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RESEARCH NOTE/NOTA DE INVESTIGACIÓN

The Digital Competence of Teachers on the Primary Education Degree Course: Instrumental Pilot Study of the "DigCompEduCheck-In" Questionnaire for Its Adaptation to University Students

La competencia digital docente en el Grado de Educación Primaria: estudio piloto instrumental del cuestionario «DigCompEduCheck-In» para su adaptación a alumnos universitarios

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ABSTRACT

The DigCompEduCheck-In questionnaire is a valuable instrument for assessing educators' digital competence, serving as a tool for both self-assessment and professional development. Grounded in the European Digital Competence Framework, it enables educators to evaluate their proficiency across key domains such as digital literacy, communication and technological creativity. Its validity has been supported through implementation in various Spanish universities, confirming its effectiveness. Moreover, the tool encourages a culture of continuous learning, promoting the integration of digital technologies into educational practice. The objective of this pilot study was to develop a measurement scale for evaluating the different areas of digital competence among undergraduate students enrolled on the bachelor's degree in primary education and to analyse the main psychometric properties. This paper details the different phases of the study – conducted with a sample of 204 students – and provides a descriptive analysis of the data collected.

KEYWORDS: teacher competence; European digital competence framework; areas of competence; DigCompEdu; pilot study; educational technology.

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RESUMEN

El cuestionario «DigCompEduCheck-In» es una herramienta esencial para evaluar la competencia digital de los educadores, promoviendo la autoevaluación y el desarrollo profesional. Basado en el Marco europeo para la competencia digital, permite a los educadores medir sus habilidades en áreas como la alfabetización digital, la comunicación y la creatividad tecnológica. Su validez se ha confirmado en diversas universidades de España, lo que respalda su eficacia. Además, fomenta una cultura de aprendizaje continuo, integrando tecnologías digitales en la educación. El objetivo de este estudio piloto fue desarrollar una escala dirigida a medir las diferentes áreas de competencia digital en el alumnado universitario del grado de educación primaria, así como examinar sus principales propiedades psicométricas. La muestra estuvo formada por 204 estudiantes. Se presentan las fases por las que ha pasado este estudio piloto y el análisis descriptivo de los datos recopilados.

PALABRAS CLAVE: competencia docente; marco europeo de competencia digital; áreas de la competencia; DigCompEdu; estudio piloto; tecnología educativa.

1. Introduction

Digital competence has emerged as an essential skill in many sectors, particularly within the field of education. Recent studies indicate that teachers generally demonstrate digital competence levels ranging from basic to intermediate. Given this context, online teaching methodologies have been recognised as an effective tool for developing and enhancing digital competence (Khademi-Vidra and Bakos, 2024).

While many teachers actively incorporate digital technologies into their daily teaching practice, there remains a clear need for more specific and targeted training programmes that are adapted to the unique characteristics of each subject area and discipline (Kiryakova and Kozhuharova, 2024). This suggests that specialised courses and training could play a critical role in improving teachers' digital competence. Furthermore, the development and consolidation of these skills are influenced by various factors, including gender, level of education and the sector in which professionals work (Nguyen *et al*., 2024).

The term digital competence is understood as a set of essential skills that enable educators to use digital technologies effectively in education. It encompasses digital literacy, referring to the ability to efficiently manage digital tools; the proficient use of educational software and platforms to enhance the teaching and learning process; and the integration of ICT into pedagogical activities, thereby facilitating the creation of interactive educational experiences. It also involves the capacity to develop e-learning resources that are tailored to students' needs, as well as the skills required to work in virtual environments – facilitating collaboration with other teachers and promoting the exchange of knowledge (Mainz *et al*., 2024).

Given the growing importance of digital competence, an increasing number of studies focus on evaluating teachers' digital competence (Cepa-Rodríguez and Murgiondo, 2024; Chen *et al.*, 2024), and, consequently, the "DigCompEdu Check-In" questionnaire is frequently used in digital competence research (Momdjian *et al.*, 2024).

The questionnaire serves as an essential tool for assessing educators' digital competence, fostering self-reflection and enabling the identification of areas requiring improvement. This instrument, based on the Digital Competence Framework for Educators, has been validated through its use in numerous studies, demonstrating its reliability and effectiveness in different educational contexts.

