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Digital Skills and Gender Equity: Perceptions and Practices of Portuguese Primary Education Teachers

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Abstract: This study aims to characterize the digital skills and pedagogical practices using digital technology among primary teachers (first CEB), as well as to map their understanding and practices of promoting gender equality using digital technology. To this end, an online questionnaire survey was conducted among teachers, which yielded 3871 valid responses, representing 17.5% of the population. The sample structure is identical to that of the population, in terms of sociodemographic and territorial characteristics, as well as to the years of schooling covered. It was found that teachers perceive themselves as digitally competent to carry out the essential part of their teaching tasks. Most have already tried to carry out a diverse set of pedagogical practices and activities using digital technology. However, as the overwhelming majority did not find differences between the uses that boys and girls make of digital technology, they also do not act to promote digital skills differently among girls. Some contextual variables were also found that explain these differences in perception and practices regarding digital in education.

Keywords: digital gender divide; teachers' perceptions; pedagogical practices; Portuguese primary teachers

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1. Introduction

Although gender equity is a fundamental right, the 2023 gender equality index (GEI) places Portugal at 16th in the European Union, below average, despite recent progress. According to the GEI report, the labor market remains gender segregated today, as the green and digital transition calls for upskilling and reskilling. Women risk being sidelined because of their lower representation in science, technology, engineering, and math (STEM) [1]. A recent study, conducted in Germany, found out that the gender gap first occurs in upper secondary education and is apparent for all adult cohorts. Moreover, the gap is small among people working or studying in STEM [2].

On STEM Education, the report above mentioned noticing that "the lack of women in STEM fields is only one consideration—underlying gender stereotypes must also be addressed. Like women in STEM, men are severely underrepresented in tertiary education in the fields of education and health. These sectors are not often recognized as relevant for the green transition" [1] (p. 42).

Connecting these two areas, one must conclude that the lack of women in STEM fields is also affecting the education system, namely by the shortage of teachers in such areas in many OECD countries [3]. Another report from UNESCO [4] highlights the importance of exposing children to learning opportunities in science and mathematics from an early age, in order that initial educational experiences have a positive effect on the subsequent choices for science and mathematics courses. On the other hand, UNESCO also highlights how teachers' pedagogical practices are partially shaped by their prejudices, which in turn affect students' values and learning. Too many girls and women are held back by biases, social norms, and expectations influencing the quality of the education they receive and the subjects they study. They are particularly under-represented in science, technology,

engineering, and mathematics (STEM) education, and consequently, in STEM careers [4]. Considering that in Portugal, and in compulsory schooling, it is in the first level of basic education that the percentage of women teachers is higher (87.4% in 2022—PORDATA), this can therefore sharpen the difficulty of STEM education at this level.

We consider that the use of emergency remote education motivated by the COVID-19 pandemic forced teachers to use digital media in a way that would hardly have happened outside this context, constituting an opportunity to build knowledge about digital literacy, pedagogical practices, and gender equality and how they intersect. Therefore, we seek to answer the following research question: How do Portuguese primary teachers understand, and put into practice, digital skills promotion among pupils, namely, boys and girls?

To support the empirical study, this paper presents recent research understandings concerning the digital gender divide concept and pedagogical understandings and practices that promote digital gender equity.

The generalized stereotype concerning the gendered use of digital technologies remains the current landscape, as a literature review, published in 2017 on the subject, reports [5]. In this study, the authors could conclude that males still hold more favorable attitudes toward technology use than females. The studies they analyzed showed that "computer use, computer skills, and computer-related self-concepts are subject to gender differences" (p. 1). When applied to educational environments, the same authors remark that such differences may affect classroom interactions and learning processes. Therefore, they conclude that differences must be carefully considered by teachers who apply computer-supported learning. Another more recent literature review, published in 2023, still identified (a) access and use of technologies, (b) social barriers, and (c) gender stereotypes and roles as the main factors that frame the gendered use of digital technology [6].

Known as digital gender divide, this concept concerns digital access and usage among persons of different genders [7]. When applying the concept to education, this is a critical issue, as it means the difference created by technology widens the gap between students from different genders. Authors as Goudeau et al. [8] linked such a gap with cultural, social, and economic inequalities in education, related with the roles of men and women in societies.

Digital gender gaps can exist in students' access and use of ICT, attitudes toward technology, and digital knowledge and skills. This concept was operationalized in research by considering the access, usage, and outcomes of digital use. "The first issue refers to disparities in access to ICT resources and attitudes toward technology. The second issue describes gender gaps in ICT usage, knowledge, and skills. Finally, the third level refers to gaps in outcomes of ICT use, such as learning or educational achievement" [6] (p. 660). Such features were the focus studied by the International Computer and Information Literacy Study (ICILS) and analyzed by Campos and Scherer [6] in two sets of data in 2013 and 2018, answered by students from eighth grade and coming five regions: Africa, the Arab States, Asia and the Pacific, Europe and North America, and Latin America and the Caribbean. Furthermore, they studied these dimensions in their interconnections. That means that they addressed this gap by directly linking digital gender divides in digital knowledge and skills and attitudes toward technology, after controlling for access to ICT resources. They found that concerning digital knowledge and skills, (a) girls outperform boys; (b) gender differences in attitudes toward technology are partially explained by gender differences in digital knowledge and skills; and (c) the country's socioeconomic development and gender inequality explain the variability within and between countries in the gender gap regarding students' digital skills. To sum up, this particular study changes the point of view of the gender digital divide to be, mainly, determined by socioeconomic features.

