

Exploring Teacher Digital Competence in Secondary Education: Influence of Teaching Experience and Type of center

Explorando la Competencia Digital Docente en Educación Secundaria: Influencia de la Experiencia Docente y la Tipología de Centro



Dña. Estefanía Sánchez-Castellanos

Estudiante de Doctorado. Universidad de Valencia. España



Dr. Vicente Gabarda-Méndez

Profesor Permanente Laborar. Universidad de Valencia. España



Dra. Diana Marín-Suelves

Profesora Titular de Universidad. Universidad de Valencia. España



Dr. Jesús Adrián Ramón-Llin

Profesor Titular de Universidad. Universidad de Valencia. España

Received: 2025/03/25; **Revised:** 2025/04/15; **Accepted:** : 2025/07/09; **Preprint:** 2025/07/27; **Published:** 2025/09/01

ABSTRACT

In an educational environment marked by constant technological advances, it is essential to reflect on teachers' digital competence and the challenges and difficulties they encounter in using technology efficiently in their teaching work. This study focuses on exploring the perception of compulsory secondary education teachers regarding their digital competence, analysing how years of classroom experience and type of school influence existing differences. The research was carried out with a sample of 1,099 teachers from all over Spain, using the DigCompEdu Check-In questionnaire, supplemented with sociodemographic data. The results show that, although teachers tend to consider their digital competence to be at an average level, this perception is lower than the specific scores obtained in the questionnaire. Furthermore, self-perception of digital competence varies according to classroom experience and the type of school where teachers work. These findings highlight the need to develop tailored training programmes to improve the digital skills of teachers in compulsory secondary education and to address differences in access to and use of technology in educational contexts in order to improve its incorporation into the classroom.

RESUMEN

En un entorno educativo marcado por el constante avance tecnológico, resulta esencial reflexionar sobre la competencia digital del profesorado, los desafíos y dificultades que encuentran al usar la tecnología de manera eficiente en su labor pedagógica. Este estudio se centra en explorar la percepción de los docentes de Educación Secundaria Obligatoria sobre su competencia digital, analizando cómo los años de experiencia en el aula y el tipo de centro influyen en las diferencias existentes. La investigación se llevó a cabo con una muestra de 1099 profesores/as de toda España, utilizando el cuestionario DigCompEdu Check-In, complementado con datos sociodemográficos. Los resultados muestran que, aunque los docentes tienden a considerar que su competencia digital es de nivel medio, esta percepción es inferior a los registros específicos obtenidos en el cuestionario. Además, la autopercepción de la competencia digital varía en función de la experiencia en el aula y la tipología de centro del profesorado. Estos hallazgos destacan la necesidad de desarrollar programas de formación adaptados para mejorar las habilidades digitales de los docentes de Educación Secundaria Obligatoria y abordar las diferencias en el acceso y empleo de la tecnología en contextos educativos para mejorar su incorporación en el aula.

KEYWORDS

Teaching digital competence, digital divide, secondary education, professional experience, teaching speciality
Competencia digital docente, brecha digital, educación secundaria, experiencia profesional, especialidad docente

1. Introduction

As education moves towards an increasingly technological landscape, digital competence is emerging as a key skill for individuals to develop in order to thrive in contemporary society. According to Gabarda et al. (2022), digital competence is defined as the knowledge, skills, attitudes and values required to use digital technologies effectively, safely and critically in different contexts, including personal, social and professional ones. In the field of education, this competence is even more strategic: teachers must not only possess it, but also transmit and develop it in their students (Martínez et al., 2023).

Within this framework, digital teaching competence (DTC) is defined as the ability of teachers to effectively utilise ICT in their teaching practice, thereby facilitating relevant learning in a digital environment (Jiménez-Hernández et al., 2021). Castillo and Esmeraldas (2024) argue that DTC encompasses not only the technical proficiency in using digital tools, but also the ability to evaluate, select and apply digital resources that are aligned with educational goals. Additionally, it entails promoting an ethical, critical, and responsible use of ICT (Casillas et al., 2023).

A large body of research has examined the development of DTC at different educational levels, emphasising its influence on teaching quality (Cisneros-Barahona et al., 2024; Fuentes et al., 2019; Rodríguez et al., 2019). In primary education, for example, Bonilla's (2024) recent research indicates that teachers with high digital competence achieve a higher level of engagement and meaningful learning among their students, particularly when they integrate interactive and collaborative tools. In secondary and upper secondary education, studies such as those by Palau et al. (2024) emphasise that teachers' experience and area of specialisation significantly influence their implementation of technology in the classroom. Furthermore, research by Pacheco et al. (2023) highlights the importance of teacher training and lifelong learning for the effective use of technology in education.

Thus, according to Mora-Barzola (2023), teachers with more experience tend to adopt emerging technologies less frequently than younger teachers, although they are better at selecting digital resources critically.

Furthermore, recent literature highlights that the digital divide in education affects not only students, but also teachers, whose DTC can vary significantly depending on factors such as their initial training, opportunities for lifelong learning, and access to technological resources (Cabero-Almenara et al., 2019; Castiñeira-Rodríguez et al., 2022; Girón-Escudero et al., 2019). According to Más-García et al. (2022), this is particularly significant in secondary education, where teachers play a crucial role in preparing students for the challenges of an increasingly digital society.

Various state-of-the-art reviews have highlighted the importance of international frameworks as key references for guiding the development and assessment of DTC, such as the European Framework for the Digital Competence of Educators (DigCompEdu) (Cabero-Almenara & Palacios-Rodríguez, 2020; Hernández et al., 2021; Verdú-Pina et al., 2023). Spain, for example, has adopted and adapted this framework through the National Institute of Educational Technologies and Teacher Training (INTEF), which proposes a progressive model based on levels of competence aligned with the different stages of teacher professional development (INTEF, 2022).

