Digital competence and content creation at University: influence of ownership and region

Competencia digital y creación de contenido en la universidad: influencia de la titularidad y la región

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Recepción: 01 Junio 2024
Aprobación: 23 Julio 2024

Abstract

The scientific literature of recent years has shown that the area of content creation is one of the most critical in the set of technological skills of teachers, also confirming that personal and professional variables influence the creation of digital educational content. The aim of this study is to investigate whether the level of self-perceived digital competence of university professors teaching in public universities differs from that of professors teaching in private universities. It also aims to investigate whether aspects such as the academic category or the location of the university influence teachers' digital competence. The research sample is made up of 770 professors from different public and private universities in the different autonomous communities that make up the country of Spain, who responded to a selection of items from the DigCompEdu Check-In questionnaire related to the use, selection and creation of digital content. The results show that teachers in private universities have a significantly higher level of digital competence than those in public universities, with no significant influence on the digital competence of teachers among tenured and full professors, and a higher Digital Content Creation (DCC) skill among teachers in universities in the Community of La Rioja, compared to those in Madrid, Catalonia, Castilla León, Castilla la Mancha, the Basque Country and Andalusia. These results make it possible to identify the needs in terms of initial and continuing training, as a means of identifying the requirements for the design of specific strategies.

Keywords: **digital competence, teachers, higher education, digital contents.**

Resumen

La literatura científica de los últimos años ha puesto de manifiesto que el área de creación de contenidos es una de las más críticas en el conjunto de habilidades tecnológicas del profesorado, habiendo igualmente variables de índole personal y profesional que influyen en la creación de contenido digital educativo. El presente estudio busca investigar sobre si el nivel de competencia digital

autopercibido del profesorado universitario que ejerce su docencia en universidades públicas es distinto al que ejerce en universidades privadas. Asimismo, se pretende, explorar si aspectos como la categoría académica o la localización de la universidad influyen en la competencia digital de los docentes. La muestra de la investigación está compuesta por 770 docentes de diferentes universidades públicas y privadas de las distintas comunidades que componen el estado español, y que han respondido a una selección de ítems del cuestionario DigCompEdu Check-In vinculados con la utilización, selección y creación de contenidos digitales. Los resultados muestran que el profesorado de universidades privadas tuvo significativamente mayores registros de competencia digital que el profesorado que ejerce en universidades públicas, no evidenciándose una influencia significativa sobre la competencia digital docente entre el profesorado Titular y Catedrático de Universidad y registrándose una mayor CCD en el profesorado de las universidades de la comunidad de La Rioja, frente a las de Madrid, Cataluña, Castilla León, Castilla la Mancha, País Vasco y Andalucía. Estos hallazgos permiten identificar necesidades en la formación inicial y permanente, sirviendo como detección de necesidades para el diseño de estrategias específicas.

Palabras clave: **competencia digital, profesorado, educación superior, contenidos digitales.**

INTRODUCTION

In a networked society, where technology transcends borders and transforms cultures and identities (Castells, 2006), digital competence is key to processes of educational transformation (Fernández-Enguita, et al., 2023). In particular, there is a growing interest in the digital competence of university teachers, as evidenced by the increase in research and systematic literature reviews on this phenomenon in recent years (Ferrando-Rodriguez et al., 2022; Perdomo et al., 2020; Viñoles-Consentino et al., 2022). Most studies show that the digital competence of university teachers is analysed on the basis of self-perception, identifying an intermediate level of digital competence and showing differences according to specific skills and personal and professional variables. The research also highlights the need for further research on this topic, to vary research designs and to promote institutional strategies that favour the digital transformation of teaching and learning processes in universities.

Without neglecting the impact that the pandemic caused by COVID-19 continues to have on the current educational scenario (Sá & Serpa, 2020), many research teams continue to address issues related to competences in universities (Villa, 2020), to the digital competence of teachers in general (Cuevas et al., 2022; Sánchez et al., 2020) and to the digital competence of university teachers in particular (Builes et al., 2021; Cabero-Almenara et al., 2021; Gabarda, Ferrando-Rodríguez & Romero, 2023; Guillén-Gámez et al, 2021; Mengual, et al., 2016; Mercader & Durán-Bellonch, 2021; Nebot, et al., 2021; Prendes, 2010;Prendes et al., 2018; Sánchez et al., 2021; Torres et al., 2022).

