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Digital competencies of Peruvian teachers in basic education

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Digital teaching competence is directly related to the knowledge, use of
Information and Communication Technologies (ICTs). Its use in educational
contexts and processes seeks to integrate technology and pedagogy. The
objectives of this study are to evaluate the level of Digital Teaching
Competencies (DTCs) possessed by basic education (BE) teachers in different
Peruvian schools and their comparison by competency area, considering
sociodemographic factors. The research responds to a quantitative
methodological approach. A non-experimental design of a comparative
descriptive type was used, and a non-probabilistic purposeful sampling was
applied. A total of 3,142 BE teachers participated in the study, including the
educational levels of preschool (0−5 years), primary school (6−11 years), and
Secondary school (12−16 years), belonging to public institutions located in
rural and urban areas of the province of Arequipa (Peru). The instrument
developed in the European Framework of Digital Competence, DigCompEdu
Check-In, was applied. This instrument aimed to measure teachers' level
of competence in the digital domain. The main results show that a more
significant number of teachers present an Integrator competence level (B1),
followed by the Expert level (B2), and the Explorer level (A2). Furthermore,
low percentages are observed in the most advanced leadership levels,
Leader (C1) and Pioneer (C2), in the use of ICTs. The results obtained
suggest implementing new strategies to improve DTCs. Based on critical
conceptions, technology constitutes an essential tool for education in the
twenty first century.

KEYWORDS

digital competence (DC), teaching, information and communication
technologies-ICTs, basic education, DigCompEdu

Introduction

Within the framework of twenty-first century education, especially in the coronavirus pandemic context, all countries have experienced different changes at various levels of the education sector.

According to the Report of the Economic Commission for Latin America and the Caribbean and the Regional Office of Education for Latin America and the Caribbean of the United Nations for Educational, Scientific and Cultural Organization (Comisión Económica para América Latina y el Caribe [CEPAL], and Oficina Regional de Educación para América Latina y el Caribe de la Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura [OREALC/UNESCO], 2020), one of the measures adopted by the governments in the countries of this geographical area at the beginning of the pandemic, was the total suspension of attendance at all educational levels; later, most of these countries gradually returned to classes. According to this report, 29 Latin American countries opted for distance education, of which 18 chose different online education modalities through virtual asynchronous learning platforms; 4 chose live classes; likewise, 23 used radio and television as teaching aids (Comisión Económica para América Latina y el Caribe [CEPAL], and Oficina Regional de Educación para América Latina y el Caribe de la Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura [OREALC/UNESCO], 2020).

Another essential piece of information in this report revolves around digital divides. In particular, access to devices in homes presents a notorious inequality. The level of access to computers, internet access, and educational software are some indicators that show that Latin American countries were not prepared, except for countries like Chile and Uruguay and, in part, Brazil. In the Peruvian case, only 57% of school-age students had internet access, one of the lowest compared to other countries in the region (Comisión Económica para América Latina y el Caribe [CEPAL], and Oficina Regional de Educación para América Latina y el Caribe de la Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura [OREALC/UNESCO], 2020).

The digital divide refers to the substantial inequality in access to new information and communication technologies (ICTs) (Ballestero, 2003, cited by Montenegro et al., 2020). This technological and digital gap is present in students and the teaching sector at different educational levels. In a study by Montenegro et al. (2020), this digital divide was analyzed from the perspective of teachers at the preschool, primary, and secondary levels of a Spanish community during the covid-19 pandemic. According to this research, the teachers perceived that the students did not achieve the minimum learning objectives during the confinement. This perception is due to the context linked to the Students' family environment, such as the availability of technological equipment and the economic situation. Similar research in rural Spain indicates a 30% digital divide among students during confinement (Álvarez-Álvarez and García Prieto, 2021).

On the other hand, the information and knowledge society promotes using digital devices that facilitate learning and achieve techno-pedagogical objectives (Pérez et al., 2018). That is, technology goes hand in hand with the development of the skills of twenty-first century students since it allows access to global knowledge (Arancibia et al., 2020). For Cabero-Almenara and Palacios-Rodríguez (2020), the ability to interpret and build messages using technology and various symbolic systems is a problem in this knowledge society. For this reason, ICTs have become central to educational processes that require developing skills and abilities that meet the new demands of the globalized world and are hyperconnected.

