Self-perception of university teachers on their digital teaching competence: the case of Peru

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Abstract

Research on university professors' digital competence is essential because the university professor is the most valuable human resource educational institutions have and is responsible for carrying out various actions to achieve institutional purposes. The present study aimed to analyze university professors' self-perception of digital competence. It is a quantitative, non-experimental, descriptive, and cross-sectional study. The sample was 122 professors from one private university in Peru. Also, a significant relationship was found between gender and knowledge of methodological strategies for networking. The teacher's age was the most relevant factor in digital competence, affecting teachers' ability to know and use communication and information tools. A significant percentage of teachers did not participate in training activities and did not evaluate their teaching practices with ICT; likewise, there was low participation in projects and groups to innovate and research teaching topics with ICT. Based on the deficiencies found, a continuous training program is expected to be designed to raise teachers' digital competence levels.

Introduction

The current context is characterized by the use of the Internet, the development of digital media, and the revolution of various concepts such as interactivity, connection, linking, and empowerment of information technology. The growth in the use of the Internet is mainly in the behaviour of the population through online shopping (Rybaczewska & Sparks, 2022; Soegoto & Eliana, 2018), daily communications (Pekkala & van Zoonen, 2022), and education (Gonzáles-Gutierrez et al., 2022; Hamadi et al., 2022; Rojas-Osorio & Alvarez-Risco, 2019). The change in Internet usage patterns has forced universities to update their teaching methods (Potter et al., 2022) and to develop digital competencies among professors (Amhag et al., 2019). Since 2020, due to the COVID-19 pandemic in Peru, there have been several educational reforms to ensure the continuity of education through digital media (Gobierno del Perú, 2020; MINEDU, 2020b), which has forced better levels of digital competence in the teaching staff at the university level. Therefore, it is essential to have quality university teachers because they are the ones who train future professionals in society. Several researchers emphasize the importance of including digital competence in teaching to contribute to student learning through ICT (De la Calle et al., 2021; Fernández-Batanero et al., 2020; Garzón Artacho et al., 2020), which has originated the need for educational institutions to organize training plans in technology to help their teachers acquire or strengthen their digital competence (Cabero-Almenara et al., 2020; Howard et al., 2021). However, some still cannot use ICT during the teaching and learning process.

Previously, international organizations have pointed out that university education must expand the training of teachers so that they can have the capacity to provide their students with the knowledge and skills they need in the 21st century to use distance learning and information and communication technologies (UNESCO, 2009). UNESCO recommends encouraging the Member States to (a) develop and implement ICT-enriched pedagogies, (b) make ICT skills a fundamental component of the teaching profession for all teachers at all levels, (c) support teachers in integrating ICT into all areas of their professional activity actively (teaching, research), (d) implement ICT-enriched pedagogies in teacher education programs and institutions, (e) ensure that teachers have access to ICT tools and materials and professional networks; (f) disseminate the UNESCO ICT Competency Framework for Teachers (ICT-CFT), as well as other relevant UNESCO publications, to appropriate institutions and agencies" (UNESCO, 2015).

In Peru, higher education institutions are divided into universities and higher education schools. Universities can be public or private, while higher education schools are generally focused on technical and technological training. In turn, universities can offer undergraduate and graduate programs in various disciplines. According to the National Superintendency of Higher University Education (SUNEDU for its acronym in Spanish), Peru has 50 public and 92 private universities (SUNEDU, 2023). Of 1,423,731 university students, 25.5% study in a public university and 74.5% in a private university (MINEDU, 2023).

One of the biggest challenges faced by Peruvian universities is the transformation of face-to-face teaching into a virtual modality, which saw its starting point in 2003 with the general education law describing distance education. An essential aspect of the law is that "this modality aims to complement, reinforce or replace face-to-face education, attending to the needs and requirements of the people". This replacement was seen during the COVID-19 pandemic. This change highlighted the need to train university professors in digital competencies, mainly in topics related to the knowledge and use of ICT tools for implementing resources, activities, and videoconferencing rooms. This training allows the development of classes in their various modalities, as well as design guidelines and strategies for teaching, tutoring, and student support using technology, which is linked to the three central guidelines provided by the Ministry of Education in the numerals 5.1 Academic planning, 5.2 Development of service delivery and 5.3 Recommendations related to the teaching exercise regarding the non-face-to-face adaptation (MINEDU, 2020a). As a result of those mentioned above, the Ministry of Education (2021) approved the technical norm N°109-2021-MINEDU to implement the "Permanent Training and Education Program during the year 2021", whose purpose is to strengthen the professional competencies of teachers, the training offer prioritizes four lines: learning, digital competence, research and innovation and socioemotional well-being (MINEDU, 2021).

The COVID-19 pandemic accelerated the digital transformation. The transformation in Peru has been heterogeneous, as Internet connectivity varies considerably, being more significant in the capital, Lima, and in the big cities. However, due to Peru's geography, there are areas in the highlands and jungle where connectivity was limited, which meant that during the pandemic, classes were halted. In its place, the Peruvian state channel broadcasts a primary education program to try to provide a solution. On the other hand, adaptation was successfully taking place in those large cities, using systems such as Blackboard, Canvas and Meet for synchronous classes and asynchronous accompaniment. However, compared to other countries, the process was more difficult due to connectivity, as Peru ranks 71st in Average Internet Speed, 60th in Median Internet Speed and 75th in Average Mobile Speed (Wisevoter, 2023).

