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Assessing digital competencies: A self-evaluation approach for university students' academic success

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Abstract

University students must be equipped with key digital competencies in Education 4.0, where connectivity, technological fluency, and digital literacy are essential for academic and professional development. This study analyzes the self-perceived digital competencies of university students enrolled in education degrees across seven universities in Spain and Latin America. Data were collected through an online survey comprising Likert-scale items assessing five core areas of digital competence aligned with the DigComp framework: information management, communication, content creation, digital safety, and problem-solving using a quantitative and descriptive methodology. The results show that students feel most competent using digital technologies to communicate, share information and search for and manage data. However, significant weaknesses were identified in areas, such as digital content creation, pro-gaming, and solving technical problems as well as managing digital safety and copyright issues. Gender and age differences were statistically significant although with small effect sizes. These findings highlight the need to enhance training programs in higher education, especially in underdeveloped areas of digital competence to better prepare future teachers. This research contributes to the growing knowledge on digital self-assessment and underscores the importance of integrating comprehensive digital literacy into teacher education curricula.

Keywords: Digital competence, Digital education, Self-perception, University student.

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Contents

Contribution of this paper to the literature
This study contributes to the literature by analyzing digital competence from the perspective of university students 4.0 across various Ibero-American countries, using the DigComp framework. Unlike previous studies, it provides a comparative analysis with a large, multi-center sample, highlighting specific weaknesses, such as digital security and programming.

1. Introduction

1.1. Towards a Student 4.0 Profile

In the past few years, many studies have identified different trends in the generational profiles of young people who coexist and interact in virtual environments and digital platforms. On the one hand, an approach based on the society of information and knowledge identified the *knowmads*, or so-called knowledge nomads, young people who are oriented towards the acquisition of invisible learning through the daily use of technology and social media (Cobo & Moravec, 2011). On the other hand, an approach centered on the workplace recognizes *millennials* as a digital generation that emerged from the demands for digital jobs, responding to the needs of companies and organizations to include a human resource with computer skills and digital competencies (Gutiérrez-Rubí, 2015). A new configuration in the way of life of young people with the internet and social media raises the need to reconsider the effect of technology on the workforce. Technological knowledge converts these profiles into versatile individuals for adapting to current and future jobs (Tinmaz & Lee, 2019).

Many authors have coined various terms to identify the new digital generations from acknowledging generations due to their frequency of use of social media, such as the YouTube Generation or the Facebook Generation (García & Gil, 2018; Suárez, 2011) to the use of digital phones, such as the App Generation (Gardner & Davis, 2014) and other labels that emerged from the pandemic, such as Generation Z or the Pandemic Generation, or Generation 4.0 itself (Arenas, García, & Ruíz, 2022; Miguel-Vergés, 2023).

Currently, a technological revolution where industries, organizations, and companies have implemented new production techniques based on the use of new technologies and the interaction with artificial intelligence (Baena, Guarin, Mora, Sauza, & Retat, 2017; Zhongshan et al., 2020). Education 4.0 has emerged from this context. It does not only seek to use digital tools or mobile devices or interact through social media but to develop, in parallel, disciplinary knowledge and cross-cutting competencies that are adapted to a complex world. This reality creates opportunities and challenges in the area of education (Flores-Alarcia & del Arco, 2024). In addition, this new approach to education integrates the ability to adapt to change and the frustration of students and helps develop the ability to communicate, exploiting the advantages of technology (Martínez Ruiz, 2019; Ocegueda, Ocegueda, & Barajas, 2022). On the other hand, education 4.0 builds societies of knowledge and reduces the digital divide (Rodríguez-Abitia, Martínez-Pérez, Ramirez-Montoya, & Lopez-Caudana, 2020). Similarly, education 4.0 integrates advanced technology with artificial intelligence, virtuality, and augmented reality in education processes to guide them towards personalized and collaborative learning infused with technology to prepare students for jobs in the future (Ahmad et al., 2024; Bonfield, Salter, Longmuir, Benson, & Adachi, 2020). At the same time, this education incorporates free software, open-source digital resources, digital pedagogy, and adaptive, smart, and disruptive technologies; and lastly, it is integrated into new models of technological innovation (González-Pérez, Ramírez Montoya, & García-Peñalvo, 2022; Patiño, Ramírez-Montoya, & Buenestado-Fernández, 2023; Sharma, Suri, Sijariya, & Jindal, 2025).