One of these competencies is digital competence, which relates to the confident, critical, and creative use of ICTs to achieve different goals (Wild and Schulze, 2020). It includes a series of skills in using ICTs, skills to search, process, and analyze information from various sources, learning to learn, capacity for abstraction, analysis, and synthesis, and ability to learn and update permanently (Fernández et al., 2019). The aim of the educational field is to integrate knowledge, pedagogy, and technology (Gisbert et al., 2016; Caena and Redecker, 2019).

Likewise, digital skills have to do with understanding the cultural context of the internet environment, the ability to communicate in online communities, the ability to create and distribute content, and skills to use digital technology for personal development (Kurnikova et al., 2021). Some authors propose a sociocultural model to develop teachers' digital competence based on four constructs: mastery, preference, reintegration, and appropriation of digital culture (Colás-Bravo et al., 2019). In any case, the use of technology in education for no reason should be separated from the context in which the educational process will take place since the different conditions in which education is given directly affect the success or failure of said process.

From the perspective of teacher development, the DTC presupposes a key competence for the digital world. Such competence is "holistic, situated, role-oriented in performance, function, and relationship, systemic, trainable, and constantly developing" (Castañeda et al., 2018, p. 14). The demand for digital competence is growing among teachers by linking various skills, knowledge, and attitudes of the digital environment. In this way, the promotion is made possible by effective learning strategies and innovative and inclusive interventions (Redecker and Punie, 2017). Teachers' digital familiarity and fluency contribute to an acceptable level of digital competence. In this sense, it raises their self-concept in digital competencies and the motivation to continue learning (Torres et al., 2022).

Several research studies have dealt with teachers' digital skills, even more so in the context of the pandemic, since

it caused this process to accelerate at different educational levels. Thus, Carrillo López and Hernández Gutiérrez (2022) analyzed the level of digital competence of 678 teachers from the Canary Islands of various educational levels and concluded that teachers at the Primary and Preschool levels have more ICT training than those in Secondary school. Likewise, teachers who work in private schools excel in the Auditory and Accessibility dimensions concerning those working in public schools; and teachers working in enclaves, who attend to special educational needs, are the ones with the best results in all dimensions.

Along the same lines, Fernández-Cruz and Fernández-Díaz (2016), when studying the ICT competencies of young teachers who belong to the so-called Generation Z and who teach at the primary and secondary levels in Spain, found that a good part of the participants in the study had a medium-low global assessment. These results indicate that even though this group of young people is generally attributed with a more significant command of technology, this does not go hand in hand with the training they have in applying ICTs in the educational field. Therefore, it is necessary to implement training programs to develop digital competencies in this young population of teachers (Grande-De-Prado et al., 2021).

In Latin America, research on digital competencies differs in findings and approaches. Thus, from a qualitative perspective, the level of digital competencies in higher education institutions is moderate, according to a study by Saltos et al. (2019). Similarly, Henríquez-Coronel et al. (2018) found diverse findings on Students' digital competencies, which leads them to affirm that young people do not possess high-level digital competencies. This affirmation leads to the assumption that teachers do not have them either.

There are also studies on the levels of digital competence in future teachers. Thus, Silva Quiroz et al. (2022) described the levels of teaching digital competence in 239 Chilean pedagogy students in seven universities. One of the results shows a significant difference in gender, where women scored higher than men in the indicator "Designs teaching-learning activities that consider the use of digital technology." This involvement in the female population suggests a more outstanding commitment to the acquisition of digital skills by women. For Sánchez and Rodríguez (2021), when evaluating the DTC, they found no significant differences. In this sense, the sex variable does not constitute a relevant variable. A similar result was obtained by Peral et al. (2015), stating that this variable does not allow to explain the level of digital competence accurately.

Another interesting aspect of digital competence is its relationship with other related competencies, such as media competence, since, after all, technology and media are inseparable. In their study, Gutiérrez-Martín et al. (2022) analyzed the perception of teachers about ICT competencies and media competencies and found a low level of this self-perception. Their findings also indicate that teachers give greater

importance to media competencies than ICT competencies. For this reason, they propose a model called COMPROMETIC (teacher competencies in media and ICT) that integrates both types of competencies and suggests that they should not be viewed separately. This proposal is timely considering that it is through new media, such as social networks, that people of different ages interact and acquire new learning.

Despite differences in the competency domains, the achievements obtained show a greater advantage for young people. Their higher level of competence is due to their more significant contact with digital technologies (Mortis et al., 2013). The achievement generates relevant gaps in the DTC between teachers and students, older and younger. The younger ones are more accustomed to this type of resource (Fernández-Cruz and Fernández-Díaz, 2016).

