DIGITAL SKILLS IN BASIC EDUCATION: THE CHALLENGES OF HYBRID TEACHING

COMPETÊNCIAS DIGITAIS NA EDUCAÇÃO BÁSICA: OS DESAFIOS DO ENSINO HÍBRIDO

COMPETENCIAS DIGITALES EN LA EDUCACIÓN BÁSICA: LOS DESAFÍOS DE LA ENSEÑANZA HÍBRIDA

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ABSTRACT: The adoption of hybrid teaching in many schools has forced teachers to develop digital skills for the integration of information and communication technologies (ICT). The aim of this research was to assess the level of acquisition and use of digital skills among high school teachers in a private education network. This is a quali-quantitative method that applied the questionnaire DigCompEdu check-in that was created to understand expectations, digital skills training needs, and challenges with hybrid teaching, to a group of high school teachers in the interior of the state of São Paulo. After administering the instrument, the results were analyzed using IBM SPSS Statistics® 22.0 software for descriptive and inferential statistical analysis of the questions. The results showed that teachers have a perception of their digital competence close to reality, but they self-assessed themselves at slightly higher levels than those revealed by the DigCompEdu check-in instrument**.**

KEYWORDS: Digital Competencies. Continuing Education. Teachers. Hybrid Teaching.

***RESUMO**: A adoção do ensino híbrido, em muitas escolas, tem obrigado os professores a desenvolverem competências digitais para a integração das tecnologias da informação e comunicação (TIC). O objetivo desta pesquisa foi avaliar o nível de competências digitais dos professores de Ensino Médio numa rede de ensino privado. Trata-se de uma pesquisa de abordagem quali-quantitativa que utilizou o questionário DigCompEdu check-in, instrumento criado para compreender as expectativas, necessidades de formação em competências digitais e desafios com o ensino híbrido, em um grupo de professores do Ensino Médio do interior do Estado de São Paulo. Após a aplicação do instrumento, analisou-se os resultados utilizando o software IBM SPSS Statistics® 22.0 para análise estatística descritiva e inferencial das questões. Os resultados mostraram que os professores têm uma percepção de sua competência digital próxima da realidade, porém autoavaliaram-se em níveis um pouco acima do revelado pelo instrumento DigCompEdu check-in.*

***PALAVRAS-CHAVE**: Competências Digitais. Formação Continuada. Professores. Ensino Híbrido.*

***RESUMEN**: La adopción de la enseñanza híbrida en muchas escuelas ha obligado a los docentes a desarrollar habilidades digitales para la integración de las tecnologías de la información y la comunicación (TIC). El objetivo de esta investigación fue evaluar el nivel de adquisición y uso de competencias digitales de los profesores de Educación Secundaria en una red de enseñanza privada. Se trata de una investigación quali-quantitativa y se aplicó el cuestionario DigCompEdu check-in, un instrumento creado para comprender las expectativas, necesidades de formación en competencias digitales y desafíos con la enseñanza híbrida en un grupo de profesores de Educación Media en el interior del Estado de São Paulo. Después de administrar el instrumento, se analizaron los resultados utilizando el software IBM SPSS Statistics® 22.0 para el análisis estadístico descriptivo e inferencial de las preguntas. Los resultados mostraron que los profesores tienen una percepción de su competencia digital cercana a la realidad, pero se autoevaluaron en niveles ligeramente superiores a los revelados por el instrumento DigCompEdu check-in.*

***PALABRAS CLAVE**: Competencias Digitales. Formación Continua. Profesores. Enseñanza Híbrida.*

Introduction

Education, as a social area in constant development, due to its responsibility towards training the subjects that makeup society, is always looking for better ways to make the teaching and learning process more effective, adapting to the trends of modern society and younger generations. However, a difficulty arises when considering the construction and assistance in learning formal knowledge. With each passing year, society becomes more technological, and the subjects that were born in this society and developed along with it have a greater tendency to use digital tools, and many teachers do not have the habit or experience of using them.

Each subject's potential in using technologies may be related to the context they experienced when they were younger or the cultural stimuli in which they were inserted. In other words, people linked to teaching and who were born in decades in which technology was not so common to the majority of society and to educational chairs may have greater difficulty in using current technologies than those born in decades in which Technologies are more accessible to the innate learning capacity. Therefore, it is possible to think of different ways of training the most experienced to use technology as a tool to aid teaching. Training will provide generational intersections and, consequently, communication and relationships so that learning takes place in a less noisy way (DESSEN, 2005).

