Digital Ethics Competency of Student Teachers

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Abstract

The purpose of this study was to analyze digital competencies of student teachers in Early Childhood Education and Primary Education of the Faculty of Education, Economy and Technology of Ceuta of the University of Granada. Specifically, we investigated the degree of competence in digital ethics that future teachers acquire, develop and/or enhance throughout their university training process. To achieve this purpose, we utilized a specifically designed and tested questionnaire, entitled "Questionnaire of Digital Competences for Citizenship with support in Ethics (QDCCE)", for which we calculated its psychometric properties. Results reveal that future male teachers are highly competent in the area of security, while future female teachers are compentent information and data literacy. Additionally, both male and female student teachers demonstrated techno-pedagogical and social inclusion skills. The degree of performance is also influenced by the socio-economic diversity of the student teachers. Student teachers with medium-high socio-economic status are more skilled in information and data literacy, while those with medium-low socioeconomic status excel in communication, collaboration, and problem solving skills.

Keywords: digital citizenship, digital competences, technology ethics, student teachers

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Introduction

The extensive use of digital resources in educational settings highlights a training gap about virtual civility (Gamito et al., 2020). This is demonstrated by the high incidence of cyberbullying, flaming, phishing, grooming, and other forms of online harassment, particularly among minors (Novella & Cloquell, 2021). Experts have identified communication deficiencies in the profiles of early childhood students, which they attribute to the excessive screen time and the inadequate parental supervision (Ortiz et al., 2023). Authors such as Gümüş et al. (2023) report that data safety awareness foretells sensitivity to cyberbullying. As observed by Balladares and Jaramillo (2022), the lack of self-assessment and self-regulation will lead to significant challenges in managing digital identity and personal data. Considering these circumstances, Lores et al. (2019) assert that "the preparation and knowledge available to teachers do not seem to be adequate to the current technological needs of 21st century citizens" (p. 236). There are few pedagogical experiences that address the critical integration of the Information and Communication Technologies (ICT) in favor of digital well-being, including data protection and the treatment of the digital footprint. López et al. (2019) identify teacher's digital competence as a key area for improvement, noting that current levels are insufficient for effectively engaging in a technopedagogical teaching and learning process. To grasp the impact of this phenomenon on teacher training programs, Castañeda et al. (2018) expanded the competence compendium by introducing an alternative diagnostic model, the *Holistic Model of Teaching Competence for the Digital World*. In their recent reports, they argue for a "humanistic" approach to teachers' digital competence, with the goal of fostering a professional identity among educational actors that is conducive to techno-pedagogical and socially inclusive actions. These specific skills include: expertise in digital pedagogical content; ability to reflect on practice and adapt to new situations; expertise in creating engaging learning environments for personal and professional growth; awareness of the potential for technology to drive social change; capacity to leverage technology to strengthen relationships with students and their families; ability to develop and manage new pedagogical approaches (Castañeda et al., 2021).

In a broader sense, Trujillo et al. (2020) introduced a new dimension through the Global Framework for Competence to Learn and the Global Framework for Educational Competence in the Digital Age. This involved distinguishing three key identities: the individual as a citizen, the individual's approach to knowledge, and the individual as a person in connection. This "comes to recognize the fact that competence is a set of knowledge, skills, and abilities linked to the different identities an individual assumes about the different social practices he develops" (p. 11). In a previous study, Krumsvik (2009) emphasized the significance of this expertise for teaching and learning. Based on a set of criteria (pedagogy, ethics, moral sense, etc.), the study identified new incentives for digital well-being.

Although there are still some who believe digital competence is solely about learning computer and office skills, the main actions that fall outside the ethical framework relate to the profile of new university students and their academic integrity (Gamage et al., 2020; Hernández & Moreno, 2023). The significant increase in misuse cases is being addressed with a more focused and comprehensive approach to digital ethics, in line with the observations made by Alfaro and De Juan (2014):

> At present, in the Knowledge Society, when we talk about education we must talk about multi-literacy, which includes a convergence of closely linked literacies [...]. All this without forgetting ethical responsibility and social commitment, concepts which have been incorporated into university curricula, but which are not always given the necessary attention or which we are not always able to adapt easily to these more dynamic and creative learning systems. (p. 6)