Thus, over the last two decades or so, studies have been developed that attempt to define new roles and functions for university teachers based on the incursion of educational technologies into the classroom. Well-known authors in this field have already pointed out that the role of the teacher should go beyond the transmission of content. Teachers must adapt the content to the context of the students, thus becoming designers and creators of the curriculum (Adell, 2006). They must be programmers, directors and coordinators of learning with interactive media (Tejada, 1999), creators and mediators of learning experiences (Pothier, 2001), managers of learning resources, and facilitators in the use of tools (Salinas, 2004). In short, they have to adapt, produce and evaluate materials from different media (Cebrián, 2016).

Recently, Builes et al. (2023) synthesised previous reviews to propose a reference framework of 12 competencies related to the role of university teachers, based on the models of teaching competencies proposed by Gallent (2015), Villa and García (2006) and Zabalza (2010): Planning competence, Learning management competence, Disciplinary knowledge competence, Communication competence, Pedagogical leadership competence, Learning assessment competence, Transversal digital competence, Tutoring competence, Psycho-pedagogical competence, Teaching collegiality competence, Personal development competence, and Competence to review and improve teaching practice.

Based on this proposal and due to the nature of this work, we will focus on competences related to the use of ICTs (Villa & García, 2006), technological competences (Gallent, 2015) and those related to the handling of new technologies, as well as the selection and preparation of digital content by university teachers, issues that Zabalza already pointed out more than a decade ago.

Recognising these skills implies viewing university teachers as professionals who not only have up-to-date knowledge of advances in educational technology, but who are also able to integrate these technologies in a relevant and effective way into their daily teaching practice. Thus, an adequate selection of content that ensures up-to-date, high-quality teaching, and where the use of educational technologies promotes opportunities to transform university teaching (Zabalza, 2010), implies that teachers must go beyond the selection and structuring of disciplinary content: teachers must integrate into their practice not only a deep knowledge of the content, but also the best way to teach it through the integration of technology (Mishra & Koehler, 2006).

This transformation of the teaching role makes teachers responsible for both designing learning opportunities and creating the environment for students to have a meaningful learning experience that integrates technology, pedagogy and disciplinary knowledge (Cejas et al., 2016).

Teachers' technological competence is therefore not merely instrumental, but involves reflection and research from and into their own professional practice.

In this way, teachers need to be experts in digital pedagogical content and enriched personal and organisational learning environments, generating and managing new pedagogical practices (Esteve-Mon et al., 2018), integrating the didactic perspective over a purely technological one in pedagogical innovations (Gisbert & Lázaro, 2015).

This improves the use of the communicative potential and access to information offered by educational technologies (Rodríguez-Hoyos et al., 2021), planning an innovative teaching-learning process that includes, among other skills, the creation of digital content that enables students to learn more autonomously (Villarroel & Stuardo, 2022).

Given that previous studies (Ferrando-Rodríguez et al., 2023a; Ferrando-Rodríguez et al., 2023b) have already analysed the level of Digital Teaching Competence (DTC) for the creation of digital content among university teachers and identified some of the variables that influence its development (such as academic level, degree, field of knowledge, technological training, age, gender, training and previous teaching experience), this work focuses on the level of self-perceived digital competence of university teachers depending on whether they teach in a private or public university.

It will also explore whether the academic category or location of the university influences teachers' digital competence.

METHOD

This study followed a quantitative research methodology. The self-perceived level of digital competence of university teachers in creating digital educational content was objectively measured.

Procedure

In order to carry out this study, the four phases detailed in Figure 1 were carried out.