We focus our analysis on the acquisition of digital technological skills, so that the integration of technologies is, in fact, a contribution to the construction of knowledge and educational innovation, and not just the presentation of content or learning objects in a digital guise. This thinking understands that in the face of technological advances, there is an obstacle to be overcome, which is teacher training aligned with the transformations of the modern world, in which the teacher would be fully able to teach, integrating the digital technologies developed, innovating and reinventing, thus, the teaching profile and practice (RODRIGUES *et al.,* 2018).

The concept of competence, also widely explored in the academic field, requires our attention, as the analysis of this research focuses on its development. The definition of competence is associated with "[...] the ability to mobilize different cognitive resources to face a type of situation" (PERRENOUD, 2000, p. 15, our translation).

This means that competence or the mobilization of resources, is a construction process, in everyday situations that deactivates mental operations or thought schemes and allows us to carry out actions to achieve the proposed objective. (TARDIF; LESSARD; LAHAYA, 1991).

Methodology

The research methods chosen for this research use the quantitative approach, since the research design and data involve both natures. Quantitative and qualitative cannot be thought of as contradictory oppositions, as "[...] it is to be desired that social relations can be analyzed in their most "ecological" and "concrete" aspects and deepened in their most essential meanings" (MINAYO; SANCHES, 1993, p. 247, our translation). The authors also add that "[...] the quantitative study can generate questions to be deepened qualitatively, and vice versa" (MINAYO; SANCHES, 1993, p. 247, our translation).

In the first stage of data collection, the survey was carried out using the *DigCompEdu check-in* questionnaire divided into two parts with 22 closed and 3 open questions. Teachers were invited to participate in the research by sending an email containing information about the project and an access link to the Free and Informed Consent Form – TCLE.

The questionnaire was answered anonymously, and the closed questions served to assess the different skills, competencies, and abilities regarding the use of technologies in the classroom. In the last part, the teacher had the opportunity to present, in open questions, his expectations, needs and challenges regarding the use of digital technology.

The statistical analysis of the data obtained from the closed questions of the *DigCompEdu check-in* was performed using the IBM SPSS Statistics® 22.0 software. Quantitative data was used to diagnose the level of digital skills of the group of teachers.

Data collect

Data collection was done electronically and took place through a questionnaire consisting of 47 questions, distributed in the following order:

a) a question for self-assessment by respondents regarding the level of their digital competence (pre-questionnaire self-assessment);

b) 22 questions included in the DigCompEdu check-in (FIGUEIRA; DOROTEA, 2022; LUCAS; BEM-HAJA, 2021), which indicated the level of calculated digital competence of the respondents both in general terms and by area of analysis, namely: involvement professional (area 1), digital resources (area 2), teaching and learning (area 3), assessment (area 4), training of learners (area 5) and promoting digital competence of learners (area 6);

c) 11 demographic questions to characterize the sample regarding gender, age, time the respondent teaches, subjects they teach regularly, school levels to which the respondent

dedicates more time in their work, age groups of students, academic qualifications, equipment that has for personal use, time used for digital technologies in teaching, percentage of subjects taught online/distance, and tools/activities used with students for teaching and learning;

d) four questions for self-description regarding the private use of digital technology (Likert scale, 1 – unfavorable self-description, 5 – favorable self-description);

e) five questions regarding the perception of the work environment as favorable to access to digital technology (Likert scale, 1 – unfavorable environment, 5 – favorable environment);

f) a question for self-assessment by respondents regarding the level of their digital competence (post-questionnaire self-assessment).

At the end of the questionnaire there were three open questions that aimed to find out:

a) teachers' expectations about the possibility of creating a digital technologies course focused on teaching practices;

b) respondents' needs (what they would need to learn), within the context of digital skills, which would assist in teaching practices; It is

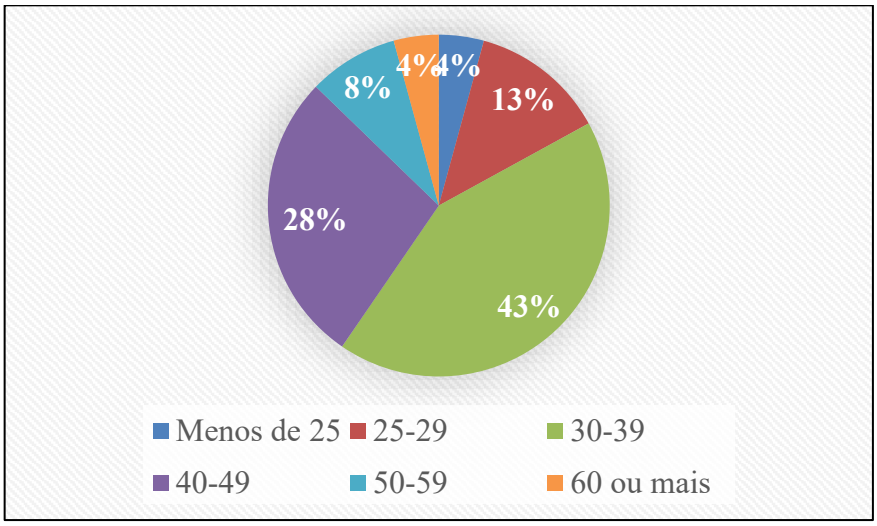
c) what positive and negative aspects does the pandemic bring to the work of an educator, regardless of whether they are professional or personal.