In the Peruvian case, recent studies have been carried out on teaching digital skills in education, such as those by Rodríguez Martínez (2021) and Montalvo-Callirgos et al. (2022). The latter conducted a documentary review of teachers' digital competencies in the context of the COVID-19 pandemic. The results show that 98% of teachers have an elementary level in using ICTs, so it is necessary to undertake updating programs to use new technologies. It should not be forgotten that social and economic inequality has exacerbated the already existing digital divide in Peru, even more so in the context of the pandemic. In this context, significant differences are established in the DTC by gender, place of birth, and institution of study (Suárez-Guerrero et al., 2020).

Another study on DTC in Peru is by Vilchez Guizado and Ramón Ortiz (2022). They analyzed and evaluated the level of development of digital competencies of Secondary school teachers in the management of virtual mathematics teaching. They considered three categories of analysis: acceptance of digital technology, digital information management, and the generation of digital content, which had a positive and moderate correlation. These results allow us to conclude that the covid-19 pandemic has led to faster development of digital competencies in teachers, even to the point of feeling more empowered in using digital technologies.

Similarly, the pandemic has prompted studies on DTCs and their relationship with the Blended Learning modality in a Peruvian context. Thus, Apaza (2022) found a statistically significant relationship between DTCs and the B-learning modality. In Apaza's (2022) study, it is evident that the DTCs are essential to bringing about substantial educational changes. Thus, it positively influences the fulfillment of educational objectives, reflected in better academic performance. Hence the need for intensive training gradually develops levels from explorer (A1, A2) to expert (B1, B2) and then to a leader (C1,

C2), proposed by Cabero-Almenara and Palacios-Rodríguez (2020).

It should also be noted that for the Peruvian Ministry of Education (Ministerio de Educación del Perú [MINEDU], 2020), the promotion and development of the DTC is an absolute necessity. The Ministerio de Educación del Perú [MINEDU] (2020) National Survey of Teachers applied remotely shows that almost 70% have difficulties systematizing virtual educational experiences. Also, 35% of teachers express virtualization difficulties during teaching and individual and collective planning. The results place teachers within a traditional use of ICTs due to the limited achievements in digital literacy (Benavente et al., 2021).

Finally, it is worth mentioning that various researchers have measured digital competencies in different contexts, which has led to the developing of a series of instruments for this purpose. In Europe, the European Framework for Digital Competence of Teachers «DigCompEdu» was proposed in Redecker and Punie (2017) to support member states in promoting teachers' digital competence and innovative educational processes (Cabero-Almenara and Palacios-Rodríguez, 2020). Likewise, Cabero-Almenara et al. (2022) validated the DigCompEdu model of the European Union, which suggests that teaching digital competence depends on professional commitment, pedagogical skills, and the ability to develop Students' digital competence.

In previous work, Cabero-Almenara and Palacios-Rodríguez (2020) proposed six levels and competency progression of the European Framework for Digital Competence of Teachers "DigCompEdu." The proposed instrument is called "DigCompEdu Check-In," which aims to assess the strengths and needs of teachers' digital competencies. The proposed levels are Novice (A1); Explorer (A2); Integrator (B1); Expert (B2); Leader (C1); and Pioneer (C2), which served as the basis for the present research (Cabero-Almenara and Palacios-Rodríguez, 2020).

Based on the studies conducted on digital competence in different educational contexts, it is possible to see the challenges and unequal conditions teachers face in today's world's new technological scenarios. Therefore, there is a need to investigate this topic in the Peruvian area to obtain accurate and recent data on the digital competencies of Peruvian teachers of BE. In this sense, the present study proposes the following objectives:

- To evaluate the level of global digital competence of BE teachers from different Peruvian schools.

- To determine the level by area of digital competence of BE teachers from different Peruvian schools according to sex, employment status, age, and educational level.

Methodology

The sampling was non-probabilistic and purposive. The present study corresponds to a quantitative methodological approach with a non-experimental design. The research is descriptive, comparative, and cross-sectional (Hernández-Sampieri and Mendoza, 2018).

Sample

A total of 3,142 teachers participated in this study: 1,020 men (32%) and 2,122 women (68%). Participation was voluntary. The ages mainly ranged between 46 and 51 years (38%) and 36 and 45 years (33%). Regarding the professional characteristics of the sample, the teachers belong to the Basic Education (BE) of the public schools located in the province of Arequipa (Peru). The teachers surveyed are distributed at the levels of Preschool (18%), Primary school (32%), and, for the most part, teachers in Secondary school (50%).