Some key observations regarding DigCompEdu include:

- The questionnaire allows educators to assess their digital competence across multiple dimensions, including digital literacy, communication and technological creativity (Martín-Párraga *et al.*, 2022).
- It has been used in various settings – such as universities in Spain and Peru – and the large sample sizes confirm its validity (Llorente-Cejudo *et al.*, 2022; Martín-Párraga *et al.*, 2022).
- It encourages continuous self-evaluation, fostering a culture of lifelong learning among educators (Economou *et al.*, 2023).
- It highlights the importance of effectively integrating digital technologies into educational practice, which improves teaching quality and promotes social inclusion (Llorente-Cejudo *et al.*, 2022).

In this context, two key benefits emerge from employing this questionnaire in research on teachers' digital competence:

- It facilitates personalised training by identifying each educator's specific strengths and weaknesses in digital competence (Dias-Trindade and Ferreira, 2020; Serrano-Hidalgo and Llorente-Cejudo, 2023).
- Feedback obtained from the questionnaire helps design targeted professional development programmes, which improve educators' digital fluency over time (Dias-Trindade and Ferreira, 2020).

In recent years, teachers' digital competence has become an increasingly prominent focus of study, particularly following the COVID-19 pandemic. These skills are essential for effective teaching within an educational landscape that has undergone significant digital transformation. Consequently, higher education institutions have encountered numerous challenges in adapting to this shift, forcing them to rethink their traditional approaches to teaching. Throughout this transition, many institutions have adopted new strategies and pedagogical models centred on online and hybrid learning, aiming to meet the demands of an increasingly digitised educational landscape. These strategies have involved not only the integration of technological

platforms and digital tools, but also the reconfiguration of teaching methodologies to facilitate the active participation of students, regardless of their location or mode of study (Vázquez-Villegas *et al.*, 2024).

Digital competences for teachers encompass the skills and knowledge required to effectively integrate digital technologies into teaching and learning processes. These include the ability to create learning materials, use technology for educational purposes and provide 21st-century students with the skills they need through innovative teaching methods.

These digital competences are grouped into different areas, as defined by the various digital competence frameworks. This study aligns with the European Framework for the Digital Competence of Educators (DigCompEdu), which emphasises the importance of digital skills in teacher education.

DigCompEdu was used by the researchers to measure and evaluate the levels of digital competence among trainee teachers. It provides a detailed structure that covers various areas of digital competence, and forms a crucial part of teacher training, since it helps ensure that educators are prepared to effectively integrate digital technologies into their pedagogical practices, thus improving the quality of the teaching and learning process in an increasingly digitised world (European Commission, 2017).

The objective of this pilot study was to develop a measurement scale for evaluating the different areas of digital competence among undergraduate students enrolled on the bachelor's degree in primary education and to analyse the main psychometric properties.

2. Method

2.1. Sample

A sample of 204 subjects was selected from three groups of second year students enrolled on the bachelor's degree in primary education at the University of Granada. The mean age of the participants was 19.29 years (SD = 1.29), with an age range of 18 to 24 years. The gender distribution was 54 males (26.47%) and 150 females (73.53%).

The sample was selected using a non-probabilistic convenience method (Kalton, 2020), with the sample size determined in accordance with the objectives of the study. Notably, the final sample exceeded the minimum thresholds recommended in various simulation studies for structural models similar to those proposed in this research (Tomarken and Waller, 2005). However, to ensure greater robustness, the minimum required sample size for the structural complexity of the specified model

was calculated (n = 148), taking into account the number of observed variables (17) and latent variables (5), the expected effect size (0.10), the associated probability (0.05) and the desired statistical power (0.80) (Soper, 2024).

2.2. Instruments

Socio-demographic and academic data questionnaire. A self-report comprising four multiple-choice items to collect socio-demographic (age and gender) and academic (degree course and university) information from the participants.

The "DigCompEdu Check-In" questionnaire was adapted to students on the bachelor's degree in primary education course. The instrument contained 17 Likert scale items, with responses ranging from 0 to 4 (0 = No engagement, 1 = Partial knowledge, 2 = Occasional use, 3 = Increasing use, 4 = Systematic and comprehensive use). These items were grouped into five areas of competence: a) Professional engagement – covering competences such as organisational communication, professional collaboration, reflective practice and digital training (four items); b) Digital resources – including competences related to the selection, creation/modification, and administration, exchange and protection of digital resources (three items); c) Digital pedagogy – encompassing competences in teaching, guidance, collaborative learning and self-directed learning (four items); d) Assessment and feedback – focusing on evaluation strategies, analysis of evidence, and feedback and planning (three items); and e) Empowering students – addressing competences related to accessibility and inclusion, differentiation and personalisation, and active student participation (three items). Similarly to the original adaptation (Cabero and Palacios, 2020), this questionnaire aims to assess the strengths and needs or areas of improvement in digital competence among future education professionals. However, it is important to note that the original adaptation (*ibid.*) did not provide details of its main psychometric properties.