A concurrent conclusion was produced by Rodrigues and Biaggi [8] when they found a positive association between disadvantaged students' achievement and the use of ICT for some purposes. Using data from PISA 2015, they reported "that students from low socio-economic backgrounds start using digital devices later in life, have slightly less access to ICT at home and tend to use ICT less intensively" [9] p. 43. A partially similar conclusion

was found in a study with children from 7 to 10 years old in their use of videogames. Researchers concluded that boys self-reported their own digital skills higher than girls did across all socioeconomic categories [10].

A longitudinal study, conducted in Germany with adolescents at ages 15 and 18 and focused on gender differences concerning digital technology (ICT) literacy and digital technology confidence, showed "that gender differences in ICT literacy were negligible at age 15, but small differences in favor of boys emerged at age 18. In contrast, gender differences in ICT confidence favored boys at age 15 but did not change subsequently" [11]. Such differences seem to emphasize the differences between knowledge and skills versus attitude regarding digital technology, which seems to be more social, and driven by stereotypes.

Such an understanding seems to be the trend for the digital gender divide. It emerges from gender–technology and power–knowledge relations.

The second approach that frames this paper concerns teachers' and schools' work related with digital gender equity promotion.

From previous statements, one can infer that schools have made a qualitative difference on the digital literacy level attained by their students, both boys and girls. However, schools still reproduce and reiterate gender stereotypes. This statement is not arising due to the numbers of children (boys and girls) using technology in the school system. This statement comes from opportunities for equal distribution of power among boys and girls in the school system [12].

The questions remaining are as follows:

- How early should this work on digital gender equity promotion begin at schools, both regarding access and use?
- How do teachers' pedagogical work contribute to closing the gap of the digital gender divide?

Exploiting the potential of digital technologies for learning and teaching and developing digital skills for all, with education and training as the keys for personal achievement, social cohesion, economic growth, and innovation, seems to be a vital element in building a fairer and more sustainable society [4]. Therefore, strengthening digital skills and skills for digital transformation, including computer teaching, from the earliest years of schooling, is a means of enabling young people to gain good dominance in the digital world, and to foster interest in studies and careers in science, technology, engineering, and mathematics (STEM) [4].

Such a goal drives the Gender@ICT' project which was committed to revealing how gender stereotypes are deep-rooted amongst young people, in a time of their lives when they need to make academic choices that lead to professional careers [13]. The authors analyzed how gender relations have materialized in technology and how gendered identities and discourses are produced simultaneously with technologies. "Class activities (games with words and pictures) with pre-school and first cycle children, aged from four to 9/10 years old, will explore their representations of stereotypical gender-related activities and behaviors" (p. 477).

Among pedagogical practices that promote gender equality, the authors explored the ideas and experiences concerning ICT of teachers in their relationships with girls and boys. They found that these teachers have privileged insights into the digital practices of students. Furthermore, the semi-structured interviews they conducted with teachers also contributed to identifying educational practices that promote gender equity [13].

From the ideas presented, it is possible to establish that digital literacy is acquired more easily through pedagogical practices, especially at younger ages, than through the formal teaching of these literacies. Also, more so than from political discourses promoting gender equality, boys and girls develop a sense of gender equality if they are also treated with equity by the pedagogical practices in which they are involved. These are key features of the project that this paper describes.

Concerning the goals of this paper, we aim to answer the following research questions:

- How do teachers' digital skills contribute to shaping their pedagogical work related to gender equity promotion?
- How do teachers' attitudes concerning the digital divide contribute to shaping their pedagogical work?
- How do teachers' pedagogical work contribute to closing the gap of the digital gender divide?

2. Materials and Methods

To answer the research questions, this research focused on the first level of primary education teachers (pupils aging 6 to 10) (first CEB), as they are those who can make a difference concerning digital skills among pupils, thus contributing to diminishing the gender gap. Considering the Portuguese population of the first level of primary education teachers, which was 22,182 in 2020 (Instituto Nacional de Estatística—National Statistical Institute), we aimed to reach at least 15%, following a cluster sample process. To do so, schools and their directors were the path to reach these teachers. An online questionnaire survey (see the Supplementary Materials) was carried out with teachers from April to June of 2022, which obtained 3871 valid responses, representing 17.5% of the population.

The questionnaire was organized in three sections. The first section (S1—questionnaire) was a Lickert scale to measure "gender equality in digital skills awareness" (GEDSA), which comprises three subscales: (1) teachers' digital knowledge; (2) their actions by using digital tools in the classroom; and (3) their perceptions regarding gender differences concerning students' digital skills. The second section (S2—questionnaire) regarded the support teachers give to gender equality promotion and had a descriptive approach with closed questions aiming to organize teachers' answers in trends that frame teachers' practices regarding GEDSA. The third section (S3—questionnaire), designed to collect data concerning the personal and professional information of teachers, allowed for the characterization of the sample in terms of clusters which were used as independent variables. It combined closed questions with others with predefined answers.

The first and second sections of the questionnaire follow the general idea that it was necessary to capture the perceptions as well as the practices of teachers. Such an idea is related to the reported difference between in-service teachers' abilities to use digital technologies for instructional planning or as a teaching resource and their competence in guiding student-centered activities or developing students' skills [14].

Under the contract signed with the La Caixa Foundation, data collection was carried out by the company EdThink, in close collaboration with the research team. The data collection process began on 14 March 2022 and ended on 30 June after authorization was granted by the Directorate-General for Education to administer the questionnaire, under Order No. 15847/2007, of 23 July. All ethical standards associated with this type of study were complied with, in particular those relating to informed consent, guarantee of anonymity, and data protection.