We can affirm that a new student 4.0 has emerged, who not only utilizes digital technology and social media but also includes other skills through hybrid methodologies, such as the development of critical thinking, creativity, online collaboration, problem- solving, and management of information for learning, among others based on the concept of education 4.0 (Astuti, Waluya, & Asikin, 2020; Fidalgo-Blanco, Sein-Echaluce, & García-Peñalvo, 2022). Students 4.0 in education are prepared to respond to a society where the production of knowledge has acquired a notable significance, and where the volume of information, known as Big Data has increased (Hımmetoglu, Aydug, & Bayrak, 2020). This type of student responds to the new trends in mobile learning, where some elements stand out in their profile:

a) The possibility of being permanently connected to different people in different countries and through different applications (apps) and platforms.

b) The tendency to facilitate collaborative work through virtual environments.

c) Responding to ubiquitous, shared, accessible, flexible, immediate, independent, and interactive learning (Iglesia Villasol, 2019).

Students 4.0 are defined as students who have clearer minds and high expectations from higher education and future jobs to meet their expectations in the university environment (Times Higher Education, 2024). For this type of student, universities try to ensure that their pedagogic models are strongly centered on the learning of students and that their education is permanently associated with work practices to better prepare students for the workplace. These students are prepared to face the challenges in current society, where technology plays a central role in diverse aspects of life.

1.2. Characteristics of the Student 4.0

The following characteristics can be cited as follows:

a) Development and mastery of digital competencies: different digital tools are utilized, and skills are developed to use technology efficiently. These digital competences are found as a function of continuous digital literacy for the acquisition of competences. At the same time, these students learn continuously through digital means and envision themselves as digital citizens (Chiecher, 2020).

b) Autonomy in learning: This student develops the ability to seek and select information to acquire and create new knowledge independently. Open education resources, digital platforms, MOOCs, and webinars among others, promote this autonomous and personalized learning (Valdez, Gómez-Arteta, & Rossel, 2022).

c) Online collaboration: There is a trend among students 4.0 to work collaboratively or cooperatively. Learning is not unique or exclusive but can be shared. Participation in online projects, the creation of content, the dialogue and sharing spaces, among others are some of the evidence of online collaboration by this type of students (Romero-Robredo, 2017).

d) Ability to adapt: These students can adapt to new technologies and continuously learn in digital environments and platforms. Social media become permanent spaces of consultation, information, communication, and interaction (López Aguilar, Álvarez Pérez, & Ravelo González, 2022).

e) Critical thinking: Students 4.0 can critically analyze, assess, and question the information that flows on the internet and social media. The information is questioned, and a reaction is elicited when dealing with false information in the press. At the same time, this critical thinking lays the foundation of a critical digital citizenship (Vernier, Cárcamo, & Scheihing, 2018; Yanti, Lufri, & Ahda, 2025).

In the current digital era, the development of digital competences has become essential for academic and professional success (Echeverría Samanes & Martínez Clares, 2018). For students 4.0, who navigate in a world of constant technological change, it is crucial to continuously acquire and improve these skills. The challenge is to continuously perform a self-assessment of their digital competences through tools such as online questionnaires or specialized platforms (Gabalán, Maluenda, & Pozo, 2023). Similarly, they can enrich their training by participating in online courses offered by recognized education platforms such as Coursera, edX, or Udemy, where they can acquire specific skills such as programming, web design, or data analysis (Ciolacu, Tehrani, Beer, & Popp, 2017). Their participation in digital projects, either in hackatons, programming competitions, or software development groups, or even the use of artificial intelligence will provide them with opportunities to apply their knowledge in a practical context (Mendoza, 2021). Lastly, it is beneficial to take advantage of social media and online communities to share experiences, ask questions, and learn from other professionals in their field of interest.

Universities can integrate continuous learning programs that allow students to stay updated and improve their digital skills even after graduation. These programs can encompass several resources, such as online courses, in-person workshops, and professional certifications. The establishment of partnerships with industry is key (Adha, Wibowo, Faslah, Ariyanti, & Lutfia, 2022; Maryanti, Rohana, & Kristiawan, 2020). On the other hand, collaborating with companies and organizations provides students with real-world experiences, joint projects, and mentorship programs which will help them apply and develop digital competencies in real work environments. Promoting research and innovation in the area of digital competencies is crucial for the identification of emerging trends and market needs, and to help education programs continuously adapt to meet these demands (Cobo, 2016). The development of digital competencies for students 4.0 requires a holistic approach that combines self-assessment, continuous training, and participation in practical projects where students, teachers and universities work together to prepare students for success in a digital world under constant evolution (Gabalán et al., 2023).