Table 1 shows the distribution according to sex, age, the educational level at which they work, and employment status.

Instrument

The information collection instrument was the "DigCompEdu Check-in" questionnaire (Cabero-Almenara and Palacios-Rodríguez, 2020), based on the European Framework Teaching Competence and allows self-perception on the level of DTC.

The instrument includes the 22 questions that measure the six areas of Digital Competencies.

TABLE 1 Sociodemographic data of the sample.

	F	%
Sex		
Woman	2,122	67.5
Man	1,020	32.5
Age		
Under 25 years	29	0.9
Between 26 and 35 years	441	14.0
Between 36 and 45 years	1,047	33.3
Between 46 and 55 years	1,180	37.6
Between 56 and 65 years	442	14.1
Over 65 years	3	0.1
Labor educational level		
Preschool	555	17.7
Primary school	1,013	32.2
Secondary school	1,574	50.1
Employment status		
Hired	1,723	54.8
Appointed	1,419	45.2
Total	3,142	100.0

TABLE 2   Structure of the "DigCompEdu Check-in" instrument.

Areas of digital competence	Competence	No. of items
Professional commitment	Organizational communication Professional collaboration Reflective practice Digital training	4
Digital resources	Selection Creation and modification Administration, exchange, and protection	3
Digital pedagogy	Teaching Guide Collaborative learning Self-directed learning	4
Evaluation and feedback	Evaluation strategies Analysis of evidence and tests Feedback and planning	3
Empowering students	Accessibility and inclusion Differentiation and personalization Student participation	3
Facilitating the digital competence of students	Information and media literacy Communication and digital collaboration Digital content creation Responsible use and wellbeing Digital problem solving	5

Next, Table 2 presents the organization of the instrument considering the six areas, the competencies, and the number of questions.

Regarding the scoring of the instrument, each question has five alternatives. Depending on the answer, it is scored as no commitment (0 points), partial knowledge (1 point), occasional use (2 points), increasing use (3 points), and systematic and comprehensive use (4 points).

Similarly, the instrument allows the overall grading of the teacher's digital competence, whose maximum score can be 88 and places in a digital competence level as described in Figure 1.

Procedure

The "DigCompEdu Check-in" questionnaire in Google Forms was used to assess teachers' digital competencies. The version includes necessary information on the research topic. The surveys were anonymous, and the participation was voluntary.

Data analysis

The data were analyzed using the IBM SPSS Statistics 25 program. Initially, normality tests were performed using the Kolmogorov-Smirnov test with a significance level $\alpha = 0.05$ with the p-value. Normality was not found in the sociodemographic variables: sex, labor educational level, and labor condition. Therefore, the non-parametric Mann-Whitney U and Kruskal-Wallis tests for independent samples were applied. Cohen's d was applied to measure the effect size of the differences by gender and labor condition: values of $d \geq 0.2$, $d \geq 0.5$, and $d \geq 0.8$ represent a small, medium, and large effect size, respectively. The age variable has normality, so the ANOVA parametric test was applied.

Results

The results obtained by teachers in the "DigCompEdu Check-in" questionnaire are presented in tables. The differences in the six competency areas of the questionnaire were analyzed