In the face of these forced changes, the research question arises: What is the perception of university faculty about their digital teaching competence?

Theoretical framework

Teachers' use of ICT involves mastering a series of competencies; it is not just using some tools. It is necessary to have a teaching model or methodology that justifies how to incorporate and use ICT in the educational process (Suárez-Rodríguez et al., 2018). Nowadays, there are models of teaching and learning where ICT is included, which has originated training needs in specific competencies to develop within the educational field known as digital teaching competence.

Constructivism in education

The theory of constructivism is an educational approach that maintains that learning is an active process in which students construct their knowledge through interaction with information and their environment (DeVries, 2000). This theory suggests that students are not passive recipients of information but are active participants in constructing their understanding of the world. When applied to remote classes, constructivism remains relevant and can have significant implications for how learning experiences are designed and carried out in virtual environments. Here are some critical connections between constructivism theory and distance learning.

Constructivism emphasizes the importance of students actively participating in their learning. In distance classes, students often have more control over their study time and pace. Online course design can encourage self-direction by providing varied resources and activities that allow students to explore and construct their understanding independently. On the other hand, constructivism highlights the importance of social interaction in learning (Feyzi Behnagh & Yasrebi, 2020). Despite the physical distance in online classes, tools and platforms can be incorporated to facilitate student collaboration. Discussion forums, videoconferences, and online group projects can promote the social construction of knowledge.

Likewise, constructivism emphasizes the importance of connecting new knowledge with students' previous experiences. In distance learning environments, case studies, practical situations and relevant examples can contextualize information and make it meaningful to students, thus facilitating the active construction of knowledge. Also, constructivism advocates continuous feedback as an integral part of the learning process (Chuang, 2021). In remote classes, educators can leverage online tools to provide regular formative feedback to students, helping them reflect on their learning and adjust their understanding.

Finally, constructivism recognizes the diversity of learning styles and the importance of using various resources. In distance classes, multimedia resources, such as videos, simulations, and interactive activities, can be incorporated to address different learning styles and enrich the learning experience.

Competence

The term *competence* appears in Latin in the form of competition with the meaning of being able and in the form of competent, the understanding of which is capacity and allowance. Throughout history, the first use of the term *competencies* is found in the work of Plato, whose origin of the word is *ikano*, a derivative of *iknoumai*, which means to arrive (Miró Vera, 2019). Likewise, in ancient Greek, its equivalent for *competence* was *ikanótis*, which translates as the quality of being *ikanos* (capable), i.e., having the skill, ability, and capacity to achieve something (Mulder et al., 2008). This term is also like *Epangelmatikes ikanotita,* which means professional/vocational ability or competence.

It should also be mentioned that in the 16th century, the concept was already used in French, English, and Dutch; at the same time, the use of the words *competence* and *competency* in Western Europe dates back to the same period, so it is clear that it has been an aspiration throughout history to be a competent and capable professional (Mulder et al., 2008).

As Naranjo et al. (2017) point out, competencies began their academic applicability in the 1960s, thanks to Chomsky, who, in aspects of the theory of syntax (1971), defines them as linguistic competence, which is put into action through communicative performance. Likewise, several authors agree that the concept of competence began in 1970 with the contributions of Chomsky's linguistics and Skinner's behavioral psychology (Trujillo-Segoviano, 2014). For Skinner (1981), competence is a behavioral model based on behavior that can be observable and verifiable, which today is called the competence approach and which is applied in the "management of human talent in organizations" as the key to the competitiveness of their workers. There are differences in the concepts of both authors; Chomsky's approaches are used in the educational process, while in the labor context, Skinner's concepts are applied to achieve productivity in organizations, relying on performance efficiency and fulfilling assigned tasks.

In the seventies, we began to talk about business and educational competencies with McClelland (1973), who points out that competencies are people's abilities to do something well. In contrast to this author, according to Palan (2003), competencies represent academic evidence. Likewise, in the 1980s, the concept of competencies in professional training (Galdeano Bienzobas & Valiente Barderas, 2010) was introduced, strengthening the construction of academic programs according to the demands of the professional profiles of the new context. Subsequently, Gagné and Briggs (1974) included the term *performance indicators* to differentiate whether a worker was competent or not, while Gardner (1982) considered competence as brain function capacities or skills of a type of intelligence (Habermas, 1984, 1987).

Teaching competence

Bearing in mind that competencies are aptitudes or capacities to carry out a specific desired performance, Bunk (1994) points out that professional competencies can be assumed from two fronts: on the one hand, there are the formal competencies that are acquired during training, and on the other hand, there are the fundamental competencies that are related to the ability to solve specific problems. In other words, the formal competencies and competencies acquired through experience are evaluated. Therefore, teaching competencies are the knowledge, skills, and attitudes to exercise a profession, solve problems autonomously (Bunk, 1994), and collaborate in their professional environment.