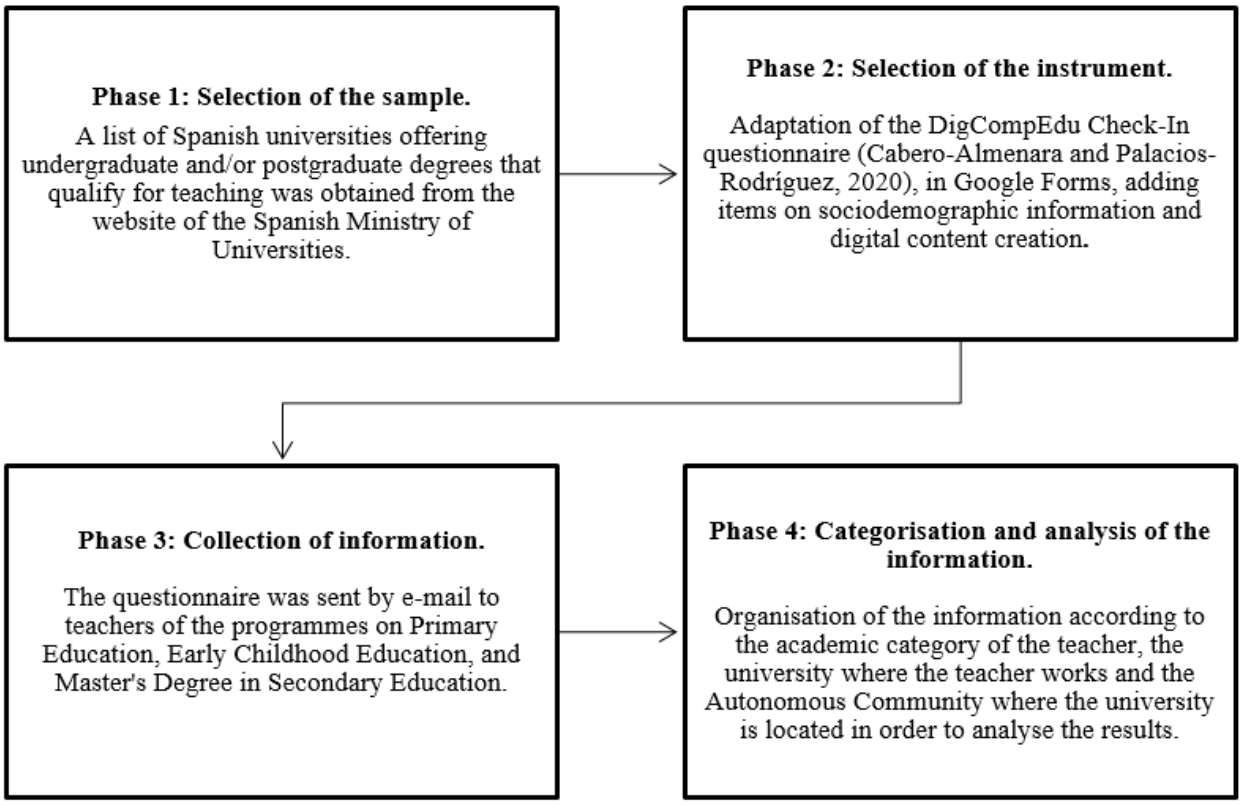

Figure 1
Study phases

Instrument

The adaptation of the DigCompEdu Check-In questionnaire (Cabero-Almenara & Palacios-Rodríguez, 2020) was used for data collection. This instrument measures the development of digital competence in teaching, as suggested by the DigCompEdu framework proposed by Redecker and Punie (2017), which includes 22 items integrated in six competence areas: professional engagement, digital resources, digital pedagogy, assessment and feedback, student empowerment, and promotion of student digital competence.

Sample

A non-probabilistic convenience sampling technique was used to obtain as many participants as possible. The sample consisted of 770 teachers with teaching qualifications in public and private universities in Spain, of whom 37.4% were men and 61.3% women.

The average age was 45.1 ± 10.3 years. In order to calculate the statistical power of the sample, we performed an analysis with G*Power 3.1 for a one-factor fixed effect ANOVA test with 17 groups (the autonomous communities) for an effect size f(V) = 0.18 and a power 1-β = 0.90, resulting in a sample of 765 teachers (Figure 2).