According to the European DigCompEdu framework (Redecker & Punie, 2017), digital competence in teaching is structured around six key dimensions: professional engagement, digital resources, digital pedagogy, assessment and feedback, student empowerment, and

facilitating digital competence. Several studies (Cabero-Almenara & Palacios-Rodríguez, 2020; Gabarda et al., 2025) have highlighted the significant impact of both initial and continuing teacher training on competence development in these areas.

This research aims to analyse the relationship between teaching experience, the type of educational institution, and teachers' self-perception of digital competence in compulsory secondary education and pre-university education in Spain. The study considers the different dimensions that make up this competence, as defined by the DigCompEdu framework, and considers the potential role of prior academic and technological training in developing teachers' digital competence in an increasingly digitised educational environment.

2. Methodology

2.1. Sample

A total of 1,099 subjects (433 men, 653 women, and 13 people who identified as other genders) participated in the study, which corresponds to a sample size of 1,050 for a one-way ANOVA test with three groups, an effect size of 0.11, and a statistical power of 0.90 (G*Power). Table 1 shows the participants categorised according to the various analysis variables.

The sample was obtained through non-probability intentional sampling, based on the availability and willingness of contacted teachers. The overrepresentation of women is consistent with the feminisation of Spain's teaching sector, particularly at pre-university level (INE, 2024).

Table 1

Distribution of study participants

Variables	Categories	N	%
Teaching experience	Limited experience	377	34.3
	Intermediate experience	387	35.2
	Senior experience	335	30.5
Type of centre	Private	56	5.1
	State-subsidised	223	20.3
	State-owned	820	74.6

2.2. Procedure

The study was designed as a quantitative, cross-sectional survey, with data collected at a single point in time. Comparisons were made between initial and final perceptions in response to self-referential items within the same questionnaire.

This study was conducted in five phases. The first phase involved identifying the target population – all teachers of compulsory secondary education in Spain. The second phase entailed obtaining contact details for all educational centres at this level and creating and organising a list of institutional email addresses by autonomous community and province. In the third phase, the schools were contacted and received the informed consent form and the link to the data collection questionnaire. The management team of each institution was asked to distribute the questionnaire among the teaching staff. The fourth stage involved analysing the collected information using the statistical techniques described in the following section. Finally, the results were compiled dissemination.

2.3. Instrument

Data were collected following the Spanish version of the DigCompEdu Check-In instrument (Redecker & Punnie, 2017), adapted by Cabero-Almenara and Palacios-Rodríguez (2020). This questionnaire assesses 22 competences organised into six dimensions: 1) professional engagement, 2) digital resources, 3) teaching and learning, 4) assessment, 5) empowering learners, and 6) facilitating learners' digital competence.

The variables analysed are described below, with a distinction made between dependent and independent variables.

a) Dependent variables:

- *Professional engagement* (DC_prof_engagement) is integrated through organisational communication, professional collaboration, reflective practice, and lifelong learning. These aspects make it possible to analyse the use of digital technologies and coordinate activities between teachers and other educational stakeholders.
- The *digital resources* variable (DC_digital_resources) refers to teachers' ability to select, create and distribute digital teaching materials. This includes the ability to select appropriate resources, adapt them to meet specific needs, and optimise learning. It also relates to protecting, managing and exchanging these materials in the current digital context.
- *Teaching and learning* (DC_teaching_learning) refers to how well teachers can integrate technology into educational processes, including teaching, providing learning support and guidance, and promoting collaborative and self-regulated learning. These skills allow teachers to design, plan, and implement technological strategies within the teaching and learning process.
- *Assessment* (DC_assessment) relates to the quality of the training process, as well as the tools and techniques that facilitate the development of assessment processes. This includes items referring to the use of assessment strategies, learning analytics, and feedback for programming and decision-making purposes.
- *Empowering learners* (DC_empowering_learners) focuses on promoting autonomy and active participation in learning, as well as encouraging involvement and attention to diversity, by responding to the individual needs of students. This includes ensuring accessibility and inclusion, personalising resources and the educational process, and encouraging students to actively commit to learning.

- *Facilitating learners' digital competence* (DC_facilitating_learners_DC) is linked to the development of essential digital skills within the school and civic context. This includes information and media literacy, digital communication and collaboration, creating digital content, using it responsibly, and solving digital problems.

In addition to the six dimensions of the DigCompEdu Check-In questionnaire, the following variables were calculated:

First, the Digital Competence Score out of 5 points (DCS_5), which is the average of the values recorded in the six dimensions of digital competence on a scale of 1 to 5. Next, the Digital Competence Score out of 6 points (DCS_6) was calculated by extrapolating DCS_5 to a scale of 1 to 6 using the formula $=1+((DCS_5)-1)*(5/4)$.

Digital Competence Perception was also recorded immediately before and after the questionnaire. Thus, Starting Perception of Digital Competence (baseline_PDC) was recorded immediately before the questionnaire, and Final Perception of Digital Competence (final_PDC) was recorded immediately after. Both baseline_PDC and final_PDC are measured on a scale of 1 to 6.

In addition, two other variables were analysed:

- The *questionnaire effect*, which compares baseline_PDC and final_PDC – i.e., the evolution of the participants' self-perception of competence before and after the DigCompEdu Check-In questionnaire.
- The level of *adjustment in teachers' self-perception of digital competence* is measured by comparing final_PDC and DCS_6. The final PDC score is the level of perceived competence immediately after the questionnaire, while the DCS_6 score is the actual digital competence score recorded, on a scale from 1 to 6.

b) Independent variables:

- *Teaching experience* has three categories: Limited experience (0–8 years), Intermediate experience (9–22) and Senior experience (more than 22 years). This classification is based on years of service and uses the 33rd percentile to create groups of similar size.
- The *type of school* also has three categories: private, state-subsidised and state-owned.