Aylett and Gregory (1997) establish two types of criteria: first, the criteria of competence of the teaching function referred to organizing and presenting academic information, establishing social or interpersonal relationships, being

willing to provide support or guidance to the student, and evaluating the evidence of learning and second, the criteria of excellence refer to reflecting on their teaching work, innovating their teaching-learning strategies, designing and participating in the curriculum of courses or programs, researching aspects related to teaching, organizing and executing courses, as well as leading groups and work teams with teachers. UNESCO (1998) establishes a series of competencies according to the members of the university environment: academic personnel, administrative personnel, managers, and institutional leaders. About the academic staff, the faculty is requested to use diverse methods to teach and include new technologies, that is to say, to know the training processes supported using technology.

Regarding the research actions of university teachers, they are related to the competencies of knowing how to write research projects, raise funds, participate in professional research networks, advise students and manage research projects (Böttcher-Oschmann et al., 2021; Castillo-Martínez & Ramírez-Montoya, 2021). Perrenoud (2004), and Zabalza and Beraza (2003) point out that teaching competence refers to aspects related to knowledge and skills whose actions of mobilizing these cognitive resources allow reaching required results, achieving objectives, carrying out an activity, and solving a problem in each context. Therefore, referring to teaching competence implies considering the values, beliefs, knowledge, skills and attitudes the teacher must have for the teaching-learning process, the educational institution, the needs of the subjects who learn, and professional ethics. An important aspect to highlight is that Perrenoud (2004) details ten domains that should be considered as priorities in teacher training, such as organizing and encouraging learning situations, involving students in their learning and their work, working in teams, participating in school management, and informing and involving parents.

Muñoz (2006) points out the need for a competency-based plan for the profession to professionalize teachers at the different levels where they teach. Likewise, the author provides several alternatives for a new and different teaching profession, such as collaborating with other professionals, increasing communication among professionals, receiving theory so as not to fall into reproductive practices, increasing awareness that teaching and learning are complex, that teaching is imbued with much diversity and training in introducing new technologies in teaching.

Dimensions of teaching competence

University teachers require training so that they can learn and teach competencies. A teacher can carry out his professional work considering aspects related to the training process, as well as having the vocation of service as a teaching professional to teach well and with the desire to do things well for the benefit of his students. Hence, Zabalza (2009) proposes the following dimensions of competence: a) Ability to plan the teaching/learning process; b) ability to select and present the disciplinary contents; c) ability to inform and explain understandably; d) technological literacy; e) ability to manage methodological strategies and learning activities; f) ability to foster a constructive relationship and a good atmosphere in the classroom; g) tutoring and accompanying of students; h) ability to reflect on their teaching practice and investigate to improve this process; i) ability to get institutionally involved.

According to OECD (2009), the teacher must manage learning processes, teach in multicultural classrooms, integrate students with special needs, work well in a team, plan evaluations, manage ICT, collaborate on projects, and communicate effectively with parents to build a community for learning. In the same way, the European Commission (2010) mentions that effective educators must have strong teamwork skills, be proficient in leveraging technology for teaching, and be active contributors to the educational community. Also, the European Commission (2012) proposes a list of competencies grouped into some dimensions. Competencies in this area include knowledge of the subject, pedagogy, curriculum, educational policies, inclusion, use of ICT, teaching and evaluation methods, planning, managing, teaching, monitoring, achieving learning objectives, research, collaboration, and adaptability. Dispositions include a predisposition to change, continuous learning, commitment to promoting learning, democratic practices and attitudes, and critical evaluation of oneself as a teacher.

Developing competencies in the educational field covers a wide range of skills and knowledge essential for teaching effectiveness. These competencies encompass a deep understanding of content, pedagogy, curriculum and educational policies. A competent teacher not only masters his subject(s) but also understands effective pedagogical strategies to convey that knowledge in a clear and accessible way to students. Inclusion is highlighted as a crucial competency, referring to educators' ability to adapt and attend to diversity in the classroom. It involves creating inclusive environments that allow all students to participate and learn meaningfully, regardless of their particular abilities or characteristics. Furthermore, the effective use of Information and Communication Technologies (ICT) is considered an essential competency in today's digital age, as it can significantly improve teaching and learning.

Other key competencies include teaching and assessment methods, efficient planning and management of time and resources, and the ability to monitor and adapt instruction according to the changing needs of students. Achieving learning objectives is essential, and this involves setting clear goals, constantly evaluating progress and adjusting strategies accordingly. Research is presented as a valuable competence since educators must be up to date on educational trends and commit to continuous improvement. Collaboration with other educators and the community is essential to enrich teaching practice and foster a collaborative learning environment.

Regarding the dispositions, fundamental attitudes that contribute to professional development and success in the classroom stand out. Predisposition to change reflects the ability to adapt to new educational methodologies and approaches, which is essential in a constantly evolving environment. Continually pursuing learning reinforces the importance of staying uptodate and committed to personal and professional development. Dedication to promoting

learning highlights the educator's responsibility to inspire students and foster an environment that stimulates curiosity and inquiry. Promoting democratic practices and attitudes suggests a commitment to equity, participation and social inclusion in the educational environment. Critical evaluation of oneself as a teacher comes to a close of the list of dispositions, highlighting the importance of continuous reflection on practice and the willingness to adjust approaches and strategies based on the observed results.