Contact with the final recipients of the questionnaire—primary school teachers—was made through the principals of each school in the target population, whose email addresses are public. Principals were asked to forward the link to access the questionnaire, which was made available in electronic format, to primary school teachers at their schools.

We used Statistical Package for the Social Sciences (version 26) for the statistical analysis of data.

A descriptive analysis of the sample characterization data was carried out, for which absolute and relative frequency analyses were performed, as shown in Tables 1–3.

The validation of the Likert scale in Section 1 of the questionnaire allowed for the calculation of five new variables, four corresponding to each of the factors (Digital Competence—Easy, Digital Competence—Difficult, Digital Competence—Class, Gender Equality—Class), the procedure for which is not described in this work. For the purposes of the data treated in this paper, inferential analyses were carried out based on the cross-analysis of these new variables with the characterization data. For this purpose, statistical

regressions were performed, using the *t*-student test. All differences are significant at $p < 0.05$.

3. Results

This section presents the study findings.

In Portugal, and in the 2018/19 academic year, there were 26.131 teachers in primary education (6–10 years old)—(1CEB) (EDUSTAT, n.d.). Of these, 23,313 (89.2%) worked in public establishments and constituted the study population. The majority of teachers in public primary education were female (86.6%; 20.187), with 3126 (13.4%) being male. Regarding age, the majority (17.891 teachers; 76.7%) were between 40 and 59 years old, with 10.011 (42.9%) aged between 40 and 49 years old, 2891 (12.4%) under 40 years old, and 2531 (10.9%) over 59 years old (see Table 1). Regarding their academic qualifications, 84.0% (19.585) had a bachelor's degree, 7.6% had a master's or doctorate (1774), 6.2% had a bachelor's degree (1457), and 2.1% (497) had other qualifications (see Table 1) (EDUSTAT, n.d.).

Table 1. Sample characterization.

		Sample		Population (DGEEC 2019/2020)	
		Teachers N	Teachers %	Teachers N	Teachers %
SOCIODEMOGRAPHIC FEATURES OF TEACHERS					
Sex	Female	3432	88.7%	20,187	86.6%
	Male	439	11.3%	3126	13.4%
	Total	3871	100%/17.5%	23,313	100%
Age	Less than 40 years old	245	6.3%	2891	12.4%
	40 to 49 years old	1921	49.6%	10,011	42.9%
	50 to 59 years old	1277	33.0%	7880	33.8%
	60 years old or more	428	11.1%	2531	10.9%
	Bachelor's or other	542	14.0%	1954	8.3%
Academic qualifications	Graduation	2857	73.8%	19,585	84%
	Master's or PhD	472	12.2%	1774	7.6%
TERRITORIAL CHARACTERISTICS OF TEACHERS' SCHOOL GROUPS					
Geographic region	Alentejo	434	11.2%	1985	8.56%
	Algarve	193	5.0%	1196	5.16%
	Lisboa Area	995	25.7%	6094	26.3%
	Center Region	979	25.3%	5424	23.4%
	Northern Region	1270	32.8%	8483	36.6%
	PIET—Priority Intervention Educational Territories	650	16.8%	4312	19%
Other features	Rural Territories	911	23.5%	5206	22%
	Schools with Science Clubs	886	22.9%	5369	24.2%
	Schools with Innovation Plans	588	15.2%	2784	12.6%

In the 2019/20 academic year (DGEEC, n.d.), and considering NUTS II, the North was the region with the most teachers (36.6%; 8483 teachers), followed by the Lisbon Metropolitan Area (26.3%; 6094 teachers) and the Center (23.4%; 5424 teachers). Only 13.7% of Portugal's teachers work in Alentejo and Algarve (8.56% and 5.16%, respectively); 41.7% work in the Lisbon and Porto metropolitan areas. Regarding the rural/urban and coastal/inland axes, the classification of municipalities established in the Law was adopted (Ordinance No. 208/2017 of 13 July, which considers population density, demographics, settlement, physical characteristics of the territory, socioeconomic characteristics, and accessibility). Most teachers (77.5%; 17.976 teachers) teach in schools located in municipalities that are not considered inland territories. The fact that groups of schools/non-grouped schools in which teachers work are covered by the Priority Intervention Educational Territories Program (TEIP) 4 was also taken into consideration, since these are "economically and socially disadvantaged territories, marked by poverty and social exclusion, where violence,

indiscipline, abandonment and school failure are most prevalent" (Directorate-General for Education, n.d., par. 1). Most teachers (81.4%; 18.870 teachers) teach in schools in clusters that are not considered TEIP (see Table 1). TEIP clusters/non-clustered schools are represented in practically the same proportion in inland and non-inland territories (18.1% and 18.7%, respectively).

Regarding the existence of science clubs in the schools where the sampled teachers teach, and whether they had an innovation plan, observation of Table 1 shows that most teachers in the study population worked in schools without science clubs (77.1%; 2985 teachers) and without an innovation plan (84.8%; 3283 teachers). In terms of AEs in the sample, 78% (491 AEs) do not have science clubs and 88% (550 AEs) do not have an innovation plan.

The study sample consists of 3871 teachers from public primary education, representing approximately 17.5% of the population. The sampling technique is stratified, so the sample is made up of the same proportion as the population, considering sociodemographic and territorial variables. The sociodemographic variables are as follows: sex, age group, and academic qualifications (see Table 1). The analysis of Table 1 allows us to conclude that, for the sample to be representative of the population, the stratification must ensure that it is mostly female (88%), aged between 40 and 59 years (82%), and with a degree (73.8%). Additionally, and in order to analyze the influence of these variables on the dependent variable, it is necessary for it to include the subgroups corresponding to the minority strata, namely male participants, those under 40 years of age and those aged 60 or over, and those with academic qualifications other than a degree. This condition was verified.