2.4. Data analysis

Data analysis was performed using SPSS 28.0 (IBM; Chicago, USA). Cronbach's alpha statistic was calculated to analyse the reliability of each dimension of digital competence (professional engagement = 0.70; digital resources = 0.547; teaching and learning = 0.794; assessment = 0.702; empowering learners = 0.729; facilitating learners' DC = 0.882). Values between 0.7 and 0.9 were assessed as indicating reliable internal consistency (Cohen et al.,

2017). The mean, median and interquartile range were used as descriptive measures. Before carrying out the inferential analysis, normality was checked using the Kolmogorov–Smirnov test and homogeneity of variances was verified using Levene's test. To make comparisons of the 6-point digital competence score (DCS_6) between the *teaching experience* and *type of centre* categories, for which normality and/or homogeneity of variances were met, one-way ANOVA tests were performed with post-hoc Bonferroni-adjusted pairwise comparisons. For the ANOVA test, the effect size statistic was calculated using η^2 , with values between 0.01 and 0.05 indicating a small effect, values between 0.06 and 0.13 indicating a medium effect, and values above 0.13 indicating a large effect (Richard et al., 2003). For variables that did not meet the criteria for normality and/or homogeneity of variances, the Kruskal–Wallis test was used to compare dimensions of digital competence and perceptions of digital competence between categories of *teaching experience* and *type of centre*. This was followed by pairwise comparisons using Mann–Whitney U tests with the significance level adjusted using the Bonferroni method (). Finally, Wilcoxon tests were performed to compare both the effect of the questionnaire (baseline_PDC vs final_PDC) and the level of adjustment of perception of digital competence (DCS_6 vs final_PDC). The significance threshold was set at $p < .05$ after the corresponding adjustment.

3. Results

3.1 Teaching experience

The findings indicate that teaching experience significantly affects digital competence (DCS_6) ($F_{2,1096}=6.959$, $p<.001$; $\eta^2_p=.028$). In the pairwise comparisons, it was observed that the *intermediate* experience group had the highest DCS_6 score, while the *senior* experience group had a lower DCS_6 score than the *lower* and *intermediate* experience groups – the latter being significantly lower. When the different variables were analysed, teaching experience was found to have a significant influence on almost all aspects of digital competence, including *professional engagement* ($H_{(2)}=12.96$, $p=.002$), *digital resources* ($H_{(2)}=15.67$, $p<.001$), *teaching and learning* ($H_{(2)}=7.65$, $p=.022$), *empowering learners* ($H_{(2)}=13.29$, $p<.001$). In pairwise comparisons, the *limited experience* group demonstrated significantly lower *professional engagement* than the *intermediate experience* group ($U=62339$, $Z=-3.5$, $p<.001$). However, the *limited experience* group demonstrated significantly greater proficiency in *digital resources* than the *senior experienced* group ($U=54772$, $Z=-3.12$, $p=.002$). Finally, the *intermediate experience* group scored significantly higher than the *senior experience* group in the following dimensions: *professional engagement* ($U=58178$, $Z=-2.39$, $p=.017$), *digital resources* ($U=54673$, $Z=-3.7$, $p<.001$), *teaching and learning* ($U=57344$, $Z=-2.69$, $p=.007$) and *empowering learners* ($U=54632$, $Z=-3.67$, $p<.001$).

Regarding their perception of digital competence perceptions (PDC) (Table 2), *teaching experience* was found to have a significant effect on both baseline ($H_2=18.79$; $p<.001$) and final PDC ($H_2=19.8$; $p<.001$). The *limited experience* group recorded significantly lower PDC than the *intermediate experience* group (baseline_PDC: $U=20341$, $Z=-4.36$, $p<.001$; and final_PDC: $U=20572$, $Z=-4.17$, $p<.001$) and the *senior experience* group (baseline_PDC: $U=53207$, $Z=-3.85$, $p<.001$; and final_PDC: $U=53912$, $Z=-3.59$; $p<.001$). Conversely, the *intermediate experience* group recorded higher PDC than the *limited experience* group, but not significantly so.

Table 2 summarises all these results and compares the means, medians and interquartile ranges according to the level of teaching experience for each dimension of digital competence and for baseline and final perceptions.

Table 2

Comparison of dimensions and perception of digital competence based on teaching experience

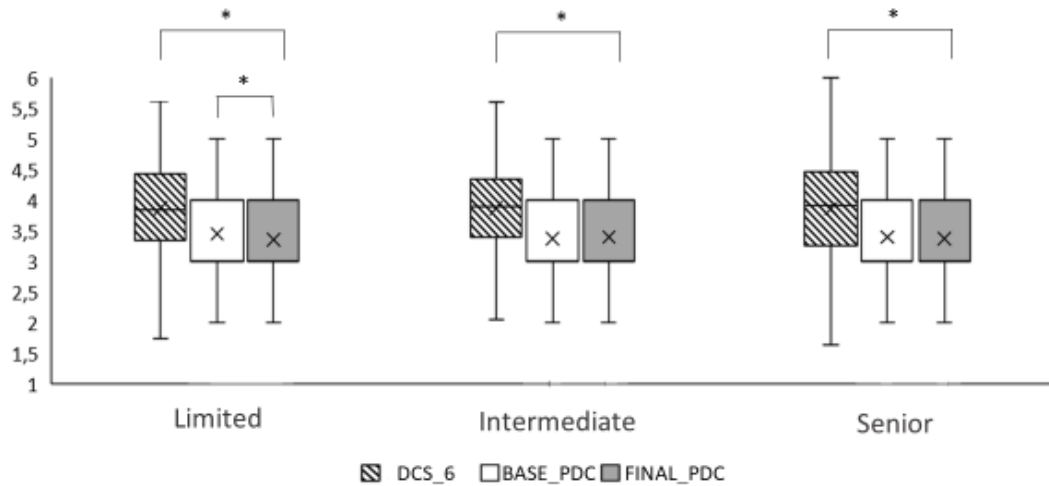
Variables	limited experience			intermediate experience			senior experience		
	M	Mn	IQR	M	Mn	IQR	M	Mn	IQR
Professional engagement	3.31	3.25 ^b	1	3.48	3.5 ^{a,c}	1	3.34	3.25 ^b	0.75
Digital resources	3.46	3.5 ^c	1	3.5	3.5 ^c	1	3.27	3.5 ^{a,b}	1.5
Teaching and learning	3.29	3.25	1.25	3.42 ^c	3.5	1.25	3.25	3.25 ^b	1
Assessment	3.16	3	1	3.21	3	1	3.07	3	0.66
Empowering learners	3.31	3.33	1.33	3.42	3.33 ^c	1.33	3.17	3 ^b	1.33
Facilitating learners' DC	3	3	0.8	3.11	3	1	3.01	3	0.8
DCS_6	3.82 ^b	3.79	1.05	3.95 ^{a,b}	3.92	1.02	3.73 ^b	3.77	1.09
baseline_PDC	3.4	3 ^c	1	3.44	3 ^c	1	3.14	3 ^{a,b}	1
final_PDC	3.35	3 ^c	1	3.42	3 ^c	1	3.1	3 ^{a,b}	1