At the same time, recent research reveals that students in higher education use Artificial Intelligence systems "in an experimental way, without clear guidance from teaching staff and with the absence of official regulations from educational authorities to regulate their responsible and ethical use" (Gallent et al., 2023, p. 14). Moreover, despite the prevalence of electronic anti-ethics resources, deficiencies have been identified in the documentary competences (Espiñeira et al., 2021). To this end, Gallent (2023) recommends intensifying efforts to ensure accurate and appropriate citation and referencing of sources in academic works, with the aim of fostering a culture of academic honesty. Cuesta et al. (2023) also emphasize the importance of integrating reflective techniques into the writing process for Education Degrees. Conversely, Gómez et al. (2016) confirm that the design of activities impacts the incidence of plagiarism among university students, with lower rates of academic fraud observed in environments of active participation (enabling more creative and original written outputs, etc.). As these authors note:

> It is possible to reduce the incidence of plagiarism by designing activities in such a way that students are motivated to come up with their ideas using the information available on the Internet as a vehicle for their solutions rather than as solutions in themselves. (p. 39)

At this point, experts advocate the so-called citizenship education, "in a more comprehensive sense than values and moral education, which aims to contribute to forming more civically competent citizens committed to collective responsibilities" (Bolívar**,** 2005, p. 96). Specifically, to analyze this ICT supported construct, a large body of research is based on the Digital Competence Framework for Citizens project, henceforth DigComp (Ferrari, 2013). This is the reference framework that, in essence, encompasses the "basic competencies that citizens must develop in the digital sphere to thrive in the social, economic, and cultural context in which we live" (Marín et al., 2021, p. 1). Based on this model, Rodríguez et al. (2019) found that future teachers of primary education from various Andalusian faculties (Spain) demonstrated moderate or intermediate levels of competence in searching and managing information (area of information and data literacy). The results indicate a need for improvement in the use of tools for browsing and filtering information. Marín et al. (2022) indicate that future teachers of Primary and Secondary Education at the University of Valencia, Spain, perceive themselves to be particularly skilled in the areas of information and literacy, as well as in safety. This complementarity between areas is in line with Castro et al. (2019), who point out that "digital literacy must be accompanied by knowledge for a critical, ethical, and responsible use of resources and media" (p. 5)**.**

Methodology

This study is based on the positivist-rationalist paradigm, also known as the empirical-analytical approach. This is a quantitative study based on the characteristics of descriptive and correlational designs (Buendía et al., 1998; Cohen & Manion, 2002). In this instance, a descriptive method has been carried out through an *ad hoc* questionnaire to address the objective and research questions. The present study aims to assess the level of digital competence of student teachers pursuing degrees in Early Childhood Education and Primary Education at the Faculty of Education, Economy and Technology of Ceuta, University of Granada, Spain. Specifically, we aim to examine the extent to which future teachers acquire, develop, and enhance their digital ethics competences across the following areas: information and data literacy, communication and collaboration, creation of digital content, digital safety, and problem solving.

This general aim is further detailed by four research questions:

RQ1. Are there significant associations in the level of performance of digital competence of student teachers according to gender?

RQ2. Are there significant associations in the level of performance of digital competence among student teachers according to the degree that they are studying?

RQ3. Are there significant associations in the level of performance of digital competence of student teachers according to their socioeconomic status?

RQ4. Are there significant associations in the level of performance of digital competence of student teachers according to the ICT extra-training (received in courses, workshops, seminars, etc.) to pay attention to diversity?

Population and Sample

During the 2023-24 academic year, the study population consisted of 100 future teachers in their final year of Early Childhood and Primary Education Degrees at the Faculty of Education, Economy, and Technology of Ceuta of the University of Granada, Spain (N=100). A non-probabilistic sampling method, also known as convenience sampling, was employed. Specifically, participants who met the established inclusion criteria were selected. The criteria include students in their fourth year of Early Childhood Education and Primary Education Degrees who are currently enrolled in the Practicum II course. These students, given their extensive training –either at the faculty or at practice centers– already possess sufficient criteria to assess their proficiency in digital skills.

A detailed examination of the sample indicates that 78.4% of the student teachers surveyed are women, while 21.6% are men. Most respondents hold a Primary Education Degree, specifically they belong to the branch of Special Education. In terms of the variable socioeconomic status, it was determined that 43 future teachers have a medium-high level of access to ICT resources, while 30 teachers in pre-service have a medium-low purchasing power.