1.3. Digital Competencies for the 21st Century: DigComp

Digital competence involves the confident, critical, and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. It includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), safety (including digital well-being and competencies related to cybersecurity), intellectual property- related questions, problem solving and critical thinking (Unión Europea, 2018).

DigComp, the abbreviation of the Digital Competence Framework for Citizens, is a framework of reference developed by the European Commission to describe and categorize the digital competences needed by citizens to effectively utilize digital technologies in modern society. DigComp was published for the first time in 2013, and has become an important reference for many digital competence initiatives at the European level and the level of the member states (Vuorikari, Punie, Gomez, & Van Den Brande, 2016).

DigComp is divided into five main areas of competence:

- Information and Data Literacy: Ability to search, assess, manage, share, and create information in an efficient and safe manner using digital technologies.
- Communication and Collaboration: Ability to communicate, collaborate, and participate in social media and online collaboration environments, understanding the digital behavior guidelines, and respecting cultural diversity.
- Digital Content Creation: Ability to creatively and ethically create and edit digital content using adequate digital tools and resources.
- Safety: Awareness and understanding of the risks associated with the use of digital technologies, as well as skills to protect one and others online.
- Problem-Solving: Ability to identify, analyze, and solve technical problems related to the use of digital technologies, as well as to make informed and responsible decisions in digital environments.

The first three areas address competencies that are directly associated with specific activities and uses. In contrast, areas 4 and 5 (safety and problem- solving) are considered cross-cutting competencies as they are applied to any type of activity performed through digital means. Although the problem- solving element is present in all the competencies, a specific area was defined to emphasize its importance in the adoption of technology and digital practices (Vuorikari et al., 2022). Each area of competence is divided into different dimensions (see Table 1).

Table 1. Dig Comp: Areas and dimensions

Areas	Dimensions
1. Information and data literacy	1.1 Browsing, searching and filtering data, information and digital content
	1.2 Evaluating data, information and digital content
	1.3 Managing data, information and digital content
2. Communication and collaboration	2.1 Interacting through digital technologies
	2.2 Sharing through digital technologies
	2.3 Engaging in citizenship through digital technologies
	2.4 Collaborating through digital technologies
	2.5 Netiquette
	2.6 Managing digital identity
3. Digital content creation	3.1 Developing digital content
	3.2 Integrating and re-elaborating digital content
	3.3 Copyright and licenses
	3.4 Programming

Areas	Dimensions
4. Safety	4.1 Protecting devices
	4.2 Protecting personal data and privacy
	4.3 Protecting health and well-being
	4.4 Protecting the environment
5. Problem- solving	5.1. Solving technical problems
	5.2. Identifying needs and technological responses
	5.3. Creatively using digital technologies
	5.4. Identifying digital competence gaps

DigComp is used as a guide for the development of policies, education programs, and assessment of digital competence across Europe with the aim of improving the digital literacy of citizens and promoting their participation in digital society.

1.4. Self-Perception of Digital Competences

Education on digital competencies is crucial in the university environment for teachers and students. Teachers must acquire these competencies to deal with the challenges found in the society of knowledge (Espinosa, Porlán, & Sánchez, 2018; Pérez, 2015) especially in the context of virtual education (García, Zapata, & Maldonado, 2021). Students also recognize the importance of these competences for their academic and job performance (Márquez, Olivencia, & Meneses, 2017) so it is a crucial aspect that must be developed during their process of education (Gisbert & Esteve, 2011).

Many studies have explored the digital competencies perceived by teachers and students as well as the digital competence of educational organizations. Perez Escoda and Rodriguez Conde (2016) indicated that teachers at a primary school lacked digital skills for their pedagogic use. Fernández-Miravete and Prendes-Espinosa (2021) assessed the digital competence of a secondary education institution showing that more efforts are made to promote practices directed to the process of teaching and learning of students or to the training of teachers, postponing other areas, such as leadership and governance or evaluation practices. Fernández-Sánchez and Quiroz (2022) underlined the gender differences in digital competence among the 1st year pedagogy students in Chile with men obtaining higher scores in certain areas. Henríquez-Coronel, Gisbert-Cervera, and Fernández (2018) provided a Latin American perspective pointing out that the best competence attained was searching and accessing information, while the lowest tended to be related to social learning.