Note. M=mean; Mn= median; IQR=interquartile range; DCS=digital competence score; PDC=perception of digital competence; a=significant differences with limited experience, b=significant differences with intermediate experience, c=significant differences with senior experience; significance adjusted according to Bonferroni to $p<.016$ for pairwise comparisons.

As can be seen in Figure 1, there was no evidence of an effect of the questionnaire on the perception of digital competence in groups with *intermediate* or *senior experience*. However, there was an effect in the group with *limited experience*, as final_PDC was significantly lower than baseline_PDC ($Z=-2.06$; $p=.039$). Furthermore, all three groups underestimated their actual digital competence, as evidenced by the significant difference observed in favour of DCS_6 compared to final_PDC (*limited experience*: $Z=-10.9$; $p<.001$; *intermediate experience*: $Z=-12.9$; $p<.001$; *senior experience*: $Z=-12.8$; $p<.001$).

Figure 1

Effect of the questionnaire (baseline_PDC vs. final_PDC) and adjustment of the perceived level of digital competence (final_PDC vs. DCS_6) in groups with different levels of teaching experience



Note. *= $p < .016$ by Bonferroni adjustment; BASE_PDC=Baseline_PDC

3.2.2. Type of centre

As shown in Table 3, the type of school had a statistically significant impact on DCS_6 ($F_{2,1085}=3.55$, $p < .001$; $\eta^2_p = .007$). Pairwise comparisons revealed that teachers at *state-subsidised schools* had a significantly higher level of digital competence than those at *state-owned schools*. Teachers at *private schools* had the highest level of digital competence, though the difference with other schools was not significant. Analysing the different DC dimensions revealed that the type of school significantly influenced the DC dimensions of professional engagement ($H_{(2)}=6.73$, $p=.035$) and teaching and learning ($H_{(2)}=23.01$, $p < .001$). Generally, teachers at *state-owned schools* recorded the lowest levels of competence across all dimensions. Teachers at *private schools* recorded the highest levels of competence in professional engagement, digital resources, and teaching and learning. Teachers at *state-subsidised schools* recorded the highest levels of competence in assessment, empowering learners, and facilitating learners' digital competence. Pairwise comparisons showed that teachers in *state-owned schools* scored lower in digital teaching and learning than those in *private schools* ($U=17324$, $Z= -2.77$, $p=.006$) and *state-subsidised schools* ($U=73086$, $Z= -4.2$, $p=.001$). Teachers at *state-owned schools* also demonstrated lower levels of professional engagement than those at *private schools* ($U=18125$, $Z= -2.32$, $p=.020$).

In terms of perception of digital competence (Table 2), the *type of school* had a significant effect on both baseline ($H_2=14.42$; $p < .001$) and final ($H_2=12.67$; $p=.002$) PDC, with PDC being higher in *private schools* than in *state-owned schools* (baseline_PDC: $U=15849$, $Z= -3.80$, $p < .001$; and final_PDC: $U=16392$, $Z= -3.50$, $p < .001$) and *state-subsidised schools* (baseline_PDC: $U=4501$, $Z= -3.14$, $p=.002$; and final_PDC: $U=4671$, $Z= -2.83$, $p=.005$). The group of *state-subsidised schools* also had higher PDS values than the group of *public schools*, but the difference was not significant.

Table 3

Comparison of dimensions and perception of digital competence according to the type of school in which teachers were employed

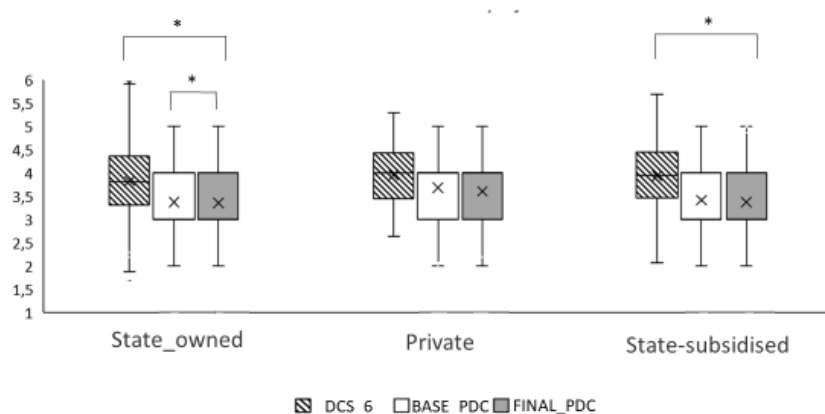
Variables	private			state-subsidised			state-owned		
	M	Mn	IQR	M	Mn	IQR	M	Mn	IQR
Professional engagement	3.58	3.5 ^c	0.75	3.42	3.5	1	3.35	3.25 ^a	0.75
Digital resources	3.56	3.5	1	3.43	3.5	1	3.4	3.5	1
Teaching and learning	3.55	3.63 ^c	1.25	3.5	3.5 ^c	1	3.26	3.25 ^{a,b}	1
Assessment	3.14	3	1.34	3.21	3	1	3.14	3	1
Empowering learners	3.33	3.33	1.5	3.34	3.33	1.33	3.29	3.33	1.33
Facilitating learners' DC	3.09	3.2	0.9	3.16	3.2	0.8	3.01	3	0.8
DCS_6	3.97	3.99	0.97	3.93 ^c	3.92	0.98	3.8 ^b	3.79	1.07
baseline_PDC	3.75	4 ^{b,c}	1	3.36	3 ^a	1	3.3	3 ^a	1
final_PDC	3.66	4 ^{b,c}	1	3.32	3 ^a	1	3.27	3 ^a	1

Note. M=mean; Mn= median; IQR=interquartile range; DCS=digital competence score; PDC=perception of digital competence; a=significant differences with private schools, b=significant differences with state-subsidised schools, c=significant differences with state-owned schools. Significance adjusted according to Bonferroni to $p<.016$ for pairwise comparisons.