Level of digital competence. Indicator of participants' perception of their own digital competence, scored on a six-point scale (A1 = Novice, A2 = Explorer, B1 = Integrator, B2 = Expert, C1 = Leader, C2 = Pioneer).

2.3. Design and procedure

This pilot study, approved by the Ethics Committee of the University of Granada (3496/CEIH/2023), has adopted an instrumental methodological design (Ato *et al*., 2013).

The "DigCompEdu Check-In" questionnaire (Cabero and Palacios, 2020) was adapted to and validated for university students enrolled on the primary education degree programme in line with the quality standards established in the specialised literature (Muñiz and Fonseca-Pedrero, 2019). The first step consisted of requesting authorisation from the authors of the original adaptation of the instrument (Cabero and Palacios, 2020).

In the second step, once authorisation was granted, the items for the different digital competence areas were designed. The five areas of competence included in the instrument were chosen, eliminating the area "promoting the development of students' digital competence", as it was not deemed applicable to trainee primary education professionals. Next, the items on the other areas of competence were adapted to trainee primary education professionals, at all times seeking an equivalence with the instrument's original adaptation (*ibid.*).

In the third phase, two experts in the field assessed the representativeness, relevance, diversity, clarity, simplicity and comprehensibility of the items included in the adaptation made in the second step (Muñiz and Fonseca-Pedrero, 2019). A pilot study of the instrument was also carried out with a small sample of primary education university students (n = 6) in order to verify approximately how long was required to complete the questionnaire and to evaluate the suitability of the items' content and format (*ibid.*).

The fourth and final phase, after obtaining the relevant institutional approvals, a sample of students enrolled on the bachelor's degree in primary education at the University of Granada (from three different classes) was invited to voluntarily participate in the research. The purpose of the study and the procedures involved were explained to the students, and once they agreed to participate, they signed the relevant agreements and informed consent forms. The instruments were administered to all students during class hours in the reference classes using the computer-assisted web interview technique (Couper and Bosnjak, 2010). This process was carried out by a member of the research team, who first informed the students of the study's objective, the voluntary nature of their participation and the confidentiality of their responses. Subsequently, the written instructions provided were supplemented with oral explanations from the researcher, and the queries raised by the participants were addressed. The participants completed the instrument within 15 to 20 minutes. Data collection was carried out in October 2023.

2.4. Data analysis

Firstly, a descriptive analysis of the collected data was conducted, assessing distribution, linearity, outliers, missing values and influential points (Tabachnick and Fidell, 2019). Next, to examine the theoretical structure of the instrument, a confirmatory factor analysis (CFA) was conducted, using a model with five first-order factors that were correlated with one another. The CFA was estimated using the weighted least squares (WLS) method, and different indices were employed to assess the model's goodness of fit (Hu and Bentler, 1999; Kline, 2015): a) The Chi-square test (χ^2), which is expected to be non-significant, although due to its sensitivity to sample size, the χ^2/degrees of freedom (*df*) ratio can also be considered, with acceptable values below 5; b) the comparative fit index (*CFI*) and goodness of fit index (*GFI*), both of which should exceed 0.90

to indicate acceptable fit; and c) the standardised root mean squared residual (*SRMR*) and the root mean square error of approximation (*RMSEA*), with acceptable thresholds below 0.08.

Thirdly, to evaluate the reliability of the instrument, internal consistency was calculated using Cronbach's alpha (α) and McDonald's omega (ω), with both coefficients expected to exceed 0.70 (Hair *et al.*, 2014).

And finally, to gather evidence of the instrument's external validity, the Spearman's rank correlation coefficient (Spearman's *r*) was used to assess the relationship between the different areas of competence and the level of digital competence. Likewise, after the Kolmogorov–Smirnov test confirmed that the data did not follow a normal distribution, Mann–Whitney *U* tests for two independent samples and Kruskal–Wallis *H* tests for independent samples were applied to examine differences in the model's areas of competence based on the *gender*, *age* and *level of digital competence* variables. The family-wise error rate resulting from the multiple comparisons problem was controlled using the Bonferroni correction.

