. However, despite the good intentions to systematize a common model for the development of digital competence in a measurable way (Carretero, Vuorikari, & Punie, 2017; Redecker & Johannessen, 2013), these proposals lack an underlying pedagogical approach as their theoretical basis.

This work illustrates how the sociocultural approach can be an ideal pedagogical theoretical approach that serves as an underlying basis for the generation of innovative models for the development of teachers' digital competence due to the transfer and operationalization potential of its constructs.

Addressing the first objective of this study, a reliable scale has been designed to empirically assess levels of development of teachers' digital competence by implementing different sociocultural constructs such as Command, Preference, Reintegration and Appropriation.

As for the second objective, the results of the study shed light on the level of development of teachers' digital competence in terms of the capacity of teachers to generate this competence in their students. Based on the results obtained, it is concluded that teachers, through their educational praxis, develop the digital competence of their students at an intermediate level. This suggests that there is still much to be done in terms of teacher training in ICT, and that strategies that enable them to create more opportunities for the development of digital competence in their students need to be provided.

As limitations to the study, due to the innovative nature of this proposal, it should be noted that the application of the sociocultural approach to the development of area 6 of the European DigCompEdu framework has been developed (Table 1). In this sense, and prospectively, it would be interesting to delve into the other areas of the framework in order to fully operationalize it from the sociocultural approach. In addition, it is considered that the generation of items to record the development of the digital competence lends itself to greater debugging, deepening, transfer, etc., in future research.

Finally, by way of foresight, the proposal is to continue researching this issue from the point of view of the teachers themselves, as well as to conduct other exploratory lines of a more qualitative nature in order to contrast these results in a more profound and comprehensive manner.

References

- Ala-Mutka, K. (2011). Mapping digital competence: Towards a conceptual understanding. Luxembourg: JRC-IPTS. <https://bit.ly/1p477BJ>
- Area, M., & Ribeiro, T. (2012). De lo sólido a lo líquido: Las nuevas alfabetizaciones ante los cambios culturales de la Web 2.0. [From solid to liquid: New literacies to the cultural changes of web 2.0]. *Comunicar*, 38, 13-20. <https://doi.org/10.3916/C38-2012-02-01>
- Bajtín, M. (1981). *Estética de la creación verbal*. México: Siglo XXI.
- Carretero, S., Vuorikari, R., & Punie, Y. (2017). DigComp 2.1: The digital competence framework for citizens with eight proficiency levels and examples of use. <https://bit.ly/2pGtGII>
- Castañeda, L., Esteve, F., & Adell, J. (2018). ¿Por qué es necesario repensar la competencia docente para el mundo digital? *Revista de Educación a Distancia*, (56), 1-20. <https://doi.org/10.6018/red/56/6>
- Colás, P., Rodríguez, M., & Jiménez, R. (2005). Evaluación de e-learning. Indicadores de calidad desde el enfoque sociocultural. *Teoría de la Educación*, 6(2). <https://bit.ly/2NAGWH1>
- Coll, C., Rochera, M.J., & Colomina, R. (2010). Usos situados de las TIC y mediación de la actividad conjunta en una secuencia instruccional de educación primaria. *Electronic Journal of Research in Educational Psychology*, 8(21), 517-540. <https://doi.org/10.25115/ejrep.v8i21.1384>
- Conde, J. (2017). *La mediación de las TIC en la creación de ambientes de aprendizaje y el logro de competencias digitales*. Tesis Doctoral. Sevilla: Universidad de Sevilla. <https://bit.ly/2BX87ae>
- Correia, A.M.R., & Teixeira, J.C. (2003). Information literacy: An integrated concept for a safer Internet. *Online Information Review*, 27(5), 311-320. <https://doi.org/10.1108/14684520310502261>