Results

The conducted research obtained 47 valid responses to the questionnaire sent. The conducted research obtained 47 valid responses to the questionnaire sent. Eighty-three teachers were invited, and 56.6% responded. Initially, the sample obtained was characterized using descriptive statistics (SWEENEY; ANDERSON; CAM, 2013) with frequency verification considering parameters such as gender, age, time the respondent teaches, subjects the respondent teaches regularly, school levels to which the respondent dedicates most of their work time, age groups of students, academic qualifications, equipment they have for personal use, time spent using digital technologies in teaching, percentage of subjects they teach online/distance learning, and tools/activities used with students for teaching and learning.

The distribution of respondents by sex indicates a balance between men (N= 23,49%) and women (N= 24,51%) in the sample considered, which will allow a future comparison between levels of digital competence, both by self-assessment as calculated, leading to the possibility of developing specific practices to improve both groups.

Figure 1 – Distribution of respondents by age group



Source: Prepared by the author

Figure 1 shows that the highest concentration of respondents is between 30 and 49 years old (71%), with a reduced number at the extremes of the ages considered, below 25 years old and 60 years old or over.

Table 1 – Distribution of respondents teaching time and academic title

	Frequency	Percentage
Years teaching		
1-3	6	12.8%
4-5	8	17.0%
6-9	10	21.3%
10-14	6	12.8%
15-20	9	19.1%
More than 20	8	17.0%
Academic title		
Graduation	14	29.8%
Postgraduate (Specialization)	30	63.8%
Master's degree	2	4.3%
Doctorate degree	1	2.1%

Source: Prepared by the author

Table 1 presents data related to the length of teaching activity and academic qualifications of the respondents. As can be seen, the greatest concentration is in the period of 6 to 9 years of operation, with the other periods being relatively balanced among themselves. Regarding academic degrees, the majority (above 63%) have a *lato sensu* postgraduate degree

(specialization) with few having a *stricto sensu* degree (masters and doctors – between 6% and 7%).

The other variables that characterize the sample (equipment owned for personal use, time spent using digital technologies in teaching, percentage of subjects taught online/distance, and tools/activities used with students for teaching and learning) were also analyzed, but they have a peculiarity that deserves to be highlighted before presenting the results. Due to their content, they allowed the respondents to select more than one alternative, meaning the total responses could be more than 100%.

Table 2 – Frequency of subjects taught regularly

Subject	Frequency	Percentage
Humanities (history, geography, social sciences, political sciences)	16	27.1%
Natural sciences (physics, chemistry, biology)	10	16.9%
Math	9	15.3%
Portuguese Language	7	11.9%
Religious education	7	11.9%
Foreign Languages	5	8.5%
Arts (visual arts, music, design)	3	5.1%
Physical education	2	3.4%

Source: Prepared by the author

Table 2 shows the frequency and percentage of occurrence of subjects taught regularly by the respondents. The subjects of Humanities (history, geography, social sciences, political sciences) and Natural Sciences (physics, chemistry, biology) are those that occupy the most teachers' time, with Mathematics coming in third place. This finding highlights the need for digital skills on the part of teachers so that they can develop their work in an updated and dynamic way, as well as guide their students in the use of the most appropriate tools for developing activities and preparing themselves for their future academic stages (colleges, technical courses, specialized courses).

Table 3 – Respondents' performance levels

School levels	Frequency	Percentage
Kindergarten	2	2.6%
Elementary School	3	3.9%
Middle School	35	46.1%
High School	36	47.4%

Source: Prepared by the author

Table 3 shows the school levels at which the respondents work. The sum of middle school and high school totals over 90%, reinforcing the importance of training teachers in digital technologies so that they can act as mentors to their students, who have already encountered digital technologies from an early age. This teacher needs to know the academic and professional tools well enough to use them in their daily lives and future opportunities.