Statistical analyses were conducted using STATA v17 (StataCorp, College Station, TX, USA).

3. Results

The descriptive statistics for the different instrument items are shown in Table 1. The values of skewness and kurtosis, as well as the Kolmogorov–Smirnov statistic, reveal a univariate non-normal distribution in all items, while Mardia's multivariate skewness (98.32; χ^2 = 3,397.66; $p < 0.001$) and kurtosis (325.74; χ^2 = 414.99; $p < 0.001$) coefficients indicate that the joint distribution of the items does not fit the multivariate normal distribution. This justifies the choice of the WLS estimator for the CFA. No missing values were detected, and outliers identified through Mahalanobis distance were processed using robust estimators. The descriptive analysis of the items revealed mean scores ranging from 1.69 (*SD* = 0.86) for item 4 to 3.60 (*SD* = 0.67) for item 15.

On the other hand, the results of the CFA model, based on five correlated first-order factors, yield relatively adequate goodness-of-fit indices and statistics: χ^2 (84; n = 204) = 207.09; $p > 0.05$; χ^2/df = 2.47; *CFI* = 0.85; *GFI* = 0.92; *SRMR* = 0.08; *RMSEA* = 0.08 (90% *CI* = 0.07–0.10). Correlation between the instrument's different areas of competence ranged from -0.14 (empowering students and professional engagement) to 0.53 (empowering students and assessment and feedback) (Table 2).

Table 1

Instrument descriptive statistics

Areas of competence / items	M (SD)	SK	KU	K-S
Professional engagement				
1. I systematically use various digital channels to improve communication with my colleagues	2.09 (0.89)	0.08	-0.65	0.88***
2. I use digital technologies to collaborate with my peers both inside and outside faculty classrooms	2.38 (0.84)	1.12	0.02	0.64***
3. I am actively developing my digital competence as a future teacher	2.24 (1.10)	-0.21	-0.53	0.91***
4. I participate in online training courses, such as online workshops, MOOCs and webinars	1.69 (0.86)	0.50	0.74	0.86***
Digital resources				
5. I use various websites and search strategies to find and select a wide range of digital resources	2.00 (0.81)	0.34	-0.60	0.84***
6. I create and modify digital resources to suit my needs as a future teacher	2.12 (0.76)	-0.61	2.31	0.74***
7. I am capable of securely protecting sensitive content such as photographs, videos, files and other works	2.43 (0.99)	0.25	-0.97	0.87***
Digital pedagogy				
8. I carefully consider how, when and why to use digital technologies in the teaching–learning process to ensure their added value is maximised	2.62 (1.08)	-0.03	-1.32	0.85***
9. I consider the supervision of my future students' activities and interactions with ICT in my educational proposals	2.93 (0.86)	-0.55	0.39	0.84***
10. I include ICT as a tool for supporting collaborative learning and knowledge documentation in my educational proposals	3.13 (0.70)	-0.19	-0.98	0.80***
11. I aim to use digital technologies to enable my future students to plan, document and evaluate their own learning, for example, through self-assessment tests, digital portfolios, blogs and forums	3.16 (0.66)	-0.18	-0.71	0.79***
Assessment and feedback In my future work as a teacher, the initial training I am receiving in my undergraduate studies will enable me to:				
12. Propose digital assessment strategies to monitor student progress in my educational proposals	3.12 (0.70)	-0.42	0.01	0.81***
13. Analyse all available data to identify students who require additional support	3.50 (0.68)	-1.30	1.54	0.70***
14. Use digital technologies to provide effective feedback	3.04 (0.67)	-0.34	0.17	0.80***
Empowering students In my future work as a teacher, the initial training I am receiving in my undergraduate studies will enable me to:				
15. Propose digital tasks while considering and addressing potential challenges, such as ensuring equal access to digital devices and resources, compatibility issues and low student levels of digital competence	3.60 (0.67)	-1.73	2.70	0.63***
16. Use digital technologies to provide students with personalised learning opportunities, such as by assigning different digital tasks tailored to individual learning needs, preferences and interests	3.40 (0.70)	-0.84	0.46	0.77***
17. Use digital technologies to actively engage students in the classroom	3.21 (0.66)	-0.24	-0.72	0.78***

N.B.: M: mean; SD: standard deviation; SK: skewness; KU: kurtosis; K-S: Kolmogorov–Smirnov; *** $p < 0.001$.