The analysis of how teachers acquired their digital skills revealed the importance of attending certified courses (82%) and self-learning (79.5%). Help from colleagues, friends, and family is also referred to by 60.7% of the sample. Teachers acquired their digital skills from several ways and the majority (63.3%) consider such skills sufficient (Table 2).

Table 2. Teachers' digital competences.

	Modes of Acquisition	N	%
Acquisition	Certified training courses	3176	**82.0%**
	Uncertified training courses	1341	34.6%
	With colleagues, friends and family	2348	60.7%
	Self learning—learning by doing	3076	79.5%
Acquisition diversity	Only one of the previous	541	14.0%
	Two of the previous	1213	31.3%
	Three of the previous	1494	**38.6%**
	All the previous	623	16.1%
Sufficiency of training	Very insufficient	126	3.3%
	Insufficient	724	18.7%
	Sufficient	2451	**63.3%**
	More than sufficient	570	14.7%

Almost all teachers have a computer in their classrooms (88.5%) and the vast majority have access to the internet in these workspaces with students (73%). Around half of the respondents have an interactive whiteboard and/or a video projector (58%), and their schools also provide a computer or tablet for students to work on (48%). Around one-third have IT support at school that they can use and 23% have a computer room.

As a result of these descriptions, teachers' appraisal of their schools ICT resources and technological infrastructure is mainly sufficient (44.8%) and insufficient (35%) (Table 3).

Table 3. Infrastructures and computer equipment of teachers' schools.

Infrastructure and IT Resources Available		N	%
Infrastructure and IT resources available	Computers/tablets for pupils in the classroom	1863	48.1%
	Computer room that can be used for teaching	899	23.2%
	Computer for the teacher to use in class	3427	**88.5%**
	Widespread internet access (Wi-Fi) in the classroom	2825	73.0%
	Interactive whiteboard/video projector	2254	58.2%
	Technical support	1312	33.9%
	Missing answer	87	2.2%
Sufficiency of IT infrastructure and digital equipment	Very insufficient	450	11.6%
	Insufficient	1378	35.6%
	Sufficient	1734	**44.8%**
	More than sufficient	222	5.7%
	Missing answer	87	2.2%

Moving to what drives teachers' practices and believes, it was found that most teachers understood digital skills development in the classroom to be very important (62.9%) or important (33.4%) (Table 4).

Table 4. Digital skills of students: boys and girls.

Importance Levels of Digital Skills Development		N	%
Importance of digital skills development in the classroom	Not important	5	0.1%
	A little important	80	2.1%
	Important	1291	33.4%
	Very important	2434	**62.9%**
	Missing answer	61	1.6%

Reporting on the results obtained in the first block of the questionnaire, it is possible to see that, in general, teachers consider that they have mastered the digital skills essential to teaching and that they use them, above all, to increase student participation and to individualize the teaching tasks that they plan for their classes. The uses of these digital resources to increase student motivation to carry out formative assessment and to create digital resources were the items that received the least agreement from the respondents (Figure 1).

Regarding the use that teachers make of digital resources in their classrooms, it was found that the use of internet research receives more agreement than the use of digital devices for students to carry out production tasks. Looking at it from the perspective of differentiation, most teachers agree that the use of digital devices is not equally appealing to everyone.

Figure 2 aggregates the teachers' responses to the items associated with the distinction of digital skills between boys and girls, and the pedagogical differentiation that is necessary in general and that which is necessary because of gender. Most teachers do not consider that there are gender differences associated with the use of digital technologies, as demonstrated by male and female students, although they believe that there is a reason for pedagogical differentiation based on the interests and motivations or difficulties of the students. The response given to the last two items in the figure is surprising, since the only difference in their formulation lay in the explicit reference to boys and girls (Figure 2). Teachers agree that there may be differences in the ways in which boys and girls carry out the activities they ask their students to do. Putting this in other words, one may say that teachers recognize the differences of interests among pupils (what is usually understood as differences of motivations), but when asked about what motivates boys and girls, differently, they do not score equally.