It is worth noting that over half of the participants have not undergone accredited ICT training to enhance their ability to cater to the diverse needs of their future pupils (59.5%).

Instrument for Data Collection

After an exhaustive review of validated instruments, we developed an *ad hoc* questionnaire that was validated using the expert judgment technique. As stated by Cabero et al. (2020), the results obtained through the questionnaire provide a comprehensive understanding of the strengths and weaknesses (areas for improvement) of the digital competences of future teachers. Specifically, we have relied on instruments and scales from national and international literature based on the analysis of digital competences for citizenship (Ata & Yildirim, 2019; Baysan & Çetin, 2021; Cabero & Palacios, 2020; Gutiérrez & Cabero, 2016; INTEF, 2022; Lozano & Fernández, 2018). The *Questionnaire of Digital Competences for Citizenship with support in Ethics* (QDCCE) is comprised 40 Likert-type items, with five options for each item (1=insufficient performance; 2=sufficient performance; 3=moderate performance; 4=outstanding performance; and 5=excellent performance).

Once the latest version of the questionnaire was completed, an exploratory phase was initiated to assess its reliability applying Cronbach's alpha (Bisquerra, 1987). In this instance, the pilot study was conducted with 28 fourth-year student teachers, resulting in a coefficient of .923. Given that a reliability value of 0.8 is deemed optimal, we can conclude that the present instrument exhibits a high degree of internal consistency (George & Mallery, 2003). It is worth noting that after obtaining Cronbach's alpha if each item was eliminated, we found a high level of consistency for the 40 items of the questionnaire. None of the items significantly altered the

value of the coefficient; hence no item could be omitted or deleted (see Table 1).

Regarding the procedure for administering the instrument, it was distributed during the training seminars for the Practicum II of the Early Childhood Education and Primary Education Degrees (in-person).

Table 1

Cronbach's Alpha Value

Items	Scale means if item has been eliminated	Scale variance if item has been eliminated	Item-total correlation	Cronbach's alpha if each item was eliminated
Item 1	191.29	651.101	-.028	0.925
Item 2	190.96	628.332	0.341	0.923
Item 3	190.79	633.212	0.258	0.923
Item 4	190.86	628.127	0.342	0.923
Item 5	190.46	622.776	0.611	0.921
Item 6	190.43	619.365	0.703	0.920
Item 7	190.75	617.750	0.599	0.920
Item 8	191.50	632.704	0.307	0.923
Item 9	190.43	628.550	0.425	0.922
Item 10	190.39	624.247	0.437	0.922
Item 11	190.32	622.893	0.631	0.921
Item 12	190.07	629.847	0.353	0.922
Item 13	191.29	623.545	0.361	0.923
Item 14	192.82	626.226	0.345	0.923
Item 15	190.82	607.782	0.619	0.920
Ítem 16	191.00	640.370	0.234	0.923
Ítem 17	192.04	643.073	0.094	0.925
Item 18	190.32	620.078	0.584	0.921
Item 19	191.04	619.665	0.454	0.922
Item 20	190.11	632.025	0.431	0.922
Item 21	190.25	627.898	0.446	0.922
Item 22	190.79	606.249	0.674	0.920
Item 23	191.64	633.794	0.252	0.923
Item 24	190.25	623.676	0.447	0.922
Item 25	191.32	601.263	0.714	0.919
Item 26	190.96	614.925	0.524	0.921
Item 27	190.36	636.238	0.257	0.923
Item 28	190.50	617.000	0.519	0.921
Item 29	189.86	636.868	0.419	0.922
Item 30	190.21	625.508	0.559	0.921
Item 31	191.21	618.915	0.559	0.921
Item 32	191.64	629.942	0.371	0.922
Item 33	190.11	640.988	0.203	0.923
Item 34	191.29	620.063	0.503	0.921
Item 35	191.11	616.840	0.531	0.921
Item 36	190.14	639.534	0.292	0.923
Item 37	190.86	603.683	0.734	0.919
Item 38	190.29	619.989	0.651	0.920

Item 39	190.21	620.841	0.507	0.921
Item 40	190.68	609.782	0.636	0.920

Note. The table shows the Cronbach's alpha if each item was eliminated.

Data Analysis

The data collected through the questionnaire were treated statistically using IBM SPSS software (George & Mallery, 2003). The statistical analysis was a contingency analysis (Chi-Square test). The inferential analysis enabled us to ascertain whether there are notable correlations between the level of performance of the future teachers and the independent variables included in the questionnaire, such as gender, degree, socioeconomic status, and the ICT extra training received to improve attention to diversity.