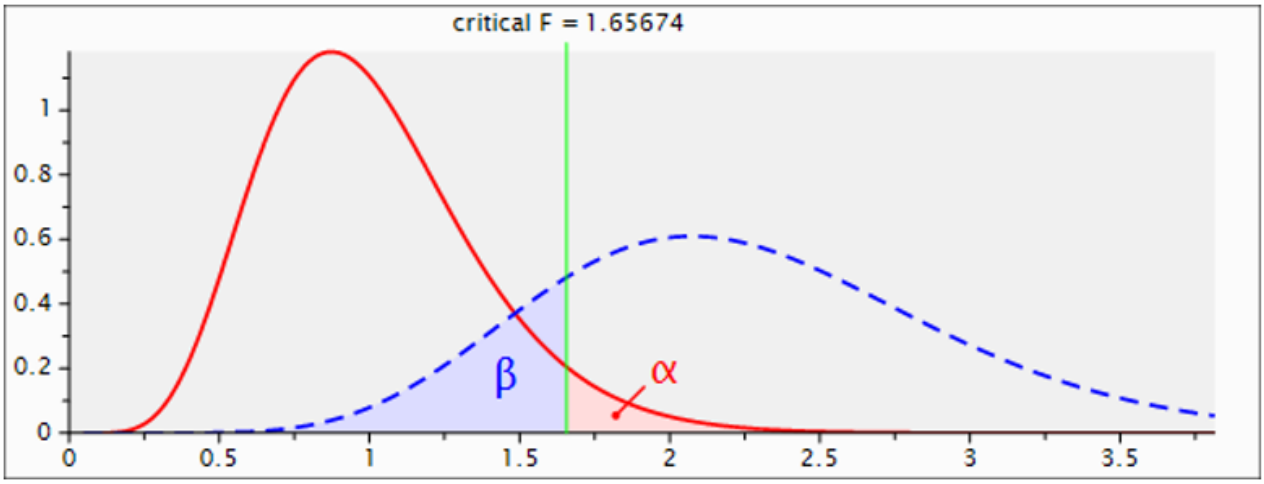

Figure 2
Calculation of the statistical power of the sample

All participants were of legal age and gave informed consent (included in the questionnaire) for voluntary and anonymous participation in the study.

Variables

The dependent variables were the following:

- Competence in Digital Content Creation (DCC_5): 5 levels of response were contemplated, based on the 5 levels of digital competence. The formula applied was DCC_6= (1+(CDCCo-1) *5/4) for the conversion to the DCC variable, which is the DCC_5 but on a base of 6.
- Initial Perception of Digital Competence (Initial_PC): This variable is the participants' self-score prior to completing the questionnaire.
- Final Perception of Digital Competence (Final_PC): This variable was measured after the completion of the questionnaire.
- Perceived Digital Competence: This variable refers both Initial_PC and Final_PC
- Effect of the questionnaire: This is the comparison between the initial and final perception scores (Initial_PC vs Final_PC).
- Adjustments in the perception of digital competence (PDC_Objectivity): This is the comparison between the final perception of competence and the CDCC (Final_PC vs DCC_6).

The independent variables were the type of university, the academic category and the autonomous community of the university. The following table shows the independent variables and the categories of analysis.

Table 1
Independent variables and category of analysis

Variables	Categories
Type of University	Public
	Private
Academic category	University professor
	Full university professor
	Tenure-track 2 professor / full-time lecturer (doctor)
	Tenure-track 1 professor / full-time trainee lecturer
	Trainee lecturer
	Adjunct professor
	Trainee research staff
	Other (e.g., substitute, collaborator, temporary, pre-tenured, etc.)
Autonomous Community	Andalusia
	Aragon
	Cantabria
	Castilla la Mancha
	Castile-Leon
	Catalonia
	Valencian Community
	Extremadura
	Galicia
	Balearic Islands
	Canary Islands
	La Rioja
	Madrid
	Murcia
	Navarra
	Online at national or Community level
	Basque Country

Data analysis

We used SPSS 28.0 software (IBM, Chicago, USA) for the quantitative analyses. The questionnaire showed high reliability, with a Cronbach's alpha of 0.894 (Cohen, 2013).

Descriptive statistics such as mean, median and interquartile range were used. Before calculating the descriptive statistics, K-S tests for normality and Levene's test for homogeneity of variances were performed.

To compare the DCC according to the academic category of the teaching staff and the Autonomous Community of the university, ANOVA tests were performed, followed by pairwise comparisons with Tukey's correction for significance. $\eta 2p$ as the effect size statistic for ANOVA was used, with values greater than 0.13 being considered a large effect (Richard et al., 2003).

To compare DCC between university types, an independent samples t-test was performed using Cohen's d as the effect size statistic - values between 0 and 0.19 were considered a minimal effect, between 0.20 and 0.49

a small effect, between 0.5 and 0.79 a moderate effect, between 0.80 and 1.29 a large effect, and greater than 1.29 a very large effect (Cohen, 2013).

Kruskal-Wallis tests were performed to compare the initial and final perceived competence as a function of the academic category of the teaching staff and the Autonomous Community of the university.

To compare the initial and final PDC according to the type of university, a Mann-Whitney U test was performed.

To compare the effect of the completion of the questionnaire on PDC, Wilcoxon tests between Initial_PC and Final_PC were performed. To compare the objectivity of the PDC, Wilcoxon tests between Initial_PC and DCC were performed. The significance level was set at $p < 0.05$.