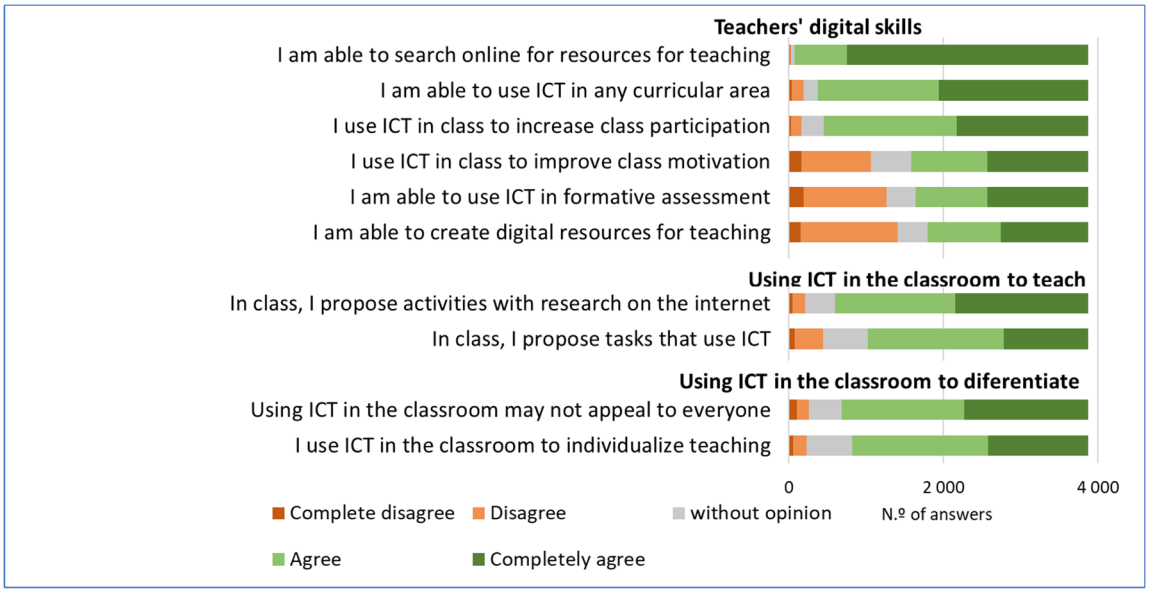

Figure 1. Teachers' perceptions regarding their digital skills and their ICT uses to teach and to differentiate. Scores emerge from a Lickert scale—first part of questionnaire; and bars represent the distribution of teachers' answers.

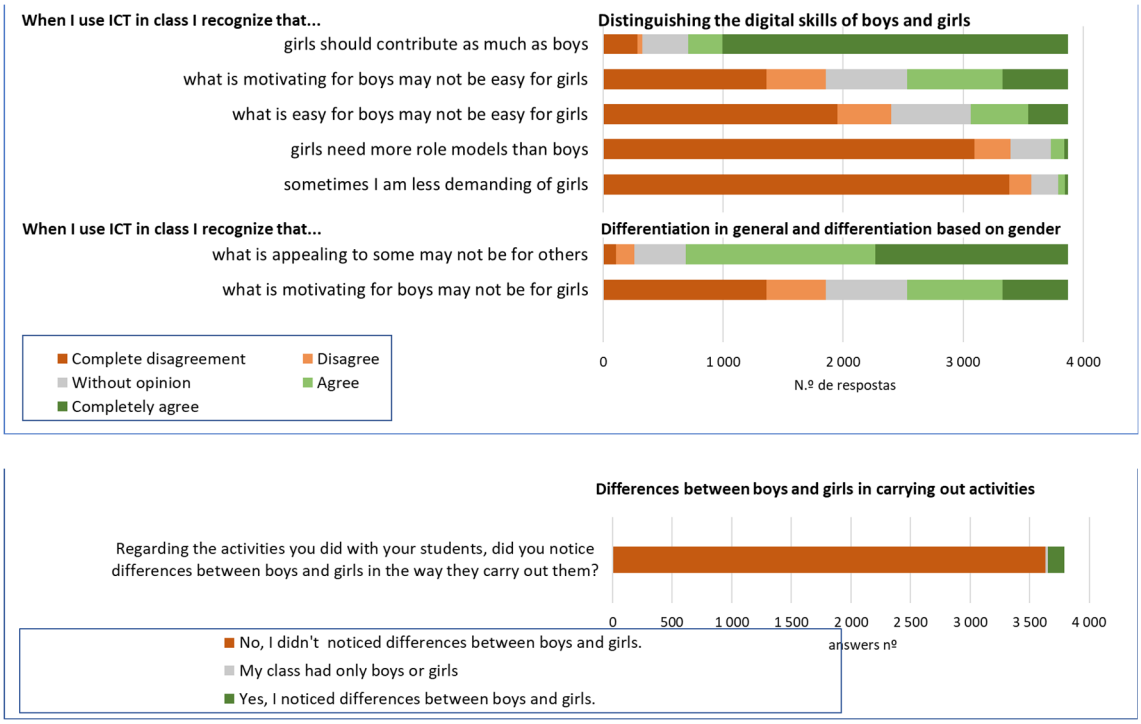

Figure 2. Teachers' perceptions regarding their practices concerning the digital gender divide. Scores emerge from a Lickert scale—first part of questionnaire; and bars represent the distribution of teachers' answers.

In order to validate the scale contained in part 1 of the questionnaire, an exploratory factor analysis was carried out on all the items contained therein. As a result of this analysis, four factors were created that were associated with the digital skills that teachers have a good command of and that are fundamental and recurrent in their teaching (Factor CP+). There is then a second factor that is associated with the skills that teachers have no difficulty in mastering, particularly for pedagogical purposes (Factor CP-). The third

factor corresponds to the items associated with the practices that teachers try out in the classroom and invite students to carry out (Factor EX+). Finally, the last factor (Factor IG+) included the items associated with the recognition of gender differences in the use of digital resources. Figure 3 highlights the comparative dimension of the factors and the dimension of the dispersion of responses for each one. From a general view, one can state that teachers feel their digital skills to teach are better than their effective exercise in the classroom with their pupils. Also, teachers mainly disagree on gender differences concerning the use of digital skills. As the figure shows, there is no difference among male and female teachers regarding the three factors CP*; EX+ or IG+. Only regarding factors that measure difficulties concerning digital skills did male teachers reveal fewer difficulties than female teachers, and the difference is meaningful. In the sequence of this text, these factors are used as independent variables to answer the research question of the study.