The presence and diversity of equipment for personal use by respondents is an important item to consider as it is an indication of the familiarity they have with such materials and the ease with which they adapt to new devices present on the market and which, in addition to personal use, it will certainly help with professional use.

Table 4 shows a distribution with laptops and smartphones occupying the top percentages of use, totaling more than 40% of the responses. Printers come next; microphones appear in fourth place, also expected for respondents who prepare video classes or teach classes via video conference and want to get their message across to students in the most appropriate way possible.

From this point until the end of the list, the use of paid software draws attention, which would not be common given the availability of free materials that the Internet offers nowadays, perhaps due to their lack of knowledge about free access software and tablets in last place, a device that doesn't seem functional enough to replace a laptop or a PC.

Table 4 – Frequency of use of personal equipment by respondents.

Personal use equipment	Frequency	Percentage
Laptop	44	21.5%
Smartphone	41	20.0%
Printer	25	12.2%
Microphones	24	11.7%
PC	18	8.8%
Cameras	15	7.3%
Lighting kit	13	6.3%
Paid software (CANVA, PREZI, EVERNOTE Etc.)	13	6.3%
Tablet	12	5.9%

Source: Prepared by the author

As for the digital tools and activities already used by respondents, table 5 shows that presentations continue to be the most frequently used element, which is justified as it is a sophistication of something that was already done even before digital technology, when they used transparencies and overhead projectors. On the other hand, the considerable incidence of

mind maps (13.6%), digital voting (13.6%) and games (10.1%) shows the ocean of possibilities that are already used by teachers and that grow every day as teaching and learning tools.

Table 5 – Frequency of digital tools/activities already used

Digital tools/activities	Frequency	Percentage
Presentations	45	17.4%
Watch videos/listen to audio	42	16.3%
Digital posters, mind maps, organization tools	35	13.6%
Quizzes or digital polls	35	13.6%
Create videos/audio	31	12.0%
Interactive applications or games	26	10.1%
Online Learning Environments	25	9.7%
Blogs or wikis	10	3.9%
Other	9	3.5%

Source: Prepared by the author

After this descriptive analysis was carried out in order to characterize the sample used in the present study, the results of the level of technological skills were evaluated, whether those resulting from self-assessment (pre- and post-questionnaire) or the value calculated by *DigCompEdu check-in*.

Comparative self-evaluation data

Table 6 – Digital skills: pre-questionnaire before and after applying *DigCompEdu check-in*

Competency levels	Before		*DigCompEdu check-in* evaluation		After	
	Freq	%	Freq	%	Freq	%
A1: Newcomer	1	2.1%	0	0.0%	0	0.0%
A2: Explorer	2	4.3%	3	6.4%	3	6.4%
B1: Integrator	15	31.9%	21	44.7%	17	36.2%
B2: Specialist	15	31.9%	14	29.8%	14	29.8%
C1: Leader	9	19.1%	8	17.0%	7	14.9%
C2: Pioneer	5	10.6%	1	2.1%	6	12.8%

Source: Prepared by the author

Table 6 shows the results obtained, allowing a comparison between these three digital skills scenarios. Before being submitted to the questionnaire, respondents filled out the protocol in which they presented their perception of their digital competence. For each question in the

protocol there are 6 possible answers, being: A1: Newcomer; A2: Explorer; B1: Integrator; B2: Specialist; C1: Leader; and C2: Pioneer.

The data analyzed presented a self-assessment with a balanced incidence at levels B1 and B2 (31.9% at each level), levels that could be called intermediate levels of digital competence. The remaining respondents were more concentrated on levels C1 and C2, which are high levels of digital competence, showing that respondents had a very positive self-assessment of their digital competencies. After completing the *DigCompEdu check-in*, this scenario was changed, increasing the combined percentages of B1 and B2 (from 63.8% to 74.5%), but reducing the percentage of B2 and increasing the percentage of B1, showing that a tool logical and structured approach was opposed to the respondents' self-assessment, giving a more rigid measure of their skills. At the highest levels (C1 + C2), the frequency of respondents decreased considerably (from 29.8% to 19.1%), showing that the self-assessment before the questionnaire did not demonstrate the reality of the facts, which the structured tool did not allow.

Another aspect observed is that at the lowest levels (A1 + A2), there was a distribution of 6.4% of respondents between the two levels, but the analysis tool (DigCompEdu check-in) presented the same percentage result (6.4%), but concentrated at level A2, showing that at these levels the respondents' self-assessment was more rigid than the structured tool. Thus, in the comparison between the scenario before the questionnaire and the tool, the possibility of a more realistic analysis of respondents by the tool is noted, as the pre-questionnaire self-assessment showed high percentages at higher levels of digital competence.