Results

The results yielded provide responses to each of the research questions presented at the outset of the study.

Are there significant associations in the level of performance of digital competence of student teachers according to gender?

Table 2 presents the specific results on which variables of the questionnaire are significantly associated with the gender of the Ceuti male and female student teachers of Early Childhood Education and Primary Education who participated in this study.

Table 2
Contingency analysis by gender

Variable	***Gender p value***
"When I shop online, I make sure that the websites are trustworthy" (item 28)	.016*
"I promote safe, legal and responsible use of information and ICT" (item 30)	.024*

Note. Equivalence: *p ≤ 0.05 ** p ≤ 0.01

The results indicate a significant correlation between gender and two variables, representing 5% of the total questionnaire. Both variables, pertaining to the safety area, have a confidence level of 95% (p-value ≤ 0.05). 62.5% of the future men teachers of Early Childhood Education and Primary Education rated their competence as "outstanding" in response to item 28. The future female teachers, on the other hand, report the same level of development, "outstanding," but at a lower rate (20.7%). While no male prospective teachers are positioned at the minimum or "insufficient" level, the female trainee teachers achieve excellence at a rate of 39.7%. This high level of development is in line with the results obtained from item 30, which formed the basis of this research. Considering these findings, it can be stated that the profile of men demonstrates a high level of competence mastery. In comparison to the 20.7% of responses from the female pre-service teachers who endorse/ratify the highest level of competence, almost twice as many future men teachers have an "excellent" level (43.8%). The

initial finding is that male trainee teachers, particularly in Primary Education Degree, demonstrate greater proficiency in promoting digital ethics.

Are there significant associations in the level of performance of digital competence of student teachers according to the degree that they are studying?

We also investigated whether there is a notable correlation between the education degree of the student teachers and the variables in the questionnaire they completed. A preliminary analysis of Table 3 indicates that two items, representing 5% of the total questionnaire, exhibit particularly strong correlations.

Table 3
Contingency analysis by degree

Variable	**Degree** ***p value***
"I am able to identify content that has been created by platforms that employ Artificial Intelligence systems (Dall-e, Midjourney)" (item 1)	.003**
"I guide others to locate the information they need to solve technical problems" (item 37)	.038*

Note. Equivalence: * $p \leq 0.05$ ** $p \leq 0.01$

Following an in-depth analysis of the cross-referencing of the variables with the qualifications of the future teachers, we determined that students pursuing a degree in Early Childhood Education have an "outstanding" level of competence in identifying images and videos created by platforms utilizing Artificial Intelligence systems (56.5%). Furthermore, 17.4% of respondents indicated positive results, demonstrating an "excellent" level of proficiency. In comparison, student teachers of Primary Education demonstrate a "moderate" level of proficiency in this skill, indicating a lack of competence in this area (31.4%). Furthermore, the same variable demonstrates a notable correlation with the specific mention/branch or area of specialization (see Table 4), which provides insight into the enhanced proficiency profile of the Primary Education Degree. In this regard, the future teachers of English as a Foreign Language stand out, with 46.7% of respondents indicating proficiency. However, the student in pre-service of Early Childhood Education remain in the leading position, with the highest level of competence. The opposite is true about item 37, which pertains to problem solving area. In this case, most student teachers of Primary Education report an "outstanding" level of development, compared to 21.7% of the responses of the future women teachers of Early Childhood Education. It can be concluded that the primary area of focus of trainee Early Childhood Education teachers is information and data literacy, while students with a degree in Primary Education demonstrate greater proficiency in problem solving skills.

Table 4
Contingency analysis by mention/branch

Variable	Mention/Branch *p value*
"I am able to identify content that has been created by platforms that employ Artificial Intelligence systems (Dall-e, Midjourney)" (item 1)	.019*

Note. Equivalence: * $p \leq 0.05$ ** $p \leq 0.01$

Are there significant associations in the level of performance of digital competence of student teachers according to their socioeconomic status?

We also wanted to ascertain whether there was a notable correlation between the socio-economic level of student teachers' access to ICT resources and the variables in the questionnaire. As illustrated in Table 5, three variables, representing 7.5% of the total questionnaire, demonstrate a statistically significant association at a 95% confidence level, except for the first variable (99%).