FIGURE 1
Levels of digital teaching competence.
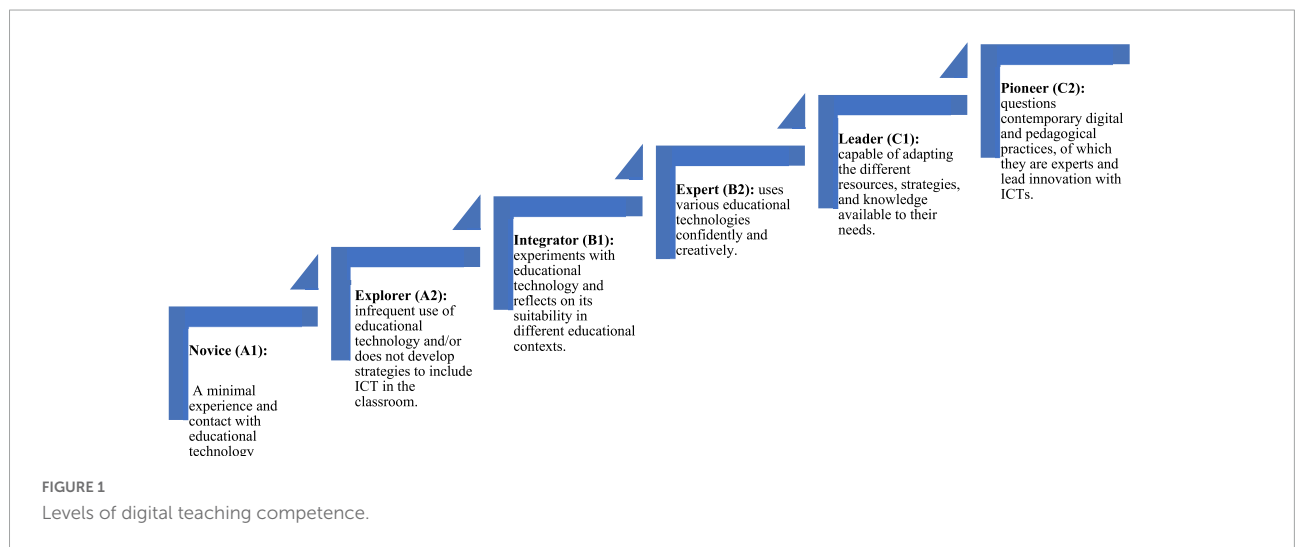
TABLE 3 Results of Mann-Whitney U for the areas of digital teaching competence with effect size by sex.

Competency area	Sex	n	Ranges	U	p	Cohen's d
Professional commitment	Woman	2,122	1559.53	1056816.0	0.283	0.05
	Man	1,020	1596.41			
Digital resources	Woman	2,122	1528.10	990130.5	0.001	0.17
	Man	1,020	1661.78			
Digital pedagogy	Woman	2,122	1483.01	894445.5	0.001	0.3
	Man	1,020	1755.59			
Evaluation and feedback	Woman	2,122	1555.87	1049050.0	0.160	0.03
	Man	1,020	1604.02			
Empowering students	Woman	2,122	1551.70	1040210.0	0.076	0.09
	Man	1,020	1612.69			
Facilitating the digital competence of students	Woman	2,122	1465.89	1465.9	0.001	0.37
	Man	1,020	1791.21			

n, sample size; U, Mann-Whitney U; p, p-value; Cohen's d (effect size).

according to the sociodemographic variables: sex, employment status, age, and educational level.

Table 3 shows the comparison of the results according to sex. In three competency areas: professional engagement, assessment and feedback, and empowering students, no significant differences were found. Instead, there are differences in digital resources, digital pedagogy, and facilitating Students' digital competence. In the latter areas, male teachers score higher than female teachers, although the differences are slight. The competency areas are related to the sources and creation of digital resources, the implementation of the use of digital technologies, and the facilitation of Students' digital competence.

Table 4 shows a comparison of the results according to employment status. Significant differences were found in all competency areas. Hired teachers obtained higher scores than appointed teachers, although with a reduced effect, except in evaluation and feedback, where the result is significant. At this level, digital tools and strategies are related to evaluating and improving teaching-learning processes.

Regarding age, significant differences were found in the first two competency areas, professional commitment and digital resources (Table 5). Participants under 25 years and between 26 and 35 years obtained higher scores in these areas. The first area refers to professional interaction with colleagues, students, family, and other agents of the educational community. The second is related to the responsible use and administration of digital resources.

The differences in teaching digital competence according to labor educational level are shown in Table 6 secondary school teachers obtain higher scores than Primary and Preschool teachers. They are located after the Preschool teachers only in professional commitment.

Regarding the level of competence (see Figure 2), 42.7% of the participants are located at the Integrator level (B1). This level is characterized by reflection on the use of technologies in different educational contexts. 27.4% are at the Expert level (B2) in search of continuous improvement of their teaching practices. Finally, 18.5% is at the Explorer level (A2), an elementary domain. In this sense, external guidelines are required to improve the level of DTCs. No specific strategies have been developed to incorporate ICTs in the classroom (Cabero-Almenara and Palacios-Rodríguez, 2020). The low percentages in the most advanced and leadership levels in using ICTs, Leader (C1) and Pioneer (C2), motivate other teachers.

Discussion

The results referred to in the study differ from those found by Rodríguez Martínez (2021), for whom most teachers only have a basic level in the use of ICT (Apaza, 2022). The average levels of achievement corroborate that continuous and persevering participation in all types of training leads to a high level of involvement and motivation (Torres et al., 2022). The findings of Apaza (2022) evidence the importance of awareness and regularity of digital technologies in educational processes,

TABLE 4 Results of Mann-Whitney U for the areas of digital teaching competence with effect size according to employment status.