RESULTS

The following results are derived from the analysis of the data obtained from the questions posed in the introductory section of this study:

Type of University

The type of university had a significant effect on DCC and PDC (Perception of Digital Competence) (Figure 3, left), such that teachers from private universities had significantly higher DCC (t_{768}=-5.38; p<.001; d=.87), Initial_PC (U=55962 Z=-2.59; p=.010) and Final_PC (U=57340; Z=-2.08; p=.038) scores. On the other hand, completion of the questionnaire did not have a significant effect on PDC, as there was no significant difference between initial and final PDC in any of the university types. However, there was a discrepancy in PDC_Objectivity, as both groups underestimated their DCC, and their Final_PC was significantly lower than their actual DCC (Public: Z=-11.2; p<.001 and Private: Z=-9.9; p<.001) (Figure 3 right).

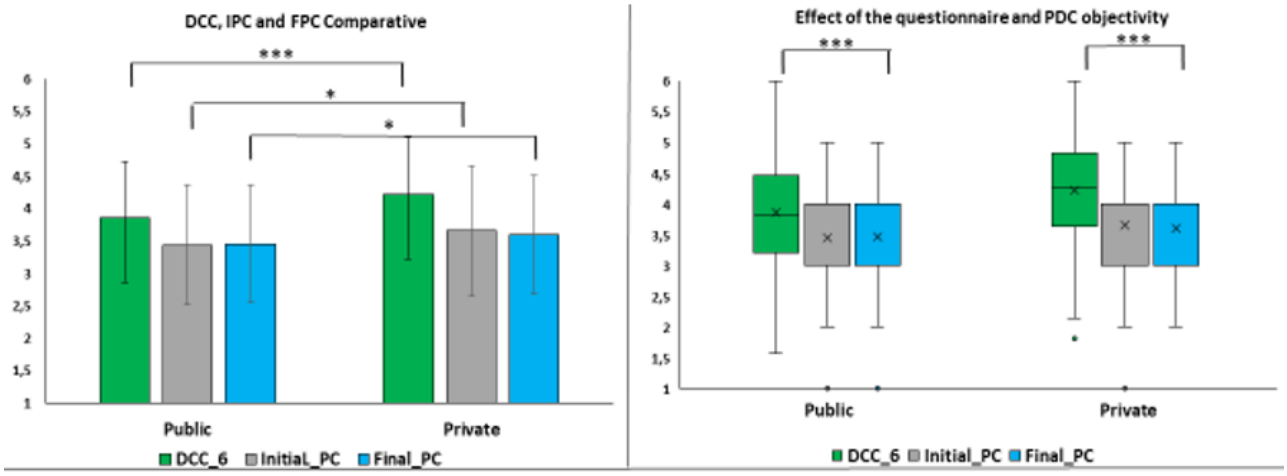

Figure 3

Comparison of digital content creation (DCC) competence, initial perception of digital competence (IPC) – before taking the questionnaire – and final perception of digital competence (FPC) –after taking the questionnaire – between the two types of universities

Note: Effect of the questionnaire on PDC (compares Final_PC and Initial_PC) and PDC_Objectivity (compares Final_PC and DCC_6) for each type of university (right image); *= p<.05; ***= p<.001

Academic status of teaching staff

The academic category of the lecturer did not have a significant weight on the DCC_6 ($F_{7.762}$=.826; p=.566; η^2=0), although it was observed that the lecturers with the highest DCC_6 were University Professors, while those with the lowest DCC_6 were Full University Professors. The same trend was observed

for PDC, although there were no significant differences for either Initial_PC (H_7=1.95; p=.963) or Final_PC (H_7=3.84; p=.798) (Table 2).