When comparing calculated levels (*DigCompEdu check-in*) and post-questionnaire self-assessment, certain corrections were noted on the part of respondents, as if exposure to the questionnaire made them reflect on their self-assessment, making them look for scores that are more faithful to what they really understand to be their digital skills.

Therefore, in the post-questionnaire self-assessment, the lowest levels (A1 and A2) were the same as those in the tool (*DigCompEdu check-in*), the intermediate levels (B1 + B2) were closer to those in the pre-questionnaire self-assessment, but with a percentage higher for B1, characterizing similarity to the pre-assessment in total but similarity to the *DigCompEdu check-in* in the sharing between the two levels, and the percentages of the highest levels (C1 + C2), although they were higher than the tool indicated, were lower than the percentages of the self-assessment prior to the application of the questionnaire.

Accordingly, it can be said that, in general, the digital skills of respondents via *DigCompEdu check-in* are at levels B (B1 and B2) and the tool, when applied, in addition to measuring the level of digital skills, promotes reflection to the respondents, since their self-assessment before and after applying the questionnaire, for a single question, changes in a way that deserves to be highlighted.

Table 7 – Digital skills by area of analysis (part 1)

Levels	Professional Involvement		Digital Resources		Teaching and learning	
	n	%	n	%	n	%
A1	1	2.1%	2	4.3%	2	4.3%
A2	3	6.4%	7	14.9%	16	12.8%
B1	9	19.1%	9	19.1%	12	14.9%
B2	19	40.4%	7	14.9%	4	34.0%
C1	14	29.8%	17	36.2%	12	25.5%
C2	1	2.1%	5	10.6%	4	8.5%

Source: Prepared by the author

Table 8 – Digital skills by area of analysis (part 2)

Levels	Evaluation		Training learners		Promoting learners' digital competence	
	n	%	n	%	n	%
A1	0	0.0%	2	4.3%	1	2.1%
A2	10	21.3%	2	4.3%	4	8.5%
B1	12	25.5%	16	34.0%	21	44.7%
B2	13	27.7%	14	29.8%	11	23.4%
C1	8	17.0%	9	19.1%	8	17.0%
C2	4	8.5%	4	8.5%	2	4.3%

Source: Prepared by the author

Tables 7 and 8 show that the areas of greatest weakness among respondents (areas with a lower level of digital competence) are areas 2 and 4 (Digital Resources and Assessment). These should be areas of greatest focus for managers to encourage the use of digital assessment tools to monitor student progress, analyze available data to identify students who need

additional support, and use digital technologies. to provide effective feedback. This does not mean that other areas do not deserve attention, but rather that this should be the first point of attack within a process of increasing the digital skills of teachers who responded to the survey.

Table 9 – Digital skills: pre-questionnaire before and after applying *DigCompEdu check-in* – difference by gender

Gender	Level	Before		Evaluation *DigCompEdu Check-in*		After	
		Frequency	%	Frequency	%	Frequency	%
Man	A1	1	4.3%	0	0.0%	0	0.0%
	A2	0	0.0%	3	13.0%	1	4.3%
	B1	7	30.4%	9	39.1%	5	21.7%
	B2	5	21.7%	7	30.4%	7	30.4%
	C1	6	26.1%	3	13.0%	4	17.4%
	C2	4	17.4%	1	4.3%	6	26.1%
Woman	A1	0	0.0%	0	0.0%	0	0.0%
	A2	2	8.3%	0	0.0%	2	8.3%
	B1	8	33.3%	12	50.0%	12	50.0%
	B2	10	41.7%	7	29.2%	7	29.2%
	C1	3	12.5%	5	20.8%	3	12.5%
	C2	1	4.2%	0	0.0%	0	0.0%

Source: Prepared by the author

Table 9 shows that in the first self-assessment, men had a more positive perception of themselves than women since they presented a higher percentage at the highest levels (C1 + C2 → men = 43.5%; women = 16.7%). Likewise, at the lowest levels (A1 + A2), there was a better self-assessment by men (4.3%) than by women (8.3%), since a lower percentage of men considered themselves less digitally competent and, therefore, classified themselves in the lowest levels. At these two levels, all men classified themselves as A1 and all women as A2. Due to the number of respondents in these classifications, it is not possible to say that this result has relevant statistical significance, however it may be an indication for future studies on the matter.