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Regarding the instrument's internal consistency, the results show a Cronbach's alpha (α) and McDonald's omega (ω) of 0.75 for the overall scale, with scores ranging from 0.63 in the digital pedagogy area of competence to 0.72 in assessment and feedback (Table 2). On the other hand, results related to the instrument's external validity reveal a consistent pattern of positive correlations between the different areas of competence of the instrument, except in the case of empowering students (Table 2).

Table 2

Correlations and reliability of the instrument

Areas of competence	1	2	3	4	5	6
1. Professional engagement	-					
2. Digital resources	0.30**	-				
3. Digital pedagogy	0.31**	0.26**	-			
4. Assessment and feedback	0.18*	0.27**	0.44**	-		
5. Empowering students	-0.14*	0.03	0.25**	0.53**	-	
6. Level of digital competence	0.47**	0.24**	0.28**	0.31**	-0.03	-
M	8.40	6.54	11.84	9.66	10.15	1.87
SD	2.44	1.57	2.19	1.50	1.49	0.75
α	0.65	0.64	0.63	0.66	0.67	-
ω	0.67	0.70	0.67	0.72	0.68	-

N.B.: M: mean; SD: standard deviation; α: Cronbach's alpha; ω: McDonald's omega; $^{*}p < 0.05$; $^{**}p < 0.001$.

Finally, the significance level for each of the multiple comparison tests was adjusted using the Bonferroni correction, resulting in 0.01 for the different contrasts (0.05/5). In this regard, the results of the comparisons based on the *gender* variable reveal statistically significant differences in favour of men in the digital resources area of competence (U = 3,186.00; $p < 0.05$) and in favour of women in the assessment and feedback (U = 3,213.00; $p < 0.05$) and empowering students (U = 2,061.00; $p < 0.001$) areas. With respect to the *age* variable, statistically significant differences were observed in favour of older students across all areas of competence, except for empowering students (H = 34.00; $p < 0.001$), where the differences were in favour of younger students (Table 3). Similarly, statistically significant differences were observed across all areas of competence measured by the instrument according to participants' level of digital competence, with those reporting higher levels of digital competence achieving the highest scores in all areas (Table 3).

Table 3
Comparison of the instrument's areas of competence based on the Gender, Age *and* Degree Course *variables*

Areas of competence	Gender (*U*)	Age (*H*)	Level of digital competence (*H*)
1. Professional engagement	3,501.00	13.18*	47.47**
2. Digital resources	3,186.00*	7.28	31.56**
3. Digital pedagogy	3,397.50	24.76**	20.49**
4. Assessment and feedback	3,213.00*	32.77**	19.38**
5. Empowering students	2,061.00**	34.00**	6.90

N.B.: H = Kruskal–Wallis *H* test; *U* = Mann–Whitney *U* test; $^{*}p < 0.05$; $^{**}p < 0.001$.

4. Discussion and conclusions

The objective of this pilot study was to develop a measurement scale for evaluating the different areas of digital competence among undergraduate students enrolled on the bachelor's degree in primary education and to analyse the psychometric properties. Therefore, based on the results obtained, the main conclusion of this study is that the instrument demonstrates adequate psychometric quality, with appropriate levels of validity and reliability. It can thus be effectively applied to assess digital competence, consistent with previous research that has employed the DigCompEdu Check-In questionnaire (Momdjian *et al.*, 2024). In this regard, a growing body of literature is dedicated to evaluating digital teaching competence (Cepa-Rodriguez and Murgiondo, 2024; Chen *et al.*, 2024; Nguyen *et al.*, 2024).

However, it is essential to emphasise that digital competence must be systematically integrated into teacher training programmes. As the digitalisation of education advances, the role of teachers must evolve accordingly. For 21st-century educators, innovation and the use of pedagogical and technological resources are fundamental components of good teaching practices. Consequently, university teacher training curricula must be adapted to provide future education professionals with both theoretical foundations and practical experience in digital pedagogy so that they can apply these skills effectively in schools and demonstrate solid levels of digital competence.

Spain is number one in terms of publications on teachers' digital competence, but further research is needed to explore specific aspects of digital competence and to identify emerging trends that can inform future educational strategies.

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