Table 5
Contingency analysis by socio-economic status/level

Variable	Level *p value*
"I know how to design activities where my future students will have to use ICT resources critically " (item 6)	.004**
"I can use ICT to form collaborative working groups" (item 9)	.031*
"When I design assignments, I take into account the availability and the connectivity of students' devices" (item 39)	.022*

*Note*Equivalence: * $p \leq 0.05$ ** $p \leq 0.01$

In terms of the design of activities leading to the critical and responsible use of ICT, we identified a noteworthy development among student teachers with a medium-high socio-economic status (48.3%), in comparison to the responses of student teachers from the lower-middle class (43.3%). In this regard, the trainee teachers with limited purchasing power indicate that they possess a "sufficient" level of competence. In terms of the variable related to the constitution of collaborative groups, the results demonstrate an "excellent" level of competence, particularly among the student teachers of lower-middle socio-economic status (43.3%). The same situation can be observed regarding the final variable, although in this case, the students in pre-service with low purchasing power indicate that their level is insufficient.

The analysis of the level of performance in digital competence according to the additional training received in ICT for diversity did not yield any significant associations. A comprehensive review of the results, as analyzed through contingency analyses, reveals that the future men teachers of Primary Education of Ceuta demonstrate expertise in safety, while the female student teachers in Early Childhood Education excel in information and data literacy. The level of development is also influenced by the socio-economic diversity of the student teachers of Early Childhood and Primary Education. The results indicate that the

participants with medium-high purchasing power demonstrate greater proficiency in information and data literacy, while those with a medium-low socioeconomic level exhibit stronger communication and collaboration skills, as well as problem-solving abilities. This is observed regardless of whether they have received supplementary or extra training in ICT for the enhancement of educational services.

Conclusions

Digital ethics stands out as a transversal element for the promotion of the fourth Sustainable Development Goal (SDG), which is the guarantee of inclusive and equitable quality education through ICT. The results of this study, obtained through an exhaustive statistical treatment, reflect the development of the ethical dimension in the Early Childhood Education and Primary Education Degrees of the Faculty of Education, Economy and Technology of Ceuta. Specifically, the results show that, thanks to the theoretical-practical training received at the faculty, future teachers have acquired and/or improved their digital competences from a critical and responsible approach. Marín et al. (2022) also confirm this optimal performance, especially in safety. This contrasts with the training gaps identified by Gómez (2023).

A comparative analysis of degree programs reveals that the female pre-service teachers of Early Childhood Education demonstrate a stronger proficiency in information and data literacy. Conversely, male students enrolled in Primary Education programs exhibit a higher level of competence in problem-solving skills, such as assisting other citizens. From an economic standpoint, these areas demonstrate disparities in the proficiency levels of the participants. In this scenario, the future teachers from upper-middle-class backgrounds tend to demonstrate superior proficiency in information and data literacy. Conversely, those from lower-middle socioeconomic backgrounds exhibit enhanced communication, collaboration, and problem-solving abilities. However, the level of development is commendable about the promotion of measures to draw attention to diversity (for example, creating personalized ICT resources). Regarding gender differences, the findings indicate that male pre-service teachers, particularly those pursuing a Primary Education Degree, demonstrate a greater ability to promote digital ethics, consistent with the observations made by Ata and Yildirim (2019).
Other studies confirm the impact of this variable on the digital competences of teacher 's staff (Moreno et al., 2019).

From a prospective standpoint, the present study offers insights that can inform the development of new lines of research and topics currently in vogue, such as digital sustainability and digital ethics training in the initial teacher training period. This aligns with the works undertaken by Flores and García (2023) and Marín and Tur (2024). The development of a culture of ethical conduct in the use of emerging technologies in higher education institutions is a crucial challenge for universities seeking to contribute to the creation of a fairer and more inclusive society. Aware of this, the University of Granada, Spain is leading a research project which focuses on the field of the professional teaching ethics and initial teacher training (Reference CE-02-UGR24). In fact, a macro-diagnosis on the professional ethics is currently being carried out with the aim to determine the state of the art in teacher training at the Faculty of Education, Economy and Technology of Ceuta of the University of Granada and to assess whether ethical competence can be considered as a viable characteristic in the selection of the future teachers. This is an innovative line of work in the Spanish university context that will promote scientific debate on the subject.

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