Finally, as illustrated in Figure 2, the questionnaire was found to have no significant impact on perceptions of digital competence among *private* and *state-subsidised schools*. However, it did have an effect on the *state-owned* group, where the final PDC decreased ($Z=-2.28$; $p=.022$). All groups underestimated their digital competence, as their DCS_6 was higher than their final_PDC (*private*: $Z=-3.13$; $p=.002$; *state-subsidised*: $Z=-9.89$; $p<.001$; *state-owned*: $Z=-18.24$; $p<.001$)

Figure 2

Effect of the questionnaire (baseline_PDC vs. final_PDC) and adjustment of the perceived level of digital competence (final_PDC vs. DCS_6) depending on the type of school



Note. $*=p<.016$ by Bonferroni adjustment; BASE_PDC=Baseline_PDC

4. Discussion

In a society characterised by constant change in all areas of daily life brought about by technology and digitalisation, education is no exception (Rodríguez et al., 2024). It is therefore essential to analyse digital teaching competence (DTC) as a key factor in responding to the new demands of the education system. This study contributes to the growing interest in evaluating and enhancing this competence across various teaching levels (Más-García et al., 2022; Pérez-García et al., 2023). Previous studies have covered topics ranging from early childhood education to higher education (Gabarda et al., 2025; Andreassen et al., 2022), while others have focused specifically on secondary education (Lindberg et al., 2017). Furthermore, the topic has attracted considerable international and comparative interest (Gouseti et al., 2023; Ishak et al., 2022; Orosco-Fabian et al., 2021; Palacios-Rodríguez et al., 2025).

This study aimed to analyse secondary school teachers' self-perceptions of digital competence by considering the scores they obtained in a questionnaire and how they perceived their own competence before and after completing it. The influence of two independent variables – teaching experience and school type – on digital competence levels was also analysed.

These variables were chosen based on a review of previous literature and studies conducted with similar samples, which examined other factors such as gender and age (González-Medina et al., 2024), as well as initial and lifelong teacher training in digital technologies (Romero-Tena et al., 2024). As Sánchez et al. (2024) point out, these variables do not uniformly impact the development of DTC, which highlights the need to further explore those that may generate gaps in the system.

In relation to teaching experience, which was also studied previously by Krumsvik et al. (2016), the results show that teachers with intermediate experience levels achieve the highest digital competence scores, both globally and in terms of professional engagement, digital resources, teaching and learning, and empowering learners. This suggests that teachers in the middle phase of their career may be more willing to embrace new technologies and combine a solid pedagogical foundation with an openness to innovation.

The most experienced group has significantly lower scores, which could be linked to their limited exposure to digital technologies during initial training. In contrast, although the least experienced group is more familiar with digital environments, they have lower scores in professional engagement, which can be explained by their limited institutional experience. These findings add nuance to previous studies, such as that by Martínez et al. (2023), which indicated higher digital self-assessment among younger teachers. Our study is also consistent with the mixed evidence provided by González-Rodríguez et al. (2023), who found no significant differences based on experience.

In terms of self-perception of digital competence, a significant difference was observed between baseline and final perceptions in the less experienced group, with scores dropping after they responded to the questionnaire. This phenomenon, which was also identified by Ferrando-Rodríguez et al. (2023), can be interpreted as competence idealisation. This is where awareness of the components of digital competence leads to a lower initial self-assessment. Previous research in this area (Gabarda et al., 2022; Cabero et al., 2020) has demonstrated that this effect is particularly evident among trainee teachers and those in the early stages of their careers.

The results also reveal significant differences regarding the type of school. Teachers in subsidised private schools demonstrate the highest levels of digital competence, particularly in the areas of teaching and learning and assessment. They were followed by those in private schools. State-owned schools generally have the lowest scores in all dimensions, potentially due to lower resource availability or differences in institutional training plans. These results are consistent with those of Portillo et al. (2022), who also observed higher levels of digital competence in state-subsidised private schools. However, other studies, such as that by Quiroz et al. (2023), which focused on future teachers, found no differences when the schools of origin were considered.

In terms of perceived digital competence according to school type, teachers in private schools exhibited higher levels of self-perception at both the beginning and end of the study. However, the questionnaire only had a significant effect in state-owned schools, where the final score increased compared to the initial perception. This pattern suggests an initial underestimation that is corrected upon becoming aware of the evaluated components, which differs from the idealisation pattern identified in other groups. These results are consistent with the findings of Ferrando et al. (2024), who also observed this self-perception adjustment effect following a structured evaluation.

In summary, the findings demonstrate that digital teaching competence is influenced by professional experience and the institutional context. Furthermore, the awareness of one's own competencies may change following a guided assessment, which highlights the importance of incorporating reflection tools, such as the DigCompEdu Check-In questionnaire, into teacher training programmes.

5. Conclusions

In today's interconnected world, which is increasingly technology-mediated and undergoing rapid change and transformation in all areas, digital teaching competence has become a key element in of teaching and learning processes, both inside and outside the classroom.

This new reality demands more and more from education professionals, as preparing students for the challenges of digital society largely depends on their own training and digital competence. In this context, understanding the level of digital competence among compulsory secondary education teachers is essential for identifying areas for improvement, designing training programmes, and promoting the critical and pedagogical integration of technology into teaching practice.