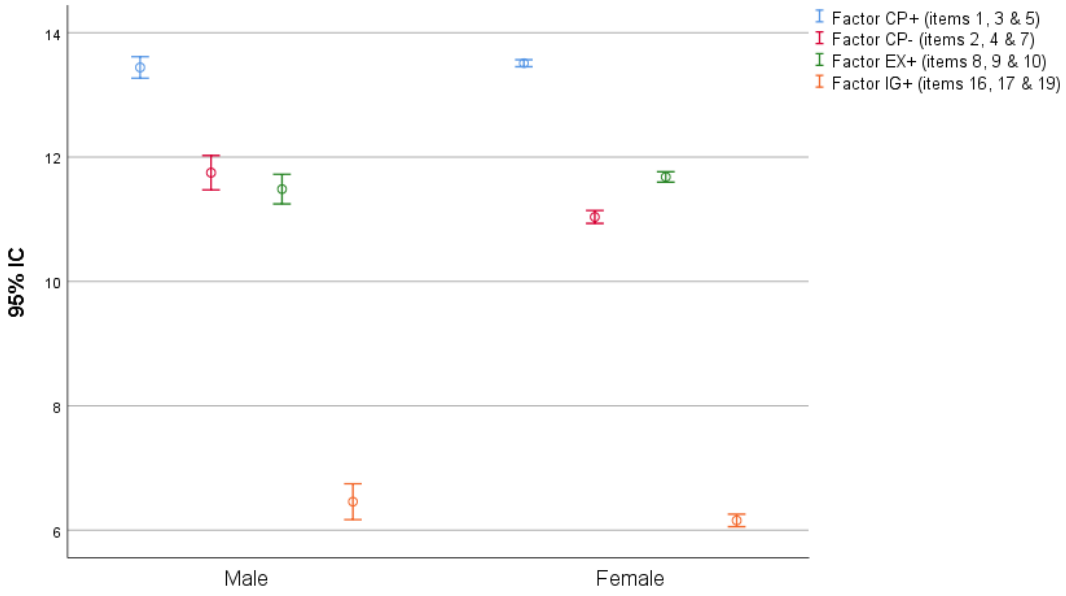

Figure 3. Clusters that emerge from teachers' perceptions concerning their digital skills, their ICT uses to teach and to differentiate, and also their gender. Graphics represent the distribution of teachers' answers in such factors that result from factor analysis accordingly with their own gender.

The second part of the questionnaire asked about the effective pedagogical practices that inform teachers' use of digital technology, in a dual dimension of questioning their use and assessing their effectiveness. Figure 4 illustrates this comparative dimension. Such pedagogical practices, aligned with digital technology, could be read following two main orientations: the first one emphasizes the nature of the task itself being more assessment oriented; the second one is more framed by learning differentiation.

The results show that teachers give more importance to using the digital as a tool to learn rather than to perform assessments.

Looking now at the activities that teachers implemented in their classrooms using digital technology, one must state that such activities are related with the work performed by pupils inside the classroom or performed by them to use in the classroom. The results show that searching on the internet, using a word processor, and creating a multimedia presentation are the three most frequently mentioned practices (Figure 5). On the other hand, activities that use artificial intelligence or involve programming are mentioned less frequently and were mentioned only by a limited number of teachers.

In the questionnaire, after the question about the activities carried out, the teacher was asked whether he or she had noticed any differences between boys and girls in the ways they carried out the activities indicated. As previously shown, most teachers responded

negatively. Only 173 said they had noticed any differences. The responses of these 173 teachers are shown in Figure 6.

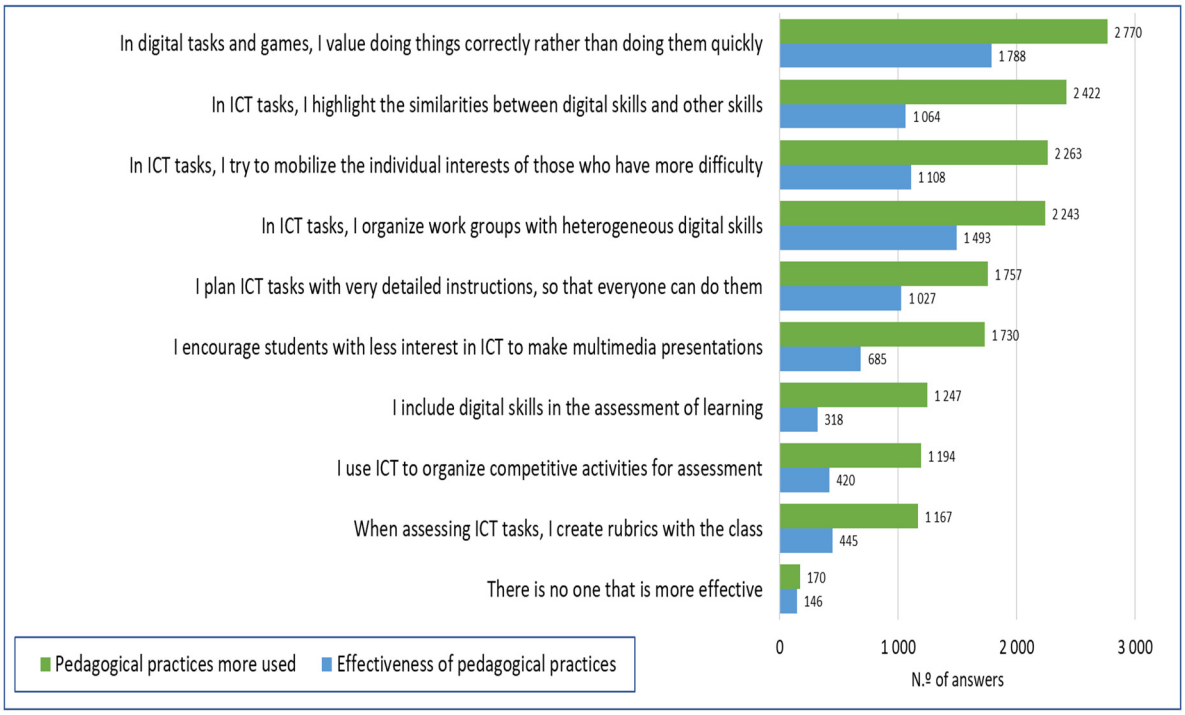

Figure 4. Use and effectiveness of pedagogical and digital practices. Numbers correspond to the number of teachers.