Table 2

Comparison of digital content creation (DCC_6) competence, initial perception of digital competence (Initial_PC) – before taking the questionnaire – and final perception of digital competence (Final_PC) –after taking the questionnaire – between different academic categories

Academic category	DCC_6			Initial_PC			Final_PC		
	M	Mn	RIC	M	Mn	RIC	M	Mn	RIC
University professor	4.03	4.07	1.4	3.56	4	1	3.6	4	1
Other categories	4.03	3.89	1.54	3.52	3	1	3.52	3	1
Trainee lecturer	4.23	4.28	1.19	3.42	3.5	1	3.42	4	1
Adjunct professor	3.96	3.94	1.25	3.55	3	1	3.53	3	1
Tenure-track 2 professor	3.94	3.97	1.22	3.47	3	1	3.42	3	1
Tenure-track 1 professor	3.91	3.92	1.3	3.47	3	1	3.45	3	1
Trainee research staff	3.9	3.76	1.12	3.5	3	1	3.6	4	1
Full university professor	3.7	3.72	1.49	3.39	3	1	3.5	3	1

Note: DCC= Digital Content Creation competence; Initial_PC= Initial Perceived Competence; Final_PC= Final Perceived Competence. The results by academic category are presented from highest to lowest DCC recorded.

The completion of the questionnaire did not affect the PDC either, as no significant differences were found between Initial_PC and Final_PC according to the academic categories of the teachers. However, there was a discrepancy in the PDC objectivity in some academic categories, which underestimated their DCC compared to their Final_PC. This is the case for University professors (Z=-5.33; p<.001), Tenure-track 2 professors (Z=-7.56; p<.001), Tenure-track 1 professors (Z=-5.74; p<.001), Trainee lecturers (Z=-3.62; p<.001), Adjunct professors (Z=-7.72; p<.001) and Other categories (Z=-5.62; p<.001). Full university professors and TRSs also underestimated their DCC, but not significantly.

University Autonomous Community

The Autonomous Community of the university had a significant influence on the DCC $F_{2.752}$=2.31; p=.002; η^2=.047, with university teachers from La Rioja registering a significantly higher DCC than those from Madrid, Catalonia, Castile and León, Castilla–La Mancha, the Basque Country and Andalusia. The same trend was observed in the PDC comparisons, where La Rioja, teachers working online in regional or national institutions, Galicia and Navarre recorded higher PDC, while the communities with the lowest PDC were Extremadura, the Basque Country and Castilla–La Mancha. However, there were no significant differences in the PDC comparisons for either Initial_PC (H_{15}=21.8; p=.102) or Final_PC (H_{15}=24.8; p=.053).

Table 3

Comparison of digital content creation (DCC) competence, initial perception of digital competence (IPC) – before taking the questionnaire – and final perception of digital competence (FPC) –after taking the questionnaire – between different Autonomous Communities

Autonomous Community	DCC_6			Initial_PC			Final_PC		
	M	Mn	RIC	M	Mn	RIC	M	Mn	RIC
La Rioja	4.84	5.01	1.28	4.26	4	2	4.32	4	2
Online at national or autonomous community level	4.19	4.35	1.21	3.75	4	1	3.79	4	1
Galicia	4.12	4.09	1.2	3.45	3	1	3.4	3	1
Navarre	4.12	4.05	1.59	3.73	4	1	3.73	4	1
Valencian Community	4.1	4.19	1.19	3.64	4	1	3.64	4	1
Madrid	4	3.97	1.33	3.49	3	1	3.48	3	1
Cantabria	3.94	4.06	1.62	3.33	3	1	3.33	3	1
Murcia	3.92	3.88	1.12	3.42	3	1	3.42	3.5	1
Balearic Islands	3.9	3.83	0.78	3.29	3	1	3.36	3	1
Catalonia	3.89	3.79	0.94	3.43	3	1	3.45	3	1
Aragon	3.88	3.77	1.49	3.6	3	1	3.6	3	1
Castile and León	3.83	3.86	1.3	3.47	3	1	3.42	3	1
Canary Islands	3.83	3.6	1.57	3.15	3	1	3.31	3	1
Andalusia	3.81	3.79	1.15	3.48	3	1	3.45	3	1
Extremadura	3.78	3.64	1.59	3.2	3	1	3.2	3	1
Basque Country	3.76	3.81	1.3	3.41	3	1	3.34	3	1
Castilla–La Mancha	3.65	3.47	1.14	3.17	3	1	3.08	3	0.5

Note: DCC_6= Digital Content Creation competence; Initial_PC= Initial Perceived Competence; Final_PC= Final Perceived Competence. The results by Autonomous Community are presented from highest to lowest DCC recorded.