This study reveals significant variations in teachers' digital competence, depending on factors such as professional experience and school type. Teachers with intermediate experience tend to have higher levels of digital competence than those with more limited or more extensive experience, while teachers in state-owned schools tend to score lower than their colleagues in subsidised and private schools. Similarly, discrepancies were observed between teachers' initial and final self-perception of competence, highlighting phenomena such as competence idealisation or underestimation, and reinforcing the value of tools that encourage reflection on one's own practice.

There is still an urgent need for more teacher training in digital technologies. The digital divide was already a reality before the pandemic (Calderón, 2019) – which only exacerbated

the issue (Rodicio-García et al., 2020) – and it continues to be a challenge today (Martín et al., 2022; Gabarda et al., 2025). Training programmes, including initial training and lifelong learning plans (Ferrando et al., 2023), should address technical, pedagogical, ethical and critical aspects in order to encourage the reflective, inclusive and adaptive use of technology, thereby addressing student diversity and reducing digital divides.

Although this study has a large, representative sample, its main limitations are its exclusive use of quantitative techniques and its cross-sectional design. This restricts the depth of the analysis and makes it difficult to establish causal relationships between the variables. A future line of research could involve complementing these results with qualitative techniques to gain a deeper understanding of how teachers perceive and construct their own digital competence on a day-to-day basis. Such a study would also be valuable in verifying the stability of the DigCompEdu model using confirmatory factor analysis – which is interesting, given its increasing use as a diagnostic and training tool.

Finally, it would be interesting to explore how secondary school teachers' actual use of digital resources in different subjects influences the development of their digital competence, and the role that schools and other organisational and contextual factors play in such competence.

Author Contributions

Conceptualisation: E.S.C., D.M.S. and V.G.M.; methodology: E.S.C., D.M.S. and J.R-L.,M.; software: J.R-L.,M.; validation: E.S.C., D.M.S. and V.G.M.; research: E.S.C., D.M.S., V.G.M. and J.R-L.,M.; resources, E.S.C., D.M.S., V.G.M. and J.R-L.,M.; data analysis: E.S.C. and J.R-L.,M.; original draft writing: E.S.C., D.M.S., V.G.M. and J.R-L.,M.; writing, review and editing: E.S.C., D.M.S., V.G.M. and J.R-L.,M.; supervision: D.M.S. and V.G.M.

Funding

This work is framed within the Secundari@ Digit@l project, funded by the Spanish Ministry of Science and Innovation in the 2022 call for Knowledge Generation Projects (PID2022-137366OB-I00). It is also related to the first author's doctoral thesis project.

Data Availability Statement

The data set used in this study is available at reasonable request to the corresponding author

Ethics approval

Not applicable

Consent for publication

All authors have consented to the publication of the results obtained by means of the corresponding consent forms.

Conflicts of interest

This study was approved by the Institutional Ethics Committee of the National University of Distance Education.

Rights and permissions

Open Access. This article is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/), which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made.

References

- Andreasen, J. K., TØmte, C. E., Bergan, I., & Kovac, V. B. (2022). Professional digital competence in initial teacher education: An examination of differences in two cohorts of pre-service teachers. *Nordic Journal of Digital Literacy*, 17(1), 61-74. <https://doi.org/10.18261/njdl.17.1.5>
- Bonilla, R. (2024). Competencia digital docente en Educación Primaria: Una revisión sistemática de la literatura. *MLS Communication Journal*, 2(2), 119-141. <https://doi.org/10.69620/mlscj.v2i2.2969>

- Cabero-Almenara, J., & Martínez-Gimeno, A. (2019). Las TIC y la formación inicial de los docentes. Modelos y competencias digitales. *Profesorado, Revista De Currículum Y Formación Del Profesorado*, 23(3), 247–268. <https://doi.org/10.30827/profesorado.v23i3.9421>
- Cabero-Almenara, J., & Palacios-Rodríguez, A. (2020). Marco Europeo de Competencia Digital Docente «DigCompEdu». Traducción y adaptación del cuestionario «DigCompEdu Check-In». *Edmetíc*, 9(1), 213-234. <https://doi.org/10.21071/edmetíc.v9i1.12462>
- Cabero, J., Barroso-Osuna, J., Rodríguez -Gallego, M., & Palacios, A. (2020). La Competencia Digital Docente. El caso de las universidades andaluzas. *Aula Abierta*, 49(4), 363–375. <https://doi.org/10.17811/rifie.49.4.2020.363-372>
- Calderón, D. (2019). Una aproximación a la evolución de la brecha digital entre la población joven en España (2006-2015). *Revista Española de Sociología*, 28(1), 27-44. <https://doi.org/10.22325/fes/res.2018.16>
- Casillas Martín, S., García-Valcárcel, A., Cabezas González, M. & García Hernández, A. (2023). *Tendencias en la investigación educativa para la actualización del profesorado en su competencia digital*. ESIC.
- Castillo, Y. M., & Esmeraldas, E. D. (2024). Estudio autoperceptivo de las competencias digitales del profesorado del ámbito pedagogía en el Distrito 13D11. *Maestro y Sociedad*, 229-239.
- Castiñeira-Rodríguez, N., Rial, L., & Pérez-Rodríguez, U. (2022). Competencia digital docente para crear contenidos: autopercepción del profesorado en formación didáctico-científica de Galicia (España). *Educação E Pesquisa: Revista Da Faculdade de Educação Da Universidade de São Paulo*, 48(1), 70. <https://dialnet.unirioja.es/download/articulo/8575102.pdf>
- Cisneros-Barahona, A. S., Marqués-Molíás, L., Samaniego-Erazo, G. N., & Mejía-Granizo, C. M. (2024). Evaluación de la competencia digital docente. Un análisis que integra las perspectivas descriptiva, inferencial y multivariada. *RIED-Revista Iberoamericana de Educación a Distancia*, 27(2), 185-221. <https://doi.org/10.5944/ried.27.2.39122>
- Cohen, L., Manion, L., & Morrison, K. (2017). *Research methods in education*. Routledge
- Ferrando-Rodríguez, M. de L., Gabarda-Méndez, V., Marín- Suelves, D., & Ramón-Llin, J. A. (2023). ¿Crea contenidos digitales el profesorado universitario? Un diseño mixto de investigación. *Pixel-Bit. Revista De Medios Y Educación*, 66, 137–172. <https://doi.org/10.12795/pixelbit.96309>