The Finnish Institute for Educational Research (2010) reveals eight competencies: Collaboration and cooperative learning; effective teaching methods; integration of theory and practice; research-based learning; knowledge management, strategy implementation; leadership promotion; lifelong learning preparation; mobility and cultural understanding' and quality evaluation and improvement. These competencies cover various aspects crucial for the effective development of educational systems. Firstly, it highlights the importance of collaboration and cooperative learning. This approach encourages student interaction, promoting an environment where the exchange of ideas and joint problem-solving are fundamental to the learning process. According to the report, the effectiveness of teaching methods constitutes another essential pillar. It recognizes the need for effective pedagogical strategies that transmit knowledge and stimulate students' interest and active participation. Integrating theory and practice, supported by research-based learning, is an essential component of a comprehensive educational approach to develop practical skills.

Knowledge management and strategy implementation feature prominently in the report. The ability to organize and apply knowledge effectively is considered crucial to educational success. Likewise, the importance of promoting leadership in the educational field is emphasized, recognizing that educational leaders play a fundamental role in the direction and development of educational institutions.

Continuous learning preparation is a critical competency in a constantly evolving world. The ability to adapt to new knowledge and contexts is presented as essential for lifelong education. Mobility and cultural understanding are also highlighted, underlining the importance of openness to diverse perspectives and experiences in an increasingly globalized world. Quality evaluation and improvement close the list of competencies outlined in the report. The ability to evaluate the effectiveness of educational methods and make continuous improvements is essential to guarantee a dynamic educational system adjusted to the changing needs of society.

Teaching digital competence

Several authors agree that the opportunities offered by ICT-mediated environments for learning enhance the role of the teacher, who facilitates and guides the search for and processing of information, making it possible for the information provided to become knowledge (Agyei, 2021; Alt, 2018; Atmacasoy & Aksu, 2018; Qaddumi et al., 2021). Similarly, some authors (Antonietti et al., 2022; Falloon, 2020;

Pöntinen & Räty-Záborszky, 2020; Pozo-Sánchez et al., 2020; Skantz-Åberg et al., 2022) agree in defining digital teaching competence as the ability to perform teaching functions about the following aspects: a) Technical b) Academic or pedagogical c) Planning and organization d) Guidance e) Social.

Yot Dominguez and Marcelo (2005) define digital teaching competence as skills to manage and use technological resources necessary for designing and developing e-learning, referring to knowing how to use synchronous and asynchronous communication tools, among others. It also includes knowledge regarding the platform on which the training activity is developed to adapt it to the type of students and the course.

According to the Parlamento Europeo (2007), digital competence must be integrated at all levels of education, which is why it must be ensured that "teachers are trained in the use of ICT for teaching", better known as digital teaching competence. Bustos López and Gómez Zermeño (2018) identified the dimensions of teachers' digital competence in a high school in Mexico through surveys of 12 teachers and interviews with four teachers. The data was analyzed based on three categories: digital competencies, use of educational technology, and social and professional development. The outcomes showed some chances for teachers as the design resources with advanced technology to create and publish and share material in virtual learning spaces.

Teachers need training that is more consistent with their teaching needs. Using a qualitative approach (Rossi Cordero & Barajas Frutos, 2018) a case study was developed in two schools, identifying enablers and barriers in teaching the acquisition of digital competence. The outcomes show that acquiring digital competence is the most important difficulty for teachers linked to the management of information, the didactic use of ICTs, the evaluation of digitally mediated activities, and collaboration in virtual environments.

In Latin America, the various advances in the digitalization of education in times of COVID-19 have been reported, as in the case of Argentina (Perrotta, 2021), which presents the efforts in public universities for teaching and learning, research and internationalization activities. There are also reports of the cultural adaptation that has had to be generated in Brazil, considering social distancing at the beginning of the pandemic (Ivenicki, 2021; Prata-Linhares et al., 2020). In Chile, it was reported that this drastic digitalization process due to the pandemic ultimately benefited their learning due to the challenge of rapid adaptation (Sepulveda-Escobar & Morrison, 2020).

Then, it is striking what was reported in Colombia regarding distance teaching of Anatomy, where students had to learn in a very different format from the conventional one but were able to improve their learning through authentic anatomical images. It is a great adaptation process to continue learning (Martinez et al., 2022). Something similar happened in Ecuador, where engineering courses had high student attendance. It should be noted that these good results were not random but corresponded to the result of a specific program designed during the pandemic aimed at

student engagement (Ricaurte et al., 2022).

Despite the excellent adaptation of students in Latin America, it has also been reported that many had difficulties, such as chemistry students in Mexico, who reported that 78.2% had technological issues and could not handle technology tools (Chávez-Miyauchi et al., 2021). In Brazil, 66.7% of students dropped out of at least one course in their curriculum (De la Fuente et al., 2021). Likewise, in the Dominican Republic, 67.1% of students expressed a lack of adequate technological equipment and Internet access. They felt uncomfortable studying from home (Santos et al., 2021). In Mexico, students reported unstable Internet access, which caused them to miss some sessions (Zúñiga Rodríguez & Cáceres Mesa, 2021).

Methodology

Sample and collection of data

The population consisted of 179 undergraduate and postgraduate teachers in regular online courses from a private university in Peru. The formula for calculating the sample size with 95% reliability and a 5% margin of error was applied, obtained by a sample of 122 teachers. The information was obtained in July 2021 by an online Google Forms questionnaire. At the beginning of the questionnaire, participants were informed that their participation was anonymous and voluntary and that the data would be used exclusively for research purposes.