The completion of the questionnaire had no effect on PDC, as there were no significant differences between IPC and FPC in any of the Autonomous Communities. However, there was an imbalance in PDC objectivity among the teachers from some Autonomous Communities. The online teachers at national or Autonomous Community level group underestimated their DCC in relation to their Final_PC (Z=-2.77; p=.006), as did teachers from Andalusia (Z=-4.07; p<.001), Cantabria (Z=-2.48; p=.013), Castilla–La Mancha (Z=-4.0; p<.001), Castile and León (Z=-5.48; p<.001), Catalonia (Z=-5.03; p<.001), Valencian Community (Z=-5.57; p<.001), Extremadura (Z=-2.80; p=.005), Galicia (Z=-3.47; p<.001), Balearic Islands (Z=-2.98; p=.003), La Rioja (Z=-2.82; p=.005), Madrid (Z=-6.87; p<.001), Murcia (Z=-2.43; p=.015) and the Basque Country (Z=-2.29; p=.022). Teachers from Aragón, Canary Islands and Navarre also underestimated their DCC, but not significantly.

DISCUSSION

As a result of our interest in identifying the level of digital competence in terms of digital content creation among university teachers, in a previous study we analysed variables such as gender, age and previous training or experience as determinants of the level of performance (Ferrando-Rodríguez et al., 2023b). In these investigations, we found that teachers perceived themselves as having an intermediate level of competence and that the variables studied conditioned the level of competence. The results confirm the findings of previous

studies such as that of Cabero-Almenara et al. (2020), whose results show that the level is moderate for the areas of digital pedagogy and digital resources.

Similarly, previous research (Ferrando-Rodríguez et al., 2023a) has analysed the level of digital teaching competence in content creation by university teachers, based on other variables such as academic level, degree, field of knowledge, technological training or the match between perceived and actual competence. These studies showed the relationship between the use of digital content and the methodology used as a pedagogical support, as well as the importance of the technological training received when taking on the role of prosumer of digital content by university teachers.

Based on these studies and on a recent study that showed significant differences in the creation of content by teachers who perform their role online or in settings other than face-to-face education (Ferrando-Rodríguez et al., 2024), this paper has tried to broaden the vision of the phenomenon under study by exploring whether aspects such as the ownership of the university where teachers provide their services, their academic category or the geographical location of the universities can have an impact on the level of self-perceived digital competence.

Thus, in relation to the first variable of analysis, we found that the type of university had a significant influence on DCC and PDC. Teachers in private universities had significantly higher DC scores for content creation than teachers in public universities. It is also clear that, far from having an idealised view of their competences (Cabero-Almenara et al., 2020), the participants underestimated their own competences, which was not the case in other studies focusing on the digital competences of future teachers (Gabarda, Marín-Suelves et al., 2023; Marín-Suelves et al., 2022).

The results of the second variable examined showed that although there were differences in the level of self-perceived digital competence according to category (for example, the teachers with the highest DCC were university professors and those with the lowest were full professors), there was no significant influence on DCC. Furthermore, no significant differences were found between IPC and FPC in any academic category.

The variable that showed the most significant differences in teachers' competence in content creation was the Autonomous Community in which they work. A higher DCC was recorded in the universities of La Rioja than in those of Madrid, Catalonia, Castile and León, Castilla–La Mancha, the Basque Country and Andalusia. In the PDC comparisons, the same line was observed, with La Rioja and the group of lecturers from national or regional online universities, Galicia and Navarre recording higher PDC compared to Extremadura, the Basque Country and Castilla–La Mancha, where the lowest PDC were recorded. However, none of the Autonomous Communities showed significant differences between IPC and FPC.

Thus, specifically in this variable, we confirm that context is another element to take into account when studying teachers' digital competence. In this sense, Paz and Gisbert (2023), in a study carried out in a Colombian university, point out that although more than half of the teachers in the sample have an intermediate level of digital competence that allows them to perform adequately in the use of digital technologies in their professional work, the results are conditioned by the context. Regardless of the location of the university where the teachers work, each Autonomous Community should guarantee the necessary resources so that teachers can be trained in the necessary digital competences (Mora et al., 2022). Therefore, and in line with Moreira et al. (2023), we consider it necessary to promote strategies that favour training plans adapted to the specificities of the universities and to the profile of the teaching staff, taking into account their experience and commitment. Accordingly, and following Sánchez-Tarazaga (2016), we must "conceive the teaching profile within a framework that includes the professional competences necessary to face the challenges of the new context" (p. 44), as this can contribute to the development of the teaching profession. In any case, these initiatives could lead to a greater use and appropriation of digital technologies in education (Paz & Gisbert, 2023), which could also facilitate a greater correspondence between the level of digital competence of teachers and a better use of their innovative practices in the classroom (López, Pozo, Fuentes, & Romero, 2019).