- Ferrando-Rodríguez, M. de L., Marín- Suelves, D., Gabarda-Méndez, V., & Ramón-Llin, J. A. (2023). Profesorado universitario. ¿Consumidor o productor de contenidos digitales educativos? *Revista Electrónica Interuniversitaria de Formación del Profesorado*, 26(1), 13–25. <https://doi.org/10.6018/reifop.543391>
- Ferrando-Rodríguez, M. de L., Gabarda-Méndez, V., Marín- Suelves, D., & Ramón-Llin, J. A. (2024). Diagnóstico del nivel de competencia digital autopercebido del profesorado universitario para la creación de contenidos: incidencia de la modalidad de enseñanza. *Bordón, Revista de Pedagogía*, 76(2), 87-105. <https://doi.org/10.13042/Bordon.2024.98836>
- Fuentes, A., Lopez, J., & Pozo, S. (2019). Análisis de la Competencia Digital Docente: Factor Clave en el Desempeño de Pedagogías Activas con Realidad Aumentada. *REICE: Revista Iberoamericana Sobre Calidad, Eficacia Y Cambio En Educación*, 17(2), 27–42. <https://dialnet.unirioja.es/descarga/articulo/6908667.pdf>
- Gabarda-Méndez, V., Marín- Suelves, D., Gabarda, C., & Ramón-Llin, J.A. (2022). Future teachers facing the use of technlogoy for inclusion: a view from the digital competence. *Education and Information Technologies*, 28, 9305-9323. <https://doi.org/10.1007/s10639-022-11105-5>
- Gabarda-Méndez, V., Cuevas, N., Colomo, E., & Cívico Ariza, A. (2022). Competencias Clave, Competencia Digital y formación del profesorado: Percepción de los Estudiantes de Pedagogía. *Profesorado, Revista de Currículum y Formación del Profesorado*, 26(2), 7–27. <https://doi.org/10.30827/profesorado.v26i2.21227>
- Gabarda-Méndez, V., Pardo, M.I., Sánchez, M., & Marín-Suelves, D. (2025). El docente digital: influencia de la formación inicial y permanente en la competencia digital docente. *IJERI: International Journal of Educational Research and Innovation*, 23, 1-13. <https://doi.org/10.46661/ijeri.10769>
- Garcés, G., & Bastías, E. (2025). Competencies model for online learning in higher education: A bibliometric analysis and systematic review. *RIED-Revista Iberoamericana de Educación a Distancia*, 28(1). <https://doi.org/10.5944/ried.28.1.41351>
- Girón-Escudero, V., Cózar-Gutiérrez, R., & González-Calero Somoza, J. A. (2019). Análisis de la autopercepción sobre el nivel de competencia digital docente en la formación inicial de maestros/as. *Revista Electrónica Interuniversitaria de Formación del Profesorado*, 22(3), 193–218. <https://doi.org/10.6018/reifop.373421>

- González-Medina, I., Pérez-Navío, E., & Gavín Chocano, O. (2024). Análisis de la competencia digital en profesores de educación primaria en relación con los factores de género, edad y experiencia. *Pixel-Bit. Revista De Medios y Educación*, 71, 179–201. <https://doi.org/10.12795/pixelbit.107277>
- González-Rodríguez, D., Rodríguez-Esteban, A., & González-Mayorga, H. (2022). Diferencias en la formación del profesorado en competencia digital y su aplicación en el aula. Estudio comparado por niveles educativos entre España y Francia. *Revista Española de Pedagogía*, 80(282), 371–390. <https://doi.org/10.22550/REP80-2-2022-06>
- Gouseti, A., Lakkala, M., Raffaghelli, J., Ranieri, M., Roffi, A., & Ilomäki, L. (2023). Exploring teachers' perceptions of critical digital literacies and how these are manifested in their teaching practices. *Educational Review*, 76(7), 1751-1785. <https://doi.org/10.1080/00131911.2022.2159933>
- INE (2024). Mujeres en el profesorado por enseñanza que imparten. Datos correspondientes al curso 2021-2022. Instituto Nacional de Estadística.
- Instituto Nacional de Tecnologías Educativas y de Formación del Profesorado (INTEF) (2022). *Marco Común de Competencia Digital Docente*. Ministerio de Educación y Formación Profesional. <https://www.intef.es/competencia-digital-docente/>
- Ishak, N., Din, R., & Othman, N. (2022). Teachers' perceptions and challenges to the use of technology in teaching and learning during COVID-19 in Malaysia. *International Journal of Learning, Teaching and Educational Research*, 21(5), 281-308. <https://doi.org/10.26803/ijlter.21.5.15>
- Jiménez-Hernández, D., Muñoz, P. & Sánchez, F.S. (2021). La Competencia Digital Docente, una revisión sistemática de los modelos más utilizados. *RiiTE Revista Interuniversitaria de Investigación en Tecnología Educativa*, 10, 105-120. <https://doi.org/10.6018/riite.472351>
- Krumsvik, R. J., Jones, L. Ø., Øfstegaard, M., & Eikeland, O. J. (2016). Upper secondary school teachers' digital competence: Analysed by demographic, personal and professional characteristics. *Nordic Journal of Digital Literacy*, 11 (3), 143-164. <https://doi.org/10.18261/issn.1891-943x-2016-03-02>
- Lindberg, O. J., Olofsson, A. D., & Fransson, G. (2017). Same but different? An examination of swedish upper secondary school teachers' and students' views and use of ICT in education. *International Journal of Information and Learning Technology*, 34(2), 122-132. <https://doi.org/10.1108/IJILT-09-2016-0043>