When comparing the first self-assessment and the standardized assessment (*DigCompEdu check-in*), clear differences can be seen, indicating that men reported better self-assessments (C1 + C2: first self-assessment = 43.5% vs. calculated assessment = 17.4%), while women at the highest levels made worse assessments of themselves (C1 + C2: first self-assessment = 16.7% vs. calculated assessment = 20.8%). At the other extreme of the level classification, the same phenomenon occurred, showing that men were in a worse situation than

they thought they were (A1 + A2: first self-assessment = 4.3% vs. calculated assessment = 13.0%), while women showed the opposite situation (A1 + A2: First self-assessment = 8.3% vs. calculated assessment = 0.0%). At intermediate levels (B1 + B2), women showed a greater balance between the percentages of the first assessment (75.0%) and standardized assessment (79.2%) than men (first self-assessment = 52.2% vs. assessment standardized = 69.6%).

In the comparison between standardized assessment (*DigCompEdu check-in*) and post-questionnaire self-assessment, the women showed a very close alignment between the intermediate levels (B1 + B2), a higher percentage in the lower levels (A1 + A2) and a lower percentage at higher levels (C1 + C2), showing a slightly stricter self-assessment than the *DigCompEdu check-in* tool. For men, the post-questionnaire self-assessment indicated lower percentages at intermediate levels (B1 + B2), much higher at higher levels (C1 + C2) and lower percentages at lower levels (A1 + A2), showing that, as it was verified in the pre-questionnaire assessment, men tend to have a more positive assessment of their digital skills than women.

Another noteworthy point is that between men's pre-questionnaire self-assessment and post-questionnaire self-assessment there is an alignment between the different level groups (A1 + A2, B1 + B2, C1 + C2), changing the percentage within each group always for the better (from A1 to A2, from B1 to B2, from C1 to C2), as if exposure to the questionnaire gave the group the perception that they are even more digitally competent than they previously thought, although the tool showed that they are not. A similar comparison (pre- and post-questionnaire) between women shows that after the questionnaire their self-assessment was more rigid, leading them to classify themselves at lower levels of digital competence than before the questionnaire.

In summary, it can be said that both groups have a higher concentration of digital competence via *DigCompEdu check-in* at intermediate levels (B1 + B2: men = 69.6% women = 79.2%), with women in the highest percentage at the highest levels (C1 + C2: men = 17.4% women = 20.8%) and a lower percentage at the lowest levels (A1 + A2: men = 13.0% women = 0.0%). Finally, when faced with more detailed questions about their digital skills in the different areas of the *DigCompEdu check-in*, men tend not to change their self-assessment while women seem to reflect on the questions and change their assessment of their knowledge of digital technologies.

Results of DigCompEdu check-in Likert scale questions

After analyzing the DigCompEdu check-in, questions about self-description regarding the private use of digital technology were addressed (four questions on a 5-point Likert scale, ranging from completely disagree (1) to completely agree (5), with 1 – unfavorable self-description, and 5 – favorable self-description) and on the perception of the work environment as favorable to access to digital technology (five questions - on a 5-point Likert scale, ranging from completely disagree (1) to completely agree (5), 1 – unfavorable environment, 5 – favorable environment).

Initially, the answers to the two groups of questions were submitted to Exploratory Factor Analysis (AFE) to evaluate the grouping of questions into one or more factors, and the factor loadings of each question. The procedure was satisfactory (HAIR *et al.*, 2005) presenting the following results: KM0 = 0.773, Bartlett's test of sphericity = 178.232(45), $p<0.001$, with factor loadings ranging from 0.621 to 0.880 and Cronbach's alpha of 0.710 (Self-description regarding Private Use of Digital Technology) and 0.811 (Perception of the Work Environment).

The KMO test (Kaiser-Meyer-Olkin) and the Bartlett sphericity test aim to verify whether the data considered are suitable for Exploratory Factor Analysis, with prerequisites for this being a KMO value greater than 0.7 and the significant Bartlett test, indicated by a p-value less than 0.05 (HAIR *et al.*, 2005; VIEIRA; RIBAS, 2011). Both conditions were met in the present study.

Factor loadings are the correlation of each measurable variable (question, statement, or questionnaire phrase) with the latent variable (or construct) related to it, indicating the correspondence between the measurable and latent variables. Factor loadings are the means of analyzing the role that each measurable variable has in characterizing the latent variable. Higher loadings indicate that the measurable variable is more representative of the latent variable. Factor loading values greater than 0.5 are considered adequate to consider the maintenance of the measurable variable in the analysis (HAIR *et al.*, 2005)**.**

The first question of the Likert scale questions “Are there interactive whiteboards available in each classroom”, theoretically belonging to the Perception of the Work Environment factor, presented a low factorial load (below 0.30) and had a negative influence on the internal consistency of the construct and, as a result, was discarded from the study.