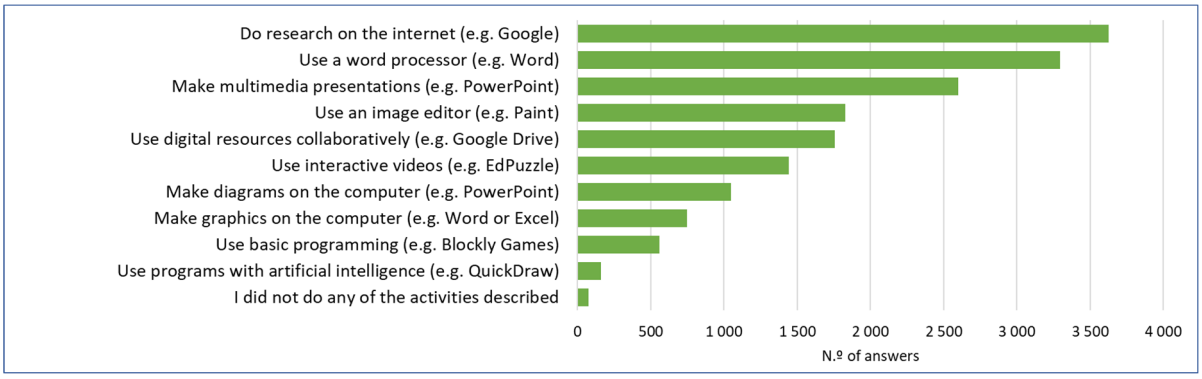

Figure 5. Learning activities proposed to pupils involving digital resources. Numbers correspond to the number of teachers that reported such activities.

The ordered list of activities is very similar to the previous set regarding the frequency of their use by almost the entire sample: internet searches, use of word processing, and production of presentations are the activities most mentioned by the 173 teachers as those in which they notice the greatest differences between boys and girls. However, in this case, the coincidence of the trend may simply be the result of these also being the most implemented activities.

The results presented up to this point characterize the sample and characterize the trends of the responding teachers regarding their perceptions and practices, including those related to the differences between boys and girls. It is important to note that 37 of these 173 teachers said that activities did not favor boys. The survey did not ask how many of these activities favor girls because of their interests or their performance. This result could be biased, because of such a lack.

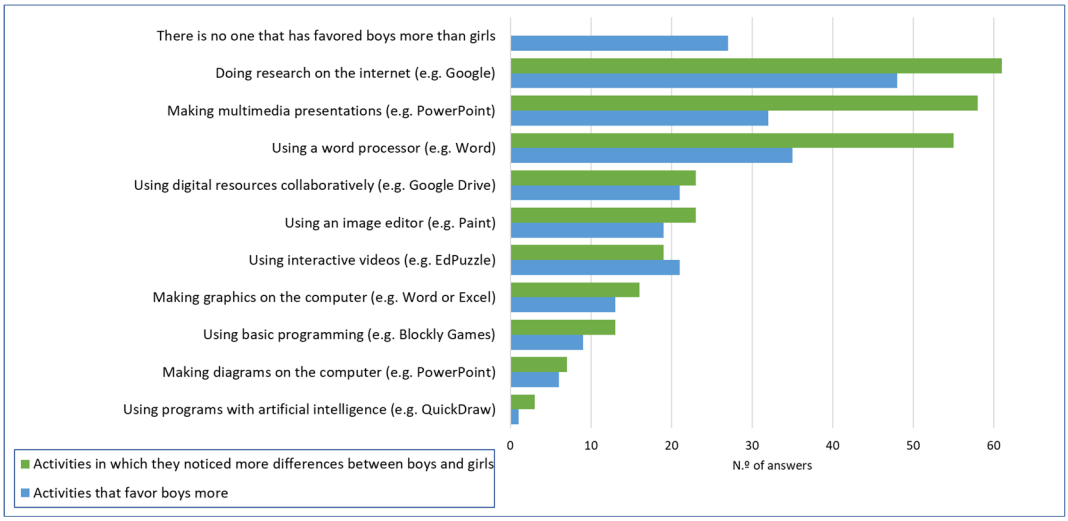

Figure 6. Activities in which teachers notice differences between boys and girls. Numbers correspond to the number of teachers that reported such activities.

However, in order to answer the research question that guided this work, it is still necessary to relate the personal and professional characteristics of the teachers with their perceptions and practices regarding the uses of digital technology, namely, to promote gender equity.

To achieve such a goal, an inferential analysis concerning some personal and contextual independent variables was performed. Its results are presented in the following paragraphs. For the analysis accomplishment, sub-samples were not randomized in cases where numerical differences were greater than 1.5. Also, one must note that all differences were significant at $p < 0.05$.

Results are presented organized into three main groups of independent variables: those regarding training and technological infrastructure; another set by teachers' personal features; and the last group from the level and intensity of practice.