- Más-García, V., Gabarda-Méndez, V., & Peirats-Chacón, J. (2022). Competencia digital del profesorado de Educación Secundaria: Análisis del estado del arte. *REIDOCREA*, 11(35), 418-430. <https://doi.org/10.30827/Digibug.76068>
- Martínez, S. J. R., González, L. G., & Álvarez, I. M. (2023). La competencia digital en profesores españoles de Primaria, Secundaria y Universidad. *Profesorado, Revista de Currículum y Formación del Profesorado*, 27(1), 347-371.
- Martín, E. L., Tapia, R. R., Martín, R. U., & Iglesias, J. D. (2022). Competencia digital del profesorado de educación secundaria en tiempo de COVID-19. *Investigações em Ensino de Ciências*, 27(3), 59-77.
- Mora-Barzola, M. K. (2023). Estrategias tecnológicas emergentes para el desempeño docente. *Revista Arbitrada Interdisciplinaria Koinonía*, 8(2), 949–964. <https://doi.org/10.35381/r.k.v8i2.3039>
- Orosco-Fabian, J. R., Pomasunco-Huaytalla, R., Gómez-Galindo, W., Salgado-Samaniego, E., & Colachagua-Calderón, D. A. (2021). Digital competences in secondary education teachers in a province of central Peru. *Revista Electrónica Educare*, 25(3), 1-25. <https://doi.org/10.15359/ree.25-3.34>
- Pacheco, R. J. P., Ashqui, M. T. U., Loachamin, L. A. M., Revelo, G. P. P., & Hidalgo, L. A. J. (2023). Revolucionando la educación: Implementación efectiva de la tecnología en el aula. *GADE: Revista Científica*, 3(1), 33-47. <https://dialnet.unirioja.es/descarga/articulo/8878525.pdf>
- Palacios-Rodríguez, A., Llorente-Cejudo, C., Lucas, M., & Bem-Haja, P. (2025). Macroevaluación de la competencia digital docente. Estudio DigCompEdu en España y Portugal. *RIED-Revista Iberoamericana de Educación a Distancia*, 28(1), 177–196. <https://doi.org/10.5944/ried.28.1.41379>
- Palau, R., Fretes, G., & Santiago-Campión, R. (2024). Propuestas para la implementación de la Competencia Digital Docente (CDD): la visión de los docentes. *Contextos Educativos. Revista De Educación*, (33), 177–192. <https://doi.org/10.18172/con.5680>
- Pérez-García, J. A., Martínez-García, M. D., & García-Hernández, Y. (2024). Estudio bibliométrico sobre competencias digitales docentes. *Revista Espacios*, 45(2), 109-122. <https://doi.org/10.48082/espacios-a24v45n02p09>
- Portillo-Berasaluce, J., Romero, A., & Tejada, E. (2022). Competencia Digital Docente en el País Vasco durante la pandemia del COVID-19. *RELATEC*, 21(1), 1-18. <https://doi.org/10.17398/1695-288X.21.1.57>
- Quiroz, J. S., Pais, M. H. R., & Faúndez, G. A. (2023). Level of digital competence of students in the first year of initial teacher training: a look from the variables of gender and educational center. *Pixel-Bit. Revista de Medios y Educación*, 68, 155-182. <https://doi.org/10.12795/pixelbit.101081>
- Redecker, C. & Punie, Y. (2017). European Framework for the Digital Competence of Educators: DigCompEdu. Publications Office of the European Union. <https://doi.org/10.2760/159770>

Richard, F. D., Bond Jr, C. F., & Stokes-Zoota, J. J. (2003). The interpretation of factor analysis in the analysis of variance. *Personality and Social Psychology Review*, 7(3), 286-300. https://doi.org/10.1207/S15327957PSPR0703_4

Rodicio-García, M. L., Ríos-de-Deus, M. P., Mosquera-González, M. J., & Penado-Abilleira, M. (2020). La Brecha digital en estudiantes españoles ante la crisis de la Covid-19. *Revista Internacional de Educación para la Justicia Social*, 9(3), 103–125. <https://doi.org/10.15366/riejs2020.9.3.006>

Rodríguez, M. C., Suelves-Marín, D., & Sáiz, H. (2019). Competencia digital e inclusión educativa. Visiones de profesorado, alumnado y familias. *Revista de Educación a Distancia (RED)*, 19(61), 1-37. <https://doi.org/10.6018/red/61/06>

Rodríguez-Rodríguez, J., Area-Moreira, M., & San Martín-Alonso, Á. (2024). *Infancia y transformación digital de la educación: miradas diversas*. Dykinson.

Romero-Tena, R., Barragán-Sánchez, R., Gutiérrez-Castillo, J. J., & Palacios-Rodríguez, A. (2024). Análisis de la competencia digital docente en Educación Infantil. Perfil e identificación de factores que influyen. *Bordón. Revista De Pedagogía*, 76(2), 45–63. <https://doi.org/10.13042/Bordon.2024.100427>

Sánchez, E., Marín-Suelves, D., & Gabarda, V. (2024). La competencia digital docente en educación secundaria: analizando la evidencia científica. *Hachetetepe*, 28, 1-32. <https://doi.org/10.25267/Hachetetepe.2024.i28.1204>

Verdú-Pina, M., Lázaro-Cantabrana, J. L., Grimalt-Álvaro, C., & Usart, M. (2023). El concepto de competencia digital docente: revisión de la literatura. *Revista electrónica de investigación educativa*, 25, e11, 1-13. <https://doi.org/10.24320/redie.2023.25.e11.4586>

How to cite:

Sánchez-Castellanos, E., Gabarda-Méndez, V., Marín-Suelves, D., & Ramón-Llin Mas, J.A. (2025). Exploring Teacher Digital Competence in Secondary Education: Impact of Teaching Experience and Type of center [Explorando la Competencia Digital Docente en Educación Secundaria: Impacto de la Experiencia Docente y la Tipología de Centro]. *Pixel-Bit, Revista de Medios y Educación*, 74, art.6. <https://doi.org/10.12795/pixelbit.114743>