The descriptive statistical analysis of the construct Self-Description regarding the Private Use of Digital Technology presented a mean value of 16.98 and a standard deviation 2.42 for a range of 4 to 20 points, indicating that the respondents have a self-description

regarding the private use of digital technology quite favorable (almost 85% of the maximum possible score), indicating that they understand that it is easy to work with computers and other technical equipment, they make extensive use of the Internet and find it easy to do so, they consider themselves open and curious about new applications, programs and resources, and are members of various social networks.

Although such an assessment is quite positive and useful for the teaching use of digital technology, as it can be understood that ease of private use implies ease of professional use, it cannot be forgotten that this is a self-assessment and that, in previous cases of self-assessment in this work, they proved to be better than when compared with structured assessment tools such as *DigCompEdu check-in*.

With regard to Perception of the Work Environment, an average value of 23.72 and a standard deviation of 4.47 were obtained for a range of 6 to 30 points, indicating that respondents have a very favorable perception of the work environment in terms of respect for access to digital technology (almost 79% of the maximum possible score), indicating high scores for student access to digital devices, speed and reliability of Internet connection, student access to digital devices connected to the Internet, support from management from school to the use of digital technologies in the classroom, and the support that the curriculum provides for the use of digital technologies in the classroom.

Finally, focusing on these two constructs, we sought to know whether there would be a difference in the average scores depending on the different levels of digital skills obtained through the different forms used in the present work (pre-questionnaire self-assessment, calculated self-assessment – *DigCompEdu check-in*, and post-questionnaire self-assessment). To this end, the analysis of variance (ANOVA) technique was used.

The results showed that there was no statistically significant difference between the average Self-Description scores regarding Private Use of Digital Technology and Perception of the Work Environment between the different levels of digital competence when performing the pre-questionnaire self-assessment and calculated assessment (*DigCompEdu check-in*). However, the same did not occur in the case of the post-questionnaire self-assessment, which showed significant differences in Self-Description regarding Private Use of Digital Technology ($F(4, 42) = 5.576$, $p = 0.001$) between the lower level A2 (Average = 15.33, SD = 2.08) and the two upper levels, C1 (Mean = 19.14, SD = 0.90) and C2 (Mean = 19.33, SD = 0.82), indicating that in this condition (post-questionnaire self-assessment), those who consider themselves to have a high level of digital competence also have a very favorable self-description of their

private use of digital technology. A similar result was not found with Perception of the Work Environment, with no difference in this factor between the different levels of digital competence obtained among respondents after the questionnaire.

Discussion

Digital competence is a key concept in the discussion about what kind of skills and understanding people should have in the knowledge society (ILOMÄKI; KANTOSALO; LAKKALA, 2011). Digital competence is a multifaceted concept that emerged from several areas of knowledge (BILBAO-AIASTUI; ARRUTI; MORILLO, 2021; GALLARDO-ECHENIQUE *et al.*, 2015; ILOMÄKI; KANTOSALO; LAKKALA, 2011).

The current generation has different technological skills and preferences than previous generations because they were born and grew up in the digital era (SOMYÜREK; COŞKUN, 2013). Digital competence is one of the eight key competencies for lifelong learning and is essential for participation in our increasingly digitalized society (FERRARI; PUNIE; BREČKO, 2013).

To assess the digital competence of teachers, this study used a highly reliable instrument created for the analysis of the "European Digital Competence Framework for Educators" ("*DigCompEdu*") and was adapted for use in Brazil (CASTRO; LUCAS, 2022; LUCAS; BEM-HAJA, 2021) clarify a variety of issues.

When characterizing the sample, it was found that most of the participants (71%) are between 30 and 49 years old, have a lot of professional experience (48.9% with more than 10 years of professional experience as a teacher) and 63.8% have a postgraduate degree *lato sensu*. Regarding technological resources, 65.4% indicated laptops, smartphones, printers, and microphones as digital tools. The minority use some paid software and other differentiated resources, as evidenced in the literature by other studies indicating the low digital literacy of primary school teachers(CHAABAN; MOLONEY, 2016; FREITAS; CUNHA; MANFREDO, 2022).