Although this study provides information on the level of digital competence of university teachers for content creation based on university type and location, and academic category of the educators, we believe that the main limitation lies in the consideration of self-perception rather than a standardised test to measure the actual digital competence of teachers. Another limitation comes from the nature of the study and the configuration of the sample, which is limited to university teachers who teach in programmes that qualify students to become teachers. Thus, extending the characteristics of the participants to teachers of other degree programmes could provide a more global view of the phenomenon under study. In this sense, we agree with Cisneros-Barahona et al. (2024) that digital competence in teaching is fundamental in university education, as it goes hand in hand with the professional development and digital literacy of students. On the other hand, we believe that it is important to go beyond quantitative data and delve, from a more qualitative perspective, into the type of digital content generated by university teachers. All these questions would undoubtedly provide data of interest to the scientific community in general and the educational community in particular.

It is important to stress the importance of the continuous updating and training of university teachers as producers of digital educational content (Ferrando-Rodriguez et al., 2024), which involves not only the knowledge and use of multimedia presentations to support teaching, but also the integration of other alternatives such as learning analytics, extended reality and even artificial intelligence (Coll et al., 2023). The commitment to continuous teacher training in digital competence and the pedagogical use of these technologies (Machuca et al., 2023) must be constant if we want to make progress not only in the design of work and learning spaces that promote new ways of teaching and learning, but also to allow for greater teacher empowerment and training in all areas, especially the more complex ones (Martín-Párraga et al., 2023).

In any case, and in line with the contributions already made by González and Rincón (2013), it is essential to consolidate a process of pedagogical transformation in higher education that emphasises both the critical capacity of teachers and the incorporation of technologies, so that teachers can assume the role of empowered prosumers. The DigCompEdu framework can serve as a reference for the digital transformation of education, helping higher education institutions to visualise, design and structure this transformation (Castañeda et al., 2023). In line with these ideas, we would also like to highlight the need to evaluate the initial training of students who are being trained to become teachers, so that "on the basis of these results, training plans can be designed and implemented to remedy the shortcomings identified" (Silva et al., 2022, p.303).

This will require a real commitment on the part of universities to support the work of teaching staff, redefining professional competences that integrate digital competence into teaching (Prendes et al., 2018) in an innovative and sustainable way (Sánchez-Tarazaga et al., 2021). At the level of digital content creation, and based on the results obtained by the team of López, Pozo, & Alonso (2019), this could lead to a real pedagogical transformation that goes beyond the use of digital resources as mere support for face-to-face sessions.

It will therefore be necessary for teachers to continue to develop their ability to select, adapt, create, redesign and/or use digital educational content in favour of a better learning experience for students (Rodríguez et al., 2022), thus helping students to apply tools and resources in their learning, especially in relation to content production (Grizzle et al., 2023). This requires the transversal development of digital teaching competences in each subject of initial teacher education curricula (Marín-Suelves et al., 2019).

Finally, given the proliferation of artificial intelligence in university classrooms, it is important that teachers are able to teach how to use AI systems in a responsible, safe and ethical manner (García, 2024). But beyond this fundamental objective, and in line with the contributions of García-Ruiz et al. (2023), studying the impact of this competence is essential for improving university teaching practices.

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Información adicional

How to cite: Ferrando-Rodríguez, M. L., Marín-Suelves, D., Gabarda Méndez, V., & Ramón-Llin Más, J. (2025). Digital competence and content creation at University: influence of ownership and region. [Competencia digital y creación de contenido en la universidad: influencia de la titularidad y la región]. *RIED-Revista Iberoamericana de Educación a Distancia, 28*(1). https://doi.org/10.5944/ried.28.1.41475

María de Lourdes Ferrando-Rodríguez, Diana Marín-Suelves, Vicente Gabarda Méndez, Jesús Ramón-Llin Más

Digital competence and content creation at University: influence of ownership and region
Competencia digital y creación de contenido en la universidad: influencia de la titularidad y la región

RIED-Revista Iberoamericana de Educación a Distancia
vol. 28, núm. 1, 2025
Asociación Iberoamericana de Educación Superior a Distancia, España
ried@edu.uned.es

ISSN: 1138-2783
ISSN-E: 1390-3306

DOI: https://doi.org/10.5944/ried.28.1.41475