Competency area	Employment status	n	Ranges	U	P	Cohen's d
Professional commitment	Appointed	1,723	1505.27	1108348.5	<0.01	0.16
	Hired	1,419	1651.92			
Digital resources	Appointed	1,723	1495.07	1090782.0	<0.01	0.18
	Hired	1,419	1664.30			
Digital pedagogy	Appointed	1,723	1490.18	1082351.0	<0.01	0.19
	Hired	1,419	1670.24			
Evaluation and feedback	Appointed	1,723	1512.71	1121181.0	<0.01	1.57
	Hired	1,419	1642.88			
Empowering students	Appointed	1,723	1511.65	1119341.0	<0.01	0.14
	Hired	1,419	1644.18			
Facilitating the digital competence of students	Appointed	1,723	1506.20	1109958.5	<0.01	0.16
	Hired	1,419	1650.79			

n, sample size; U, Mann-Whitney U; p, p-value; Cohen's d (effect size).

which occurs similarly in the present study. Most teachers are at an integrative level (B1), characterized by a reflexive use of technologies. Another group of teachers, although in a smaller proportion, is at a higher level called experts (B2). Therefore, the levels of DTC achieved by the surveyed teachers

TABLE 5 Results of the analysis of variance (ANOVA) for the areas of digital teaching competence according to age.

Competency area	Age	n	Mean	F	p
Professional commitment	Under 25 years	29	9.00	17.58	0.001
	Between 26 and 35 years	441	9.09		
	Between 36 and 45 years	1,047	8.66		
	Between 46 and 55 years	1,180	8.22		
	Between 56 and 65 years	442	7.49		
	Over 65	3	6.67		
Digital resources	Under 25 years	29	7.34	30.28	0.001
	Between 26 and 35 years	441	6.56		
	Between 36 and 45 years	1,047	6.01		
	Between 46 and 55 years	1,180	5.61		
	Between 56 and 65 years	442	5.15		
	Over 65	3	4.00		
Digital pedagogy	Under 25 years	29	8.07	1.39	0.226
	Between 26 and 35 years	441	8.31		
	Between 36 and 45 years	1,047	7.98		
	Between 46 and 55 years	1,180	7.89		
	Between 56 and 65 years	442	7.83		
	Over 65	3	6.00		
Evaluation and feedback	Under 25 years	29	6.76	1.85	0.099
	Between 26 and 35 years	441	6.86		
	Between 36 and 45 years	1,047	6.74		
	Between 46 and 55 years	1,180	6.70		
	Between 56 and 65 years	442	6.48		
	Over 65	3	4.67		
Empowering students	Under 25 years	29	6.45	2.14	0.057
	Between 26 and 35 years	441	6.73		
	Between 36 and 45 years	1,047	6.50		
	Between 46 and 55 years	1,180	6.43		
	Between 56 and 65 years	442	6.17		
	Over 65	3	4.67		
Facilitating the digital competence of students	Under 25 years	29	8.00	1.40	0.220
	Between 26 and 35 years	441	9.12		
	Between 36 and 45 years	1,047	9.02		
	Between 46 and 55 years	1,180	9.26		
	Between 56 and 65 years	442	9.02		
	Over 65	3	4.67		

Mean difference is significant at $p = 0.05$ by Duncan.

TABLE 6 Kruskal-Wallis H results for the areas of digital teaching competence according to labor educational level.