Specifically analyzing the data obtained through the application of *DigCompEdu check-in*, which brings results about the subject's perception regarding their digital literacy, it was possible to verify that the first self-analysis on their own knowledge of digital technologies was quite optimistic, in which the participants assessed themselves at levels B1 = Integrator (31.9%) and B2 = Specialist (31.9%), and 10.6% assessed themselves at level C2 = Pioneer. However,

after completing the entire *DigCompEdu check-in*, it was possible to verify that these levels were not corresponding, and although the level of people in B1 = Integrator (44.7%) and B2 = Specialist (29.8%) increased), decreased by 2.1%, the level C2 = Pioneer, which in self-analysis we had 10.6%, in *DigCompEdu check-in* goes to 2.1%, which indicates that some respondents who self-analyzed at the highest level high, in fact, did not have perceived dominance (BENEDET, 2020; CUADRADO, SÁNCHEZ; TORRE, 2020; VÓLQUEZ PÉREZ; AMADOR ORTÍZ, 2020).

One of the questions raised by the results of this study was the comparison of perceptions of digital skills between men and women in the sample. Women were more modest in their assessment and men appeared to be more confident in their perception of their digital skills, although the values given in the self-assessment did not always match the reality. Other international studies also point to differences when comparing men and women on digital technology topics (JIMÉNEZ-HERNÁNDEZ *et al.*, 2020; VÁZQUEZ-CANO; MENESES; GARCÍA-GARZÓN, 2017; VÁZQUEZ-CANO; MENGUAL-ANDRÉS; ROIG-VILA, 2015).

A study conducted at two public universities in Spain (UNED - National University of Distance Learning, and the Universidad Pablo de Olavide) with a sample of 923 students, analyzed the differences in the basic digital skills of male and female university students in the courses of Social Education, Social Work and Pedagogy. The study pointed out that greater digital competence is perceived by men in certain digital skills (VÁZQUEZ-CANO; MENESES; GARCÍA-GARZÓN, 2017). Another study that assessed digital skills in postgraduate students showed the need to offer training to people who are less intensely involved with digital technologies, such as women, older people, and teachers (JIMÉNEZ-HERNÁNDEZ *et al.*, 2020).

In another study, the authors provide information that there are discrepancies in digital skills when looking at gender differences in teachers. There are studies that find a clear difference and show that male teachers are better at gathering information through technological means than female teachers, and others show that men perform slightly better than women on digital skills tests (JIMÉNEZ-HERNÁNDEZ *et al.*, 2020). However, there is still little research that focuses on comparing the performance of men and women in terms of digital skills.

Final considerations

The main objective of this research was to evaluate the level of acquisition and use of digital skills of high school and basic education teachers, final grades, in a private education network, aiming to analyze their training needs, challenges and expectations for the future of teaching in pandemic and post-pandemic scenarios.

Observing the discussions of the results presented, teachers are located between the integrative and specialist levels in the skills analyzed in general and in self-assessment, although 10.6% assessed themselves at level C2 (Pioneer), which does not was confirmed using *DigCompEdu check-in*, which assessed 2.1% of this sample as being at the highest level (C2).

In the analysis conducted by area, the levels were well differentiated and, although in areas 1 (professional involvement) and 2 (digital resources), teachers remained at levels B2 and C1, it is concluded that the level of proficiency in digital competence of teachers is low, since in areas 3 to 6 most of the teachers are at levels B2 and B1. The *DigCompEdu check-in* places the B2 Specialist level as a foundation for digital transformation and critical, effective, and innovative use of digital technologies. The average level achieved corresponding to B1 Integrator, describes a less consistent use and integration of digital technologies. At this level, teachers need support to improve their understanding of which tools work best in each professional activity situation, as well as information about the suitability of digital technologies to pedagogical methods and strategies (LUCAS; BEM-HAJA, 2021).

The analysis of teachers' digital skills based on self-assessment can have positive impacts on the intrinsic motivation for the continuous development of such teachers' skills (SILVA; LOUREIRO; PISCHETOLA, 2019). To advance in proficiency levels, teachers must receive incentives to experiment, reflect and, through collaborative action, exchange knowledge with their peers (SANTOS, 2022).

Although the results of this study are encouraging, its limitations must also be recognized. First, a response rate of 56.6% of teachers and a small sample size of 47 teachers limit the generalizability of the data. Secondly, some of the survey instruments from previous versions had to be adapted to Brazilian Portuguese (*DigCompEdu check-in*), and the researcher created three open-ended questions.

However, the contribution of this work points to new opportunities. It is needed in basic education and highlights the importance of promoting teacher training in various areas, especially in digital technology, which is advancing rapidly, and educators need to know how to achieve better results with their students.

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