Measures

The questionnaire that was developed evaluated the self-perception of digital competence, including a few specific dimensions. The first section of the questionnaire includes the presentation of the study and sociodemographic data, time dedicated to classes (partial or complete time), professional category as a professor (contracted or ordinary), and level of education (undergraduate and postgraduate). Subsequently, 53 items were presented that make up the body of the questionnaire, which were distributed as follows:

a. General knowledge of the computer and ICT possibilities (Items 1-6)

b. Knowledge and use of methodological strategies for networking (Item 7)

c. Opportunities and limitations of ICT in the teaching-learning process (Items 8-9)

d. Importance that the teacher gives to the factors when choosing an ICT resource for the classroom (Items 10-18)

e. Knowledge and use of the virtual campus (Item 19)

f. Procedures for publishing educational material/scientific production on the web (Items 20, 21, 25,

27, and 35)

g. Teacher training and evaluation of teaching practice with ICT (Items 23, 28, and 29)

h. Use of ICT for teaching tasks (Items 22 and 24)

i. Use of various protection measures for your equipment (Items 30-32)

j. Autonomy for technical problems regarding your computer equipment (Items 33 and 34)

k. Research and educational innovation (Items 36 and 37)

l. Strategies to promote student participation (Items 38 and 39)

m. Evaluation of processes using ICT (Items 40 and 41)

n. University support services (Items 42 and 43)

o. Knowledge of basic concepts, essential computer components, and ICT resources (Items 44, 45, and 46)

p. Actions carried out by teachers to improve their skills in the use of ICT (Items 47-53)

Data analysis

The chi-square test was used to verify the hypothesis of whether there is a relationship between the variables to perform the correlational analysis of the data. The alpha coefficient of 0.05 was used. In this sense, the relationships between the sociodemographic variables and the dimensions of digital competencies were analyzed. A certain number of items were applied on a Likert scale to assess the level of digital skills. Likewise, the statistical package SPSS v26 and descriptive statistics were used.

Ethical issues

Ethical review and approval were waived for this study because it does not involve any risk to the participant's life or health. No substance has been tested on the participants, and they have not been endangered. All procedures performed in studies involving human participants were by the ethical standards of the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Results

Sociodemographic data

The group of participants consisted of 88 men and 34 women. The age groups are shown in Table 1.

Table 1. Demographic characteristics of the sample of professors.

Age	Number of teachers	%
Up to 35 years	6	4.92
From 36 to 45 years	32	26.23
From 46 to 55 years	40	32.79
From 56 to 65 years	34	27.87
From 66 years and older	10	8.20
Teaching experience	**Number of teachers**	**%**
Less than 5 years	18	14.75
From 5 to 10 years	30	24.59
From 11 to 20 years	43	35.25
From 21 to 30 years	21	17.21
More than 30 years	10	8.20
Time of dedication	**Number of teachers**	**%**
Full-time	24	19.68
Part-time	98	80.32
Hiring category	**Number of teachers**	**%**
Hired	113	92.62
Ordinary	9	7.38
Total	**122**	**100%**

Correlational analysis of digital competence with sociodemographic variables

The chi-square test statistic is used to verify the hypothesis of whether there is a relationship or association between the variables, working with an alpha coefficient of 0.005 to perform the correlational analysis of the data. In this sense, the relationships between the sociodemographic variables and the dimensions of digital competencies are analyzed. In this correlation analysis, not all the dimensions of digital competence are presented; the dimension that provides information or where there are findings of greater importance is being considered. Table 1 shows the correlation between sociodemographic variables and knowledge of networking methodological strategies.

When relating the sociodemographic variables with the knowledge and use of networking methodological strategies, we found no relationship between these variables since the significance level in each one is more significant than 0.05 (α), as seen in Table 2. And Table 3 shows the correlation between sociodemographic variables and the importance that the teacher gives to the factors when choosing an ICT resource for the classroom.

Table 2. Correlation between sociodemographic variables and knowledge of networking methodological strategies.

Variable	Value	df	Asymptotic significance (bilateral)
			Regarding knowledge
Age	8,264	8	0,408
Sex	0,022	2	0,989
Teaching experience	7,836	8	0,450
			Regarding use
Age	6,368[a]	8	0,606
Sex	0,177[a]	2	0,915
Teaching experience	5,084[a]	8	0,749

Table 3. Correlation between sociodemographic variables and the importance that the teacher gives to the factors when choosing an ICT resource for the classroom.

Variable	Value	df	Asymptotic significance (bilateral)
Age	5,912[a]	8	0,657
Sex	0,025[a]	2	0,988
Teaching experience	4,883[a]	8	0,770

When relating the sociodemographic variables and the importance that the teacher gives to the factors when choosing an ICT resource for the classroom, there is no relationship between these variables since the level of significance in each one is more significant than 0.05 (α), as can be seen in Table 3.

Table 4. Correlation between sociodemographic variables and knowledge/use of communication tools and application.