Research on the self-perceived digital competencies of students has revealed a generally positive perception but also significant gaps in specific areas (Rampasso et al., 2021). Araiza-Vazquez and Pedraza-Sánchez (2019) found a mean value of 3.85 (on a 1 to 5 scale) at the general level of self-perceived digital competence among university students enrolled in business school. Martzoukou, Fulton, Kostagiolas, and Lavranos (2020) stated that the higher the levels of self-perceived digital competence, based on dealing with daily digital tasks, the higher probability they had of developing a high self-perceived competence in other digital areas related to education. Zhao, Sánchez Gómez, Pinto Llorente, and Zhao (2021) indicated that the perceptions of students on digital competences in terms of information and data literacy, communication and collaboration, and safety were positive. Also, significant differences were found in the self-perception of students on digital competence related to gender, course level, area of residency, and relevant previous education on the instrument based on the DigComp framework.

Sánchez-Caballé, Gisbert-Cervera, and Esteve-Mon (2020) observed that the authors considered that digital competence was composed of different elements (information skills, content creation, communication, ethical skills, problem solving, technical skills/use, and strategic skills). As for the terminology used to refer to this competence, it was observed that the terms used in the literature were literacy and digital competence. Lastly, most of the authors did not consider that the youth truly had the digital competences they believed they had. The students do not have well-developed digital competence.

2. Materials and Methods

A quantitative descriptive study was performed using a survey composed of close-ended questions. The aim was to obtain data that would help us answer the following research question: What perceptions do university students have about their level of technological competence?

2.1. Objectives

The present study aimed to analyze the results of the self-assessment of digital competencies declared by students.

In this way, we will be able to identify which competence they feel the strongest with and which the weakest.

2.2. Participants

Seven universities that offered degrees in education participated in the present study. The seven universities are part of the cooperation network that agglutinates professors and researchers who cooperate in the development of studies, research, and education. Of these seven universities, two were in Spain, while the rest were in Latin America (Chile, Colombia, and Ecuador). The sample was chosen by convenience, but at the same time, the informants were chosen randomly from the university student population enrolled in education. In this way, the development of a broader study consisting of diagnosing the level of competence in digital matters of future education professionals is addressed.

The final sample was composed of 875 informants. Considering that the entire student population is 6159 that the sample is composed of 875 participants, and with a margin of error of ± 3.07 %, we can conclude that the sample is representative of the population.

The sample is characterized by

- Age: Most of the samples were aged between 18-20 years old: 68.9% (603 participants). The remaining 17.6% (154 cases) were aged 21-22 years old while the rest were older.

- Gender: The sample was composed of mostly women (63.3% and n=554), as compared to men (35.5%; and n=311). The 10 remaining participants were distributed similarly between those who defined themselves as non-binary and those who preferred not to answer.
- Lastly, with respect to the place of residency, 3 categories were considered after defining an intermediate one between the clearly urban and rural areas, named "hybrid" (like semi-urban). Practically, 2/3 of the participants lived in urban areas (66.7% and n=583). The remaining 1/3 was similarly distributed between those living in rural areas (n=135; 15.4%) and those who lived in intermediate hybrid areas (n=157 and 17.9%).

2.3. Instrument

The instrument that was used to obtain the data was organized according to Table 2, which shows the heading of the question and the number of variables that it generates (and its type of measurement).

After the informed consent, accepted by the informant on item 1, we find the first part, which encompasses the identification sociodemographic data of the participants, from item 2 to item 6: age, gender, level of education, place of residence, university. Then, 3 dimensions are defined. The 1st, equipment availability is composed of 15 items, where the answer "yes" is scored with 1 point while the "no" and n/a answers are scored with a 0. The 2nd, use of internet and digital devices, is composed of 22 items with a Likert-type response of 5 options, from never=0, to always=4. Lastly, the 3rd, self-assessment of digital competencies, contains 5 Likert-type items with 5 response options, from nothing=0, to a lot=4.