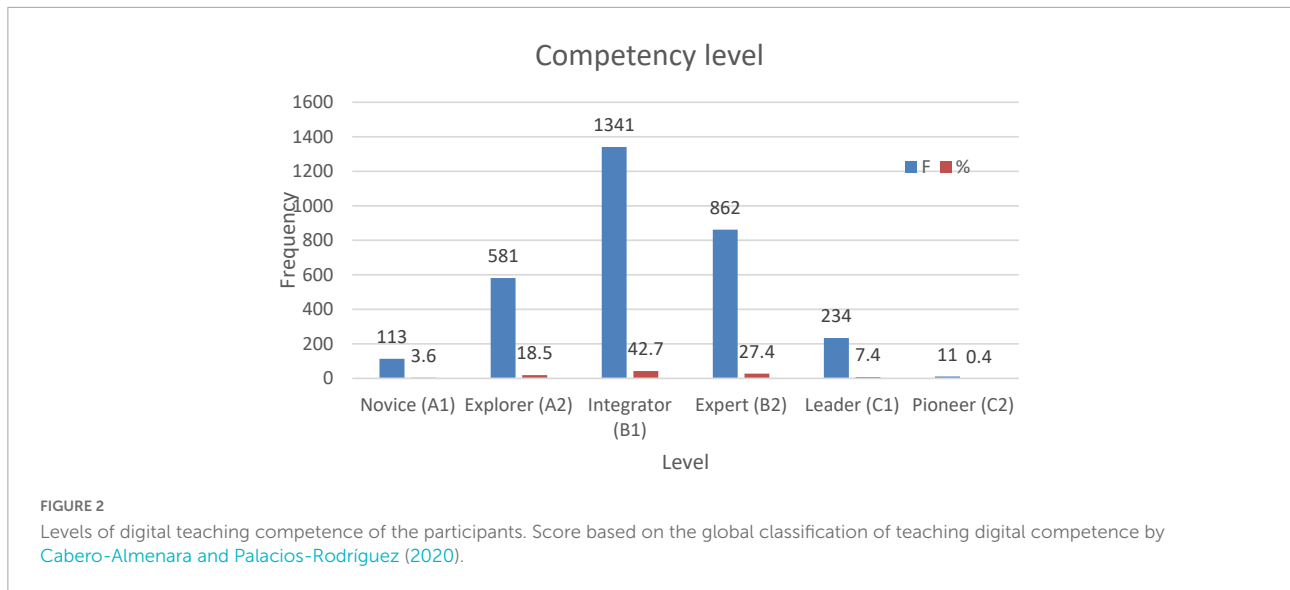| Competency area	Labor educational level	n	Ranges	Kruskal-Wallis H	p
Professional commitment	Preschool	555	1654.36	19.407	<0.01
	Primary school	1,013	1471.81		
	Secondary school	1,574	1606.44		
Digital resources	Preschool	555	1534.96	49.620	<0.01
	Primary school	1,013	1426.13		
	Secondary school	1,574	1677.94		
Digital pedagogy	Preschool	555	1151.11	196.739	<0.01
	Primary school	1,013	1503.84		
	Secondary school	1,574	1763.28		
Evaluation and feedback	Preschool	555	1538.73	8.033	<0.01
	Primary school	1,013	1519.69		
	Secondary school	1,574	1616.40		
Empowering students	Preschool	555	1377.31	53.724	<0.01
	Primary school	1,013	1508.35		
	Secondary school	1,574	1680.62		
Facilitating the digital competence of students	Preschool	555	939.80	369.451	<0.01
	Primary school	1,013	1565.15		
	Secondary school	1,574	1798.32		

n, sample size; p, p-value.

are acceptable, coinciding with what Torres et al. (2022) referred to, highlighting professional commitment as a means of improvement.

Considering the sex of the teachers who work in BE schools, discrepancies are found in three areas: digital resources, digital pedagogy, and facilitating Students' digital competence. In these areas, male teachers obtained higher scores than female teachers; but with little effect. In general, according to the scale (**Figure 1**), the average value obtained allows us to understand that most teachers are at the B1 integrator level (Rodríguez Martínez, 2021).

There are conflicting opinions on the incidence of the sex factor in the achievement of DTC. According to some researchers, there are significant differences (Silva Quiroz et al., 2022), and for others, they are not presented exhaustively (Peral et al., 2015; Sánchez and Rodríguez, 2021). The contradictions presented lay the foundations for future research, becoming the object of study. The expanded analysis of the sex variable will allow a better description of DTC and how to encourage their training.

By employment status, significant differences were found in all competency areas. Thus, hired (temporary) teachers obtained

FIGURE 2
Levels of digital teaching competence of the participants. Score based on the global classification of teaching digital competence by Cabero-Almenara and Palacios-Rodríguez (2020).

higher scores than appointed (permanent) teachers, although the effect is little. Hired teachers are usually younger and are in a career initiation period, so their knowledge and willingness are more intense (Fernández-Cruz and Fernández-Díaz, 2016). The distinction by the domains achieved allows verification of the levels of the areas of competence, assessing what type of training will be the most appropriate for each teacher (Carrillo López and Hernández Gutiérrez, 2022). The differences between permanent and temporary teachers may be due to age. Younger hires have a better command of technological tools (Mortis et al., 2013). In addition, hired teachers show greater fluency and ease in "mobilizing" in the digital world (Torres et al., 2022).