Variable	Value	df	Asymptotic significance (bilateral)
			Regarding knowledge
Age	10,864[a]	8	0,210
Sex	**5,864[a]**	**2**	**0,043**
Teaching experience	7,072[a]	8	0,529
			Regarding use
Age	**16,754[a]**	**8**	**0,033**
Sex	0,240[a]	2	0,887
Teaching experience	12,671[a]	8	0,124

When relating the sociodemographic variables with the knowledge and use of tools and applications related to communication, it was found that there is a relationship between sex and knowledge of the tools since the significance level is lower (Sig. = 0.043 < 0.05 (α)), as seen in Table 4. Likewise, there is a relationship between age and the use of tools and applications related to communication since the significance level is lower (Sig. = 0.033 < 0.05 (α)). In addition, in the correlation of the other sociodemographic variables, there is no relationship between these variables since the significance level in each one is more significant than 0.05 (α), as seen in Table 4.

Table 5. Correlation between sociodemographic variables and knowledge/use of information tools and applications.

Variable	Value	df	Asymptotic significance (bilateral)
			Regarding knowledge
Age	**19,085[a]**	**8**	**0,014**
Sex	0,199[a]	2	0,905
Teaching experience	11,147[a]	8	0,194
			Regarding use
Age	11,243[a]	8	0,188
Sex	3,143[a]	2	0,208
Teaching experience	8,076[a]	8	0,426

When relating age and knowledge of tools and applications related to information, we found a direct relationship between these variables (Sig. = 0.014 < 0.05 (α)). There is no relationship between the correlations of the other sociodemographic variables since the significance level in each one is more significant than 0.05 (α), as seen in Table 5.

Discussion

Teachers generally believe their digital competence is high and use it effectively in higher education. A constructive approach should strengthen some deficiencies, but generally, the results are encouraging. While analyzing the teaching of digital competence and its dimensions according to the model proposed by Prendes Espinoza (2010), the model and instrument that have been used in this research, we find certain similarities with the results obtained in earlier research. They include the research conducted by Gutiérrez Porlán (2011), whose study that was conducted with university teachers in Spain, with Carrillo (2014) study conducted with teachers from the Universidad Los Andes in Venezuela and finally Inchaustegui Santoni (2015) whose study was conducted with teachers from UNAPEC in the Dominican Republic.

The analysis showed that the highest scores were found in dimensions d, f and n, such as factors of importance in the choice of ICT resources for the classroom, followed by using the virtual campus and evaluation of processes using ICT. It was found that the lowest scores in dimensions f, k and l, knowledge of the virtual campus, a result that is also contradictory concerning use because a high percentage of teachers uses the tools of the virtual campus. It was also observed that many teachers do not resolve technical issues autonomously and do not participate in research and educational innovation groups. Similarly, it was observed that teachers older than 66 years show less knowledge and use of communication and information tools and applications.

The observation that many teachers struggle with technical issues independently and refrain from participating in research and innovation groups underlines challenges in fostering a self-sufficient and collaborative teaching environment. Additionally, the revelation that educators aged 66 and above exhibit less proficiency in communication and information tools underscores the age-related digital divide, highlighting a crucial area for targeted support and training initiatives. Overall, this analysis provides valuable insights into educators' ICT integration, pinpointing areas for improvement and tailored interventions.

The results show differences between the groups analyzed according to age, sex, and teaching experience. Regarding the age of the participating teachers, it was found in the research of Inchaustegui Santoni (Inchaustegui Santoni, 2015) that the highest percentage of participating teachers is between 40 to 60 years, in Carrillo (2014) between 32 and 42 years, in Gutiérrez Porlán (2011), the teaching staff is younger than 45 years, while in our data obtained, it is from 46 to 55 years. The faculty in Spain and Venezuela are younger than UNAPEC and our study. It can also be observed that younger teachers have a higher perception of their digital competence (Inchaustegui Santoni, 2015) in all dimensions and that there is a significant relationship between age and the use of tools and applications related to communication (Inchaustegui Santoni, 2015). These results also coincide with the study proposed by Esteve (2015).

On the other hand, regarding the sex of the participating teachers, we found in Inchaustegui Santoni (2015), Gutiérrez Porlán (2011), and in our study that the highest percentage of teachers is male, while in Carrillo (2014), the highest percentage is female. With this comparison, we have some evidence that males predominate in university teaching positions. In addition, the highest scores in knowing and using ICT tools correspond to men at a general level, and except for dimensions f, k and l, the score of men was slightly higher, showing minimal and non-significant differences.

Teaching experience plays a vital role in improving teachers' pedagogical practices through continuous learning and exchanging experiences with students. According to Inchaustegui Santoni (2015), the highest percentage of teachers in UNAPEC have experience ranging from 21 to 30 years. On the other hand, Gutiérrez Porlán (2011) found that the teachers' experience is from 11 to 20 years. It is worth noting that the teachers in Spain are younger compared to the other studies analyzed, including ours. However, there is no relationship between teaching experience, knowledge, and methodological networking strategies.

Another characteristic point we have is the time of teaching dedication in Carrillo (2014) and Inchaustegui Santoni (2015); it was found that the highest percentage of teachers is full-time, while in our study, the highest percentage is part-time. Likewise, concerning the distribution by faculty category, we found that in Carrillo (2014), Gutiérrez Porlán (2011), and Inchaustegui Santoni (2015), the highest percentage of teachers are in the category of full professors, compared to our study, where 94% are in the category of contract teachers, i.e., they are not tenured or appointed in the Peruvian context.