Table 2. Structure of the dimensions of the questionnaire

Dimension	General question statement	Variables
Equipment availability	7: Do you have any of the following products in your home?	5 categorical items
	8: What type of Internet connection do you usually use?	2 categorical items
	9: What electronic devices do you have for your exclusive personal use?	4 categorical items
	10: Regarding the internet connection	4 categorical items
Use of internet and digital devices	11: Indicate what activity you carry out on the internet	22 Likert items with 5 options
Self-assessment of digital competencies	12-13: Self-assessment of digital competencies	9 Likert items with 5 options

In the present article, we will focus on the dimension self-assessment of digital competencies, which is composed of 5 items in a Likert format of 5 points (0-4). The reliability coefficient obtained was high (Cronbach's alpha: 0.87; 95% CI: 0.85 -0.89) which provides a high degree of confidence in the answers of the participants.

Next, an Exploratory Factor Analysis (EFA) was performed which found that all the items in this dimension obtained high intensity coefficients (between 0.80 and 0.84), demonstrating their belonging to an underlying common dimension. The Confirmatory Factor Analysis (CFA) validates this result, as high factorial loads were obtained (see Table 3), which were highly significant ($p<0.001$). Therefore, the existence of this dimension is concluded, which allows the creation of a total dimensional variable.

Table 3. Factor analysis of the items in the self-assessment of digital competences dimension. Total sample. (N=875)

Areas	Standardized coefficient	*Significance test*	
		Value	*P-value*
1. Search for information, evaluate it and manage it…	0.85	28.30 (**)	<0.001
2. Communicate, share data, …	0.83	27.29 (**)	<0.001
3. Create digital content, program …	0.7	21.12 (**)	<0.001
4. Keep own information safe, …	0.69	20.90 (**)	<0.001
5. Solve technical problems…	0.68	20.14 (**)	<0.001

Note: (**) = Highly significant

2.4. Data Analysis

The statistical analysis was performed with the use of the IBM-SPSS Statistics-28 program. Statistical techniques and tests were the following:

- The quantitative variables were described through the common tools of centrality and variability.
- The reliability of the questionnaire was assessed through Cronbach's alpha coefficient of internal consistency. A value higher than 0.60 indicates an acceptable reliability. Therefore, a value higher than 0.80 is good, and a value >0.90 is very good).
- Factor analyses were used: Exploratory (EFA) and Confirmatory (CFA) to determine and validate the dimensional structure of the questionnaire.

In all the inferential statistical tests, significance was considered when $p<0.05$ (common 5% confidence level) and a high significance when $p<0.01$ (1% confidence level). In addition, almost significant or a high tendency towards it, was considered when $p<0.10$ (<10%).

3. Results

Table 4 contains a description of the responses of the participants in the total sample to these 5 items. The internal variability of the responses in this group is very similar (homogeneous) when some items are compared with others with all the standard deviations found to be between ±1.02 and ±1.23 points. In the same sense, it can be verified that in all of these items, the complete range of responses (0-4) were covered; although it is true that a certain tendency of responses with high values (3-4) was observed, it implies that the means will be on the higher part of the scale, as was the case with scores within the 2.21 and 3.07 point range.

Table 4. Descriptive analysis of the items in the self-assessment of digital competences dimension in the total sample (N=875).

Item number: Ability to	Ns/Nc	N valid	Response for each option (%)					Mean	Standard deviation
			0	1	2	3	4		
1. Search for information, evaluate it and manage it…	2	873	3.4	5.8	21.0	38.9	30.8	2.88	1.02
2. Communicate, share data, …	3	873	3.6	5.2	15.6	32.6	43.1	3.07	1.05
3. Create digital content, program …	8	867	10.4	18.5	28.6	24.6	18.0	2.21	1.23
4. Keep own information safe, …	7	868	5.5	17.3	27.6	30.8	18.8	2.40	1.14
5. Solve technical problems…	5	870	8.0	20.1	30.9	26.6	14.4	2.19	1.15

There was only one skill above 3 points (from a maximum of 4): communication, sharing data and interacting with members through digital technologies (3.07). Close to 3 points, we find search for information, evaluate it, and manage it, within digital contents (2.88). In third place, we find the ability to keep one's information, devices, and personal and private platforms protected in a digital environment (2.40). The bottom places were occupied by the ability to create digital content, program, and establish copyrights and licenses (2.21) and the ability to solve technical problems and provide a response to technological-digital problems when they appear (2.19 points).

Some highly significant differences were observed ($p<0.001$) as a function of gender and age although with very small effect sizes (2.9% and 2.2%, respectively). The data pointed to a slight difference in favor of women and the participants starting at 23 years of age. On the other hand, significance ($p>0.05$) was not found as a function of the place of residence with the effect size being almost null (see Table 5).