Regarding age, the teachers surveyed showed significant differences in the first two areas of competence, professional commitment, and digital resources. Participants under 25 years and between 26 and 35 years obtained higher scores. The demand for digital competencies is essential in the current situation, where a large part of the educational process is associated with digital technology. Hence, the younger teaching population, under 35 years, has better domains (Fernández-Cruz and Fernández-Díaz, 2016). It should be noted that their proximity to digital technologies is closer, unlike those over 35 years. The manifest contrasts are not decisive since they combine other factors, such as digital divides (Suárez-Guerrero et al., 2020). The study shows that experience contributes to slightly higher results among teachers working with digital technologies for more years.

According to labor educational level, BE teachers in Secondary school obtain higher scores than Primary and Preschool teachers. Only in the professional commitment, they ranked after Preschool teachers. These educational level results differ from Carrillo López and Hernández Gutiérrez's (2022) findings. These researchers found that Primary and Preschool teachers had more ICT training than Secondary school teachers.

The distinctions confirm that the educational level where teachers work is not a fully determinant for a higher or lower DTC. The results show that, on the one hand, the level achieved is closer to those predisposed to greater use, with an increasing and almost generalized tendency. On the other hand, there are demands from teachers for further updating (Grande-De-Prado et al., 2021).

Conclusion

The principal purpose of this research was to evaluate the level of digital competencies of BE teachers in different Peruvian schools. Regarding the competence level, most of the participants are at the Integrator level (B1), followed by the Expert level (B2) and the Explorer level (A2). The average levels achieved in the DTC show achievements in essential competencies that demonstrate their preparation in digital technologies. There are differences in the acquisition of the competency areas. Personal variables (age, sex), work, and educational level are related to the use of ICT since younger and hired teachers use more technological resources than appointed teachers who have been teaching for a longer time. Secondary-level teachers obtain better levels of digital competence than their peers in primary and preschool education. Likewise, male teachers reported higher levels of competencies than female teachers, which allows them to create digital resources and transfer them to students in the teaching-learning process.

In general terms, the study highlights that the differences in DTC contribute to the promotion of a reflexive praxis with a view to the continuous improvement of the educational process. Likewise, it contributes to adapting teaching practices to student needs (Vilchez Guizado and Ramón Ortiz, 2022). From that perspective, the DTC level responds to digital technologies

that promote inclusion, engagement, and mainly technological involvement fostering student autonomy (Kurnikova et al., 2021). In a broad sense, although the disparities are not profoundly significant, they provide a basis for further research. This way, the possible contrasts could be analyzed according to these and other sociodemographic variables (Sánchez and Rodríguez, 2021).

The study results make it possible to design training plans that respond to teachers' real and particular needs. The specific design would lead to higher levels of achievement. Advancing in this perspective is essential, given that certain demographic factors and the educational level where teachers work are not determining factors for a greater or lesser DTC. In this way, as they pass through distinctive and more demanding experiences, the competencies are affirmed. Such circumstances signify the need for a public policy recognizing teachers' innovation and good practices (Ministerio de Educación del Perú [MINEDU], 2020). In this regard, as Montalvo-Callirgos et al. (2022) point out, teacher updating plays a significant role. Universities should make a more outstanding commitment to training teachers in digital competencies. We must not forget the low percentages achieved at the Leader and Pioneer levels, which should significantly impact training. These levels represent the highest levels at the DTC level. Training this type of teacher should be a pending task for the coming years.

The use of ICT by teachers is fundamental in educational processes, so much so that current education cannot be understood without them. The DTC has become a key competence for the exercise of teaching. The pandemic has made it more visible, given the prominence of virtual and interactive scenarios. Circumstances demand changes and adaptations the surveyed teachers do not shun. Although they present distinctions in the levels of competence, in general, they are oriented toward progressive technological appropriations. In this perspective, sociodemographic factors are present considerably, making it evident that generational proximity to technological changes is significant. In essence, singularities to be considered are revealed and findings for future research. The application of a standardized questionnaire limits the study; although validated, not yet in the Peruvian context.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

AH-M: substantial contributions to the conception or design of the work and the acquisition of data, provide approval for publication of the content, and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity. RN-P: drafting the work or revising it critically for important intellectual content, provide approval for publication of the content, and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity. AB-P: substantial contributions of the interpretation of data for the work and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity. EG-C: substantial contributions to the conception or design of the work, drafting the work or revising it critically for important intellectual content in English, and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity. OT-G: substantial contributions to the conception or design of the work and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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