Similarly, the significant difference in faculty category distribution, with a majority in the category of contract teachers in our study, suggests a distinct faculty composition compared to the other studies. These variations could impact an institution's overall dynamics of teaching and academic responsibilities. It would be valuable to explore the reasons behind these differences and their potential effects on teaching quality, faculty engagement, and other relevant aspects in the Peruvian context.

Concerning knowledge about essential computer components and basic ICT concepts, we find similar results with Gutiérrez Porlán (2011), Carrillo (2014), and Inchaustegui Santoni (2015), where the highest percentage of the teaching staff values their competence at a superficial level. The only difference is that in our study, for the indicator selection and acquisition of ICT resources, the highest percentage of the participating teaching staff values their competence in the deep level. Likewise, we have very favorable results regarding the use of protection measures for their equipment since the highest percentage of teachers use security measures. In addition, our results are like the ones by Gutiérrez Porlán (2011) and Carrillo (2014), while in Inchaustegui Santoni (2015), it was observed that the highest percentage of teachers do not use security measures.

Regarding knowledge and use of methodological strategies for networking, the results of our study show a similarity with Gutiérrez Porlán (2011) and Carrillo (2014) since the highest percentage of teachers have evaluated their competence that they know and use a little to a lot, while the results of Inchaustegui Santoni (2015) show that the highest percentage of teachers have no knowledge and also do not use the tools.

About the possibilities and limitations of ICT in the teaching-learning process (Prendes Espinoza, 2010), we see that the possibilities or advantages best valued both in Gutiérrez Porlán (2011), Inchaustegui Santoni (2015), Carrillo (2014) and also in our study are the access to information and time flexibility (Prendes Espinoza, 2010). Regarding the most significant limitations, we agree with Gutiérrez Porlán (2011), Carrillo (2014), and Inchaustegui Santoni (2015), where the highest percentage selected user limitations and technical failures. However, among the least valued, we also agree with Gutiérrez Porlán (2011), who reported the flexibility of spaces and publication of information.

About the factors of importance when choosing ICT resources for the classroom, the three studies and ours have coincided in valuing as the most important being the knowledge of the use of the resources, that it solves learning needs, there is ease of access for students and that it is a motivating resource for students. Another aspect where there is a surprising coincidence between the three studies and ours is the dimension knowledge and use of communication and information tools and applications, where they state that they know and use tools such as e-mail, forums, and instant messaging or chat. In the less known ones, Gutiérrez Porlán (2011) and our study coincide in teachers not knowing and using microblogging and virtual worlds, while in Inchaustegui Santoni (2015)'s research, teachers do not know and use file sharing. Likewise, regarding the knowledge and use of information tools, the three studies agree on teachers knowing and using search tools, followed by text editors and visual presentation creators. In contrast, Gutiérrez Porlán (2011) and Inchaustegui Santoni (2015) agree in the teachers not knowing and using live streaming, while in our study, it turned out to be social bookmarking, podcasts, and web page editor. According to Gutiérrez Porlán (2011) and Inchaustegui Santoni (2015), the teaching staff is familiar with and uses the virtual campus extensively.

Regarding the publication of didactic material and scientific production on the network, it was found that in Inchaustegui Santoni (2015)'s paper, teachers sometimes publish, while in Gutiérrez Porlán (2011)'s, the teachers declare to carry out quite a lot of publication actions. About the autonomous ability to solve technical problems on computer equipment, we find significant differences in UNAPEC.

In a recent study, only 9% of respondents claimed to be able to solve technical incidents, while in Spain, the figure was 55%. However, in this study, 78% of respondents stated that they can do so, which is a very encouraging result compared to previous studies. This increase in technical proficiency can be attributed to the current COVID-19 health emergency, which has increased the need for individuals to learn and use ICT tools.

In relation to the use of ICTs for teaching tasks, both Inchaustegui Santoni (2015)'s, Gutiérrez Porlán (2011)'s and our study coincide in using technology tools a lot for electronic administration and management (Prendes Espinoza, 2010).

Regarding the use of virtual tutoring to engage students, there are notable differences between the studies conducted by Gutiérrez Porlán (2011), Inchaustegui Santoni (2015) and our study. Gutiérrez Porlán (2011) reports that 40% of teachers use virtual tutoring frequently, while Inchaustegui Santoni (2015) reports a frequency of 29%. Our study, on the other hand, found that 83% of teachers use virtual tutoring frequently to evaluate students. Regarding using virtual tutoring to evaluate students, we agree with Gutiérrez Porlán (2011) that 80% of teachers use it, as opposed to Inchaustegui Santoni (2015), where only 49% of teachers use it.

Less than 60% of the participants in Gutiérrez Porlán (2011) and Inchaustegui Santoni (2015) studies believed they had effective strategies to encourage student participation. In our study, 86% declare that they have a skill between quite a lot and a lot. However, when analyzing the percentage of those who marked which strategies they apply, we find slight differences with the Spanish teachers since, despite having a lower percentage, they show that they use more strategies compared to UNAPEC and our study. Regarding the assessment of processes using ICT, ICT is used more in the assessment process for the same reason that teachers use a variety of tools that have to do with online questionnaires, followed by creation, understanding and memory, and lastly application.

Regarding the support services by the university, we have agreed with a high percentage of the three authors that the teaching staff declares to know and use the support service of their universities. Regarding teacher training and evaluation of teaching practice with ICT, both Gutiérrez Porlán (2011) and Inchaustegui Santoni (2015) agree to participate often and very often in ICT training actions. However, regarding the frequency in which they impart ICT training, it is observed that more than 50% of the Spanish teachers state that they have never imparted training compared to 29% of UNAPEC and 19% in our study that they imparted training.