Table 5. Dimension 4: Self-assessment of digital competences. Complete sample (N=875). Comparison to factors

Factors / *Categories*	N	Mean (±D.S.)	Significance test		Effect size: R^2
			Value (sig)	*P-value*	
Gender					
Male	311	12.25 (±4.75)	T=2.16 (*)	0.031	0.005
Female	554	12.94 (±4.38)			
Age					
18-20 years	601	12.83 (±4.40)	F=0.68 (ns)	0.506	0.001
21-22 years	154	12.40 (±4.87)			
23 or older	118	12.50 (±4.69)			
Residence					
Rural	135	13.12 (±4.60)	T=1.44 (ns)	0.149	0.003
Urban	582	12.48 (±4.62)			

Note: (ns)= Not significant (*) = Significant

Next, each dimension of the questionnaire was correlated with the rest. The results (see Table 6) indicate that the self-assessment of digital competencies is strongly correlated in intensity and significance ($p<0.001$) with the use of the Internet and digital devices.

Table 6. Correlation coefficients between the dimensions of the questionnaire. Total sample. (N=875)

Corr. coeff. / P-value (sig)	Variable of the dimension			
	Equipment	Connections	Use of the internet digital devices	Self-assessment of digital competences
Equipment	----------			
Connections	**0.23** / <0.001 (**)	----------		
Use of the internet digital devices	**0.18** / <0.001 (**)	**0.07** / 0.018 (*)	----------	
Self-assessment of digital competences	**0.23** / <0.001 (**)	**0.09**/0.003 (**)	**0.55**/ <0.001 (**)	----------

Note: (*)= Significant (**) = Highly significant

Table 7 shows that we have three differentiated blocks of activities to correlate the digital competences declared by the informants with their use of the internet. Everything is related to using instant messaging and participating in social media with a mean above 3 (from 0 to 4). We find the activities related to communicating through emails or messaging, video calls, and those related to text processing, use of storage spaces, searching for information, creating presentations or documents with texts and images, and using editing software for photos, videos, or audio with a mean between 2.5 and 3.

The lowest values close to 1 or below are found in activities such as changing program configurations with the lowest being programming with a programming language or installing programs for the functioning of computers or apps.

These uses are directly related to the declared digital competencies where we find predominance in searching for, evaluating, and managing information, communicating, and sharing data. While the weakest competence was creating digital content, programming, and establishing copyrights and licenses, together with solving technical problems and providing a response to technological-digital problems when they emerge, which was the lowest.

Table 7. Descriptive analysis of the items from the use of the Internet and digital devices dimension in the total sample (N=875).

Item number: heading	N/A	Valid N	Response for each option (%)					Mean	Standard deviation
			0	*1*	*2*	*3*	*4*		
1. Receive or send emails	1	874	5.5	4.2	35.2	25.6	29.4	2.69	1.10
2. Make a telephone call or video call with the internet	2	873	6.5	9.2	27.9	19.9	36.4	2.71	1.23
3. Participate in social media	5	870	6.7	4.9	17.0	16.4	54.9	3.08	1.23
4. Using instant messaging	10	865	5.5	2.4	12.6	13.9	65.5	3.31	1.13
5. Look for information on services or goods	8	867	7.6	7.7	27.5	28.8	28.4	2.63	1.19
6. Read news or magazines online	9	866	8.3	12.1	35.5	24.4	19.7	2.35	1.17

Item number: heading	N/A	Valid N	Response for each option (%)					Mean	Standard deviation
			0	1	2	3	4		
7. Sell goods or services	12	863	38.6	25.4	19.7	10.2	6.1	1.20	1.23
8. Use e-banking	20	855	19.9	14.7	21.8	21.4	22.2	2.11	1.43
9. Upload own content	9	866	18.9	14.5	28.2	15.7	22.6	2.09	1.40
10. Use storage spaces	24	851	7.3	7.5	23.9	24.7	36.7	2.76	1.23
11. Access personal files from the health system	12	863	14.4	21.4	33.0	16.7	15.1	1.96	1.25
12. Take online courses	11	864	22.3	23.1	28.5	12.6	13.4	1.72	1.31
13. Communicate with professors and colleagues	25	850	6.1	3.4	25.1	20.2	35.2	2.85	1.13
14. Obtain information from the administration website	20	855	10.4	16.3	32.2	19.9	21.3	2.25	1.25
15. Send completed forms	15	860	25.0	26.2	21.0	14.3	13.6	1.65	1.35
16. Transfer files between computers	14	861	16.4	27.9	24.5	14.3	17.0	1.88	1.32
17. Install computer programs and apps	20	855	16.4	19.5	26.2	19.8	18.1	2.04	1.33
18. Change program configurations	15	860	26.4	25.7	22.7	12.8	12.4	1.59	1.33
19. Create presentations or documents with texts and images.	27	848	7.9	8.1	23.1	30.4	30.4	2.67	1.21
20. Using programs to edit photos, videos, or audio	23	852	10.7	13.3	27.8	22.7	25.6	2.39	1.29
21. Program with a programming language	9	866	56.5	23.7	12.5	5.0	2.4	0.73	1.02
22. Using basic text functions or Excel	9	866	5.2	4.8	24.4	25.4	40.2	2.91	1.14