- De-Pablos, J. (2006). El marco del impacto de las tecnologías de la información. Herramientas conceptuales para interpretar la mediación tecnológica educativa. *Telos*, (67), 68-74. <https://bit.ly/2ED8Hf8>
- De-Pablos, J., Colás, P., Conde, J., & Reyes, S. (2017). La competencia digital de los estudiantes de educación no universitaria: variables predictivas. *Bordón*, 69(1), 169-188. <https://doi.org/10.13042/Bordon.2016.48594>
- Departamento de Educación del Gobierno Vasco (Ed.) (2012). Competencia en el tratamiento de la información y competencia digital. Marco Teórico. <https://bit.ly/2TrJYCGT>
- DiCTE (Ed.) (2017). About DiCTE project. Developing ICT in teacher education. Oslo, Norway. <https://bit.ly/2TkTVlp>
- Ferrari, A. (2012). Digital competence in practice: An analysis of frameworks. Sevilla: JRC-IPTS. <https://doi.org/10.2791/82116>
- Ferrari, A. (2013). DIGCOMP: A framework for developing and understanding digital competence in Europe. Sevilla: JRC-IPTS. <https://doi.org/10.2788/52966>
- Giddens, A., & Turner, J. (Eds.) (1990). *La teoría social hoy*. Madrid: Alianza.
- Hernández, R., Fernández, C., & Baptista P. (2003). *Metodología de la investigación*. México: McGraw-Hill.
- INTEF (Ed.) (2017a). Marco Común de Competencia Digital Docente. Madrid: Ministerio de Educación, Cultura y Deporte. <https://bit.ly/2jqkssz>
- INTEF (Ed.) (2017b). Comparativa Marco Competencia Digital Docente y Marco Europeo: DigCompEdu. <https://bit.ly/2EvmymL>
- ISTE (Ed.) (2008). NETS for teachers: National educational technology standards for teachers, Second Edition. <https://bit.ly/2UaLExK>
- Kwan, M. (2001). Cyberspatial cognition and individual access to information: The behavioral foundation of cybergeography. *Environment and Planning B*, (28), 21-37. <https://doi.org/10.1068/b256>
- Leontiev, A. (1978). *Activity, consciousness and personality*. Englewood: Prentice Hall.
- Martin, A., & Grudziecki, J. (2006). DigEuLit: Concepts and tools for digital literacy development. *Innovations in Teaching & Learning in Information & Computer Sciences*, 5(4), 246-264. <https://doi.org/10.11120/ital.2006.05040249>
- Martínez, M. (1999). The sociocultural focus in the education and development. *Revista Electrónica de Investigación Educativa*, 1(1), 16-36. <https://bit.ly/2IJOr1d>
- Onrubia, J. (2005). Aprender y enseñar en entornos virtuales: actividad conjunta, ayuda pedagógica y construcción del conocimiento. *Revista de Educación a Distancia*, 2, 1-12. <https://doi.org/10.6018/red/50/3>
- Redecker, C. (2017). European framework for the Digital Competence of Educators: DigCompEdu. Luxembourg: Publications Office of the European Union. <https://doi.org/10.2760/159770>
- Redecker, C., & Johannessen, O. (2013). Changing assessment - Towards a new assessment paradigm using ICT. *European Journal of Education*, 48(1), 79-96. <https://doi.org/10.1111/ejed.12018>
- Søby, M. (2013). Learning to be: Developing and understanding digital competence. *Nordic Journal of Digital Literacy*, 8(3), 135-138. <https://bit.ly/2ThuTUR>
- UNESCO (Ed.) (2008). ICT competency standard for teachers. <https://bit.ly/2TsJsER>
- Van-Deursen, A., & Van-Dijk, J. (2009). Using the Internet: Skill related problems in users' online behavior. *Interacting with Computers*, 21(6), 393-402. <https://doi.org/10.1016/j.intcom.2009.06.005>
- Van-Deursen, A., & Van-Dijk, J. (2016). Modeling traditional literacy, Internet skills and internet usage: An empirical study. *Interacting with Computers*, 28(1), 13-26. <https://doi.org/10.1093/iwc/iwu027>
- Wertsch, J.V. (1994). The primacy of mediated action in sociocultural studies. *Mind, Culture and Activity*, 1(4), 202-208. <https://bit.ly/2UkuBco>
- Zinchenko, V.P. (1985). Vygotsky's ideas about units for the analysis of mind. In J.V. Wertsch (Ed.), *Culture, communication and cognition: Vygotskian perspectives* (pp. 94-118). New York: Cambridge University Press.