Regarding the support services provided by the university, the high percentage of agreement between the three authors is notable, where the teaching staff declares that they know and use the support services of their respective institutions. It is crucial to address these differences to promote comprehensive and practical teacher training, thus guaranteeing a more homogeneous implementation of ICT in teaching.

There are significant differences in the evaluation of their teaching practice since in the study by Gutiérrez Porlán (2011) and Inchaustegui Santoni (2015), less than 50% evaluate their teaching practices with ICT, while in our study, more than 80% of teachers evaluate their practice with ICT. Regarding the actions to improve ICT skills, answers are varied; we observed that UNAPEC teachers outperform teachers in Spain in the use of professional networks, as

well as in disseminating their teaching experience with ICT, while in our study regarding actions to improve ICT skills, the results are disappointing because it was found that 34% of teachers never use digital technology and 54% use sources only sometimes, we also have that 33% who never access digital resource repositories and 50% who access only sometimes.

In a similar situation, 30% never participate in reflection forums, 47% only do so sometimes, and 70% do not participate in professional networks. We also have low participation in research and innovation groups, finding that 19% have never participated and 36% have only participated a few times. Likewise, in the dimension of participation in educational innovation projects, we find that 52% of teachers do not participate.

After the discussion, we can find that it is necessary to continue raising the level of digital competence of university teachers through autonomous learning by the teachers themselves or continuous training by universities (Bozu & Canto, 2009). If we reflect on what is analyzed in this study, we can mention that through digital education, all professionals and, in this case, the teachers can immerse themselves in the current world through technology. As the number of teachers trained in knowing and using ICT tools increases, they can work in collaborative networks, publish research in scientific networks, learn autonomously and independently with the ability to promote creative thinking in their students and reflect on their teaching practice.

University education in Peru and worldwide has experienced a notable digital transformation in recent years, marked by technological advances that have impacted how it is taught and learned. The information provided reveals both advances and challenges in integrating information and communication technologies (ICT) in the university environment. This academic discussion highlights the changes in digital education, the need to develop more significant digital competencies and the crucial role of artificial intelligence (AI) in education and research.

Based on the results of various investigations, it is evident that university teachers in Peru show a favorable perception of their level of digital competence. However, deficiencies that require strengthening from a constructive approach are also highlighted. The findings reveal that teachers show strengths in the choice of technological resources for the classroom, using the virtual campus and evaluating processes through ICT. On the other hand, weaknesses are observed in areas such as knowledge of the virtual campus and autonomous resolution of technical problems. Furthermore, it is worrying that many teachers do not participate in educational research and innovation groups. These results underline the need to promote the development of digital competencies more comprehensively and promote technical autonomy among educators.

The results also reveal significant differences in age, gender and teaching experience. Regarding age, it stands out that younger teachers tend to perceive their digital competence more positively. This correlation between youth and digital competence is consistent with previous studies. Furthermore,

a male predominance is identified in university teaching positions, which suggests possible challenges related to gender equity in this area. Although teaching experience is vital to improving pedagogical practices, it does not present a transparent relationship with digital competence. This finding highlights the importance of addressing digital divides through continuing education programs, regardless of accumulated teaching experience.

It is crucial to analyze teachers' knowledge and use of specific digital tools in digital education. Choosing classroom resources, publishing teaching materials online, and participating in university support services are areas in which teachers show strengths. However, challenges persist in implementing methodological strategies for interconnection (networking) and the stimulation of student participation.

The research reveals that the perceived limitations when using ICT in the teaching-learning process focus on the limitations of the users and technical failures. However, the most valued possibilities include access to information and flexibility over time, highlighting the importance of integrating digital education to take advantage of these advantages.

Conclusion

The results obtained in this research reveal a worrying panorama regarding the digital competence of the teachers surveyed and analyzed. A general level that ranges between low and medium, with some indicators standing out at the high level, is evident. These findings pose a significant challenge since today's society is immersed in a reality where education has been strongly impacted, demanding the presence of teachers with solid digital skills to face the various educational demands. It is crucial to highlight that the dimensions related to the knowledge and use of methodological strategies for interconnection, as well as the mastery of communication and information tools and applications, the publication of didactic material and scientific production on the Internet, together with the ability to solve technical problems in their technological equipment autonomously, reflect worryingly low results. These aspects are fundamental in today's educational environment, where technology plays a crucial role in pedagogical effectiveness.

Additionally, disparities were identified in teachers' digital competence based on gender and age, with the relationship between gender and knowledge of interconnection methodological strategies being the most significant. Likewise, a correlation was evident between age and the use of tools and applications related to communication and between age and knowledge of tools and applications linked to communication. Younger teachers perceive themselves as more competent in using digital tools, while older teachers report using them infrequently or not at all.

The authors hope this research will not only shed light on the current situation but also provide practical proposals to improve the quality of the teaching staff, the educational institution and, ultimately, student learning. Furthermore, in

line with the principles of educational design, it is intended that this study has an applicable value in different contexts and contributes to the knowledge of society as a whole, transcending the limits of the specific institution in which it was carried out.

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