4. Discussion

It is important to self-assess digital competencies to know one's deficiencies and to work on mastering these competencies, which will help with one's university and professional success. With respect to the result of the level of digital competencies, their assessment becomes a priority for creating literacy proposals based on trustworthy and precise information (Henríquez-Coronel et al., 2018).

In this context, various standards have been established to assess and accredit digital competencies, such as the International Computer Driving License (ICDL), the PISA test by OECD (2011) and DIGCOMP and ISTE, in the United States and Europe (Henríquez-Coronel et al., 2018). In the case of Latin America, reference frameworks are not found although we find initiatives, such as the matrix of ICT skills for learning (HTPA) by the Center of Education and Technology from the Ministry of Education of Chile, or the Standards of Performance in Costa Rica (Zuñiga & Brenes, 2011) just as initiatives from private foundations, researchers, or institutions to discover the level of digital competencies of both students and teachers at all levels of education (Hernandez-Carranza, Romero-Corella, & Ramirez-Montoya, 2015; Mon & Cervera, 2013).

According to the results, the most consolidated digital competence is communication given the broad affirmative response on the use of digital communication tools by students, which they have incorporated into their university education, such as social media, instant messaging and so on within the self-assessment framework proposed in the present study (Purwanto, Fahmi, & Cahyono, 2022). In this respect, Ruiz Bolívar (2016) states that given the interest and motivation of the university students for social media due to their generalized use as a means of communicating and for entertainment, a need has arisen for educational actions that are different from the traditional ones that favor the passive transmission of content. Thus, each educational action must be substituted or at least complemented with highly interactive learning processes.

This means that the enthusiasm of the university students for social media has led to the justification of their presence in university classrooms as education resources. Moreover, Gómez, Roses, and Farias (2012) affirm that "the networks permit and favor the publication and sharing of information, self-learning, teamwork, communication between students –teacher, feedback, access to other sources of information that support or even facilitate constructivist learning and collaborative learning and contact with experts" (p. 132).

Nevertheless, authors such as García Canclini (2006) and Pérez-Rodríguez and Delgado-Ponce (2012) maintain that the youth are experiencing a deep gap between the digital culture they inhabit and the academic world. This reinforces the idea that both teachers and education institutions in general must promote a true pedagogic approach to the use of digital communication tools in didactic processes to avoid the construction of mosaic knowledge or a network of knowledge circulation apart from the academic environment. It is about, as Flores-Alarcia and del Arco (2024) indicate taking advantage of opportunities offered by the ICT without dismissing the underlying challenges.

The creation of digital resources and content competence is relevant in the training of future education professionals. Presently, education without the presence of these resources and contents cannot be understood, which among other things, allows students to access other contents on the internet, and favor a better understanding as the contents are presented in a more attractive manner that is adapted to different ways of thinking, acting, and communicating. All of this improves knowledge appropriation through the different multimedia languages, and favors the adaptation to different work contexts or social needs and demands (Moya, 2013).

Thus, one of the challenges for teaching will be the design and sharing of digital contents that is dynamic, interactive, and attractive. UNESCO proposed the use of mobile and open digital contents that contribute towards new forms of creation-interaction with educational content within the trends on digital education contents in Latin America (Chiappe, 2016). At the same time, we must consider the latest generation of formats for the creation of digital educational content, such as micro content, the recording of classes, interactive guides and lessons, podcasts, infographics, and animated presentations, among others, which are digital education content formats that contribute towards learning that is more oriented to students.

In the competence related to the resolution of technical problems, the results also evidence a limited development of competences by the students. Little knowledge is inferred on strategies and tools needed to solve difficult problems that may arise with the use of technology. When encountered, education institutions must implement digital literacy programs to identify technical problems in the use of digital tools and virtual environments, and at the same time, seek solutions for their use (del Valle Coronel & Curotto, 2008; Matamala, 2018). As a function of the technological responses, personalized learning environments (PLE) can become an

alternative solution to digital problems, as these individualized environments would allow students to adapt and personalize the resources, environments, technologies, and social media according to their personal needs and interests (Leiva Núñez, Cabero Almenara, & Ugalde Meza, 2018).

Lastly, the importance of providing training on the protection of information and ethical matters must be highlighted. The results show vulnerability in cybersecurity. The starting point for the development of this competence is the strengthening of the concept of privacy, understood as the protection of personal data, which is articulated with informational consent (Solove, 2013; Vilanova, 2024). Digital literacy must be created on the correct use of information and data of a person to guarantee good safety practices in virtual environments, as well as the safe use of the internet, ICT and social media (Ahamed et al., 2024; Castillejos López, Torres Gastelú, & Lagunes Domínguez, 2016).

Many studies highlight the need and importance of protecting information on social media (Blandón Rizo, 2023; Londoño-Camargo, 2013; Martos-Carrión, 2010; Romero-Robredo, 2017) given the repercussions for those affected by this problem with respect to the exposure and dissemination of personal data on social media and messaging apps. Although we live with technology every day, we must not forget that the internet is a worldwide service, and if we want to enjoy it, a good use must be made of it (Londoño-Camargo, 2013).

In the present study, a high percentage of those polled, 74% had allowed unconscious access to personal information by internet platforms, using profiles in social media as a method of starting a session or by completing forms for surveys, raffles, and questionnaires on the web. This is in agreement with 86% of those polled, who did not know how their personal preferences or internet searches were compiled at the same time that their personal information was collected (Blandón Rizo, 2023). These are significant data that serve to raise an alarm to further reflect on this matter.

Without a doubt, the training of education professionals on data management and protection is fundamental, given the growing digitalization of education environments and the need to safeguard both the privacy of students, and the integrity of information systems. According to the UNESCO report, "the digitalization of education requires teachers to be equipped not only with digital skills but also with a deep understanding of how to manage and protect the personal information of students" (UNESCO, 2021). This capacitation ensures that educators will be informed about their legal obligations concerning data protection (Greenleaf & Livingstone, 2019).

Diagnosing the deficiencies in the training of technological competence of future teachers helps to redefine education proposals. Ultimately, it is about guaranteeing professionals who are well-versed in data protection to create safer and trustworthy environments for their future students. They integrate technological advances, contents, and resources with absolute normality and efficacy, thus guaranteeing the critical management of information.

This study has some limitations that must be considered when interpreting the results. First, self-assessment, although valuable, may be subject to personal biases that could have an influence on the precision of the data collected. Second, although multiple international and regional standards and frameworks were mentioned for the assessment of digital competencies, the lack of a unified framework in Latin America could limit the comparability of the results between regions. Similarly, the present study did not deeply examine the contextual differences that could affect the implementation and success of the education interventions in different cultural and educational settings.

However, these limitations do not invalidate the results, as they mark a clear tendency that at the same time underlines the importance of continuing to make advances in the research and development of education strategies that include robust digital competencies in the training of teachers. It is essential for future research studies to address the gaps identified, especially those pertaining to the creation of digital contents, digital safety, and the solving of technical problems, to prepare future teachers not only to teach in a digital world but also to lead in the configuration of digital education in the future.

5. Conclusion

The present study has highlighted the critical importance of self-assessment of digital competence among university students, emphasizing that the presumption of digital competence inherent to the youth, students 4.0, due to their mere membership to a digital generation, is inadequate and possibly erroneous. The self-assessment helped identify areas of strength, such as digital communication, and significant areas of weakness in the creation of content, programming, solving technical problems, and the safety of the information. Evidence was gathered on the need for adapted education that includes the use of social media and digital technologies, not only as communication tools but also as platforms integrated into the teaching-learning process. This integration is not only a response to the preferences of the students but it also promotes the use of a pedagogic approach that is more interactive and constructivist.

In addition, the results suggest that teacher's training programs must intensify their focus on digital literacy, especially related to the protection and management of personal information and the solving of technical problems, the areas in which the students showed important limitations.

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