A—How do teachers' appraisal of their ICT training, the technological infrastructure of their schools, and the digital skills development of their students explain their perceptions and practices in the development of students' digital skills?

(a) There are differences between teachers who considered that they had sufficient training (3021) and those who considered that the training provided was insufficient (850). Teachers who considered their training sufficient or very sufficient showed higher values in the CP+ Cp- and EX factors, relating to mastery of digital skills: easy control of difficulties and effective exercise in the classroom of activities that use digital technology. There are no differences between teachers relating their training to their awareness of gender equity concerning digital issues.

(b) There are differences between teachers who assess the technological infrastructure of their schools as insufficient (positions 1 and 2 of the codification) (1828), as opposed to those who assess them as sufficient (positions 3 and 4 of the codification) (1956). This means that teachers who consider the digital resources of their school to be sufficient also value more the factor EX+, which concerns the effective implementation of activities in the classroom that use digital technology. There are no differences between teachers relating their appraisal of digital infrastructures at schools to their awareness of gender equity concerning digital issues.

(c) There are differences between teachers who assess the development of digital skills in the first CEB as very important (positions 4 of the codification) (1376), as opposed to those who assess it as not very important or only a little important (positions 1, 2, 3 of the codification) (2423) (Table 5). Those teachers who consider pupils' digital skills to be very important also evidence more digital skills themselves and effectively

promote more digital practices in the classroom. These teachers also show a greater concern for gender equity in their pedagogical practices.

Table 5. Statistical analysis concerning the importance given by teachers to digital skills development among pupils.

Appraisal of Developing Digital Skills Among Pupils in the 1st CEB						
	Levels of Apraisal	**N**	**Mean**	**Standard Deviation**	**t Value**	***p* Value**
Factor CP+ (items 1, 3 & 5)	>=4	2434	13.77	0.031	13.268	0.000
	<4	1376	13.04	0.050		
Factor CP− (items 2, 4 & 7)	>=4	2434	11.52	0.062	11.245	0.000
	<4	1376	10.37	0.082		
Factor EX+ (items 8, 9 & 10)	>=4	2434	12.18	0.047	17.647	0.000
	<4	1376	10.75	0.067		
Fator IG+ (items 16, 17 & 19)	>=4	2434	6.06	0.061	−3.371	0.001
	<4	1376	6.40	0.080		

B—How do teachers' personal characteristics explain their perceptions and practices in the development of students' digital skills?

(a) Teachers who have worked for 25 years or more (1825), and those who are more (1705) than 50 years old, value their skills, their competence to challenge difficulties, and their competence to improve differentiation practices more highly than those who have worked for less time (2046), as well as teachers who are younger (2166) (Table 6). These two variables (age and time worked) which are concurrent are also important for explaining differences regarding the gender factor. The younger teachers and those who have worked for less time show more awareness of gender equity concerning digital issues.

(b) Concerning teachers' gender, the men (439) give more importance to their capacity to face difficulties than women (3432). Also, men give more value to the IG factor, composed of items associated with the recognition of gender differences in the use of digital resources (Table 7).

Table 6. Statistical analysis concerning teaching time worked.

	Working Time	**N**	**Mean**	**Standard Deviation**	**t Value**	***p* Value**
Factor CP+ (items 1, 3 & 5)	>=25	1825	13.31	0.041	−6.896	0.000
	<25	2046	13.68	0.036		
Factor CP− (items 2, 4 & 7)	>=25	1825	10.63	0.073	−9.464	0.000
	<25	2046	11.56	0.066		
Factor EX+ (items 8, 9 & 10)	>=25	1825	11.73	0.057	1.773	0.076
	<25	2046	11.59	0.056		
Fator IG+ (items 16, 17 & 19)	>=25	1825	5.94	0.069	−4.996	0.000
	<25	2046	6.42	0.067		

Table 7. Statistical analysis concerning teachers' gender.

	Gender	**N**	**Mean**	**Standard Deviation**	**t Value**	***p* Value**
Factor CP+ (items 1, 3 & 5)	Male	439	13.44	0.088	−0.797	0.426
	Female	3432	13.51	0.029		
Factor CP− (items 2, 4 & 7)	Male	439	11.75	0.141	4.560	0.000
	Female	3432	11.04	0.052		
Factor EX+ (items 8, 9 & 10)	Male	439	11.49	0.121	−1.547	0.122
	Female	3432	11.68	0.042		
Fator IG+ (items 16, 17 & 19)	Male	439	6.46	0.147	1.983	0.047
	Female	3432	6.16	0.051		

Adding other results from differences related to activities used in the classroom that utilized digital devices, it was possible to confirm that male teachers use digital activities more often and more diversely with pupils in the classroom (Table 8). In fact, even in quite common digital activities like using a word processor or making a multimedia presentation, male teachers, more than female teachers, promote the use of such devices and resources in the classroom.

Table 8. Statistical analysis concerning teachers' gender differences related to digital activities.

Activities Promoted with Pupils in the Classroom	Gender	N	Mean	Standard Deviation	t Value	*p* Value
Using a word processor (ex, word)	Male	439	0.89	0.318	2.212	0.027
	Female	3432	0.85	0.361		
Doing multimedia presentations	Male	439	0.72	0.450	2.271	0.023
	Female	3432	0.67	0.472		
Using an image editor	Male	439	0.56	0.497	3.821	0.000
	Female	3432	0.46	0.499		
Doing graphs on computer	Male	439	0.32	0.466	6.996	0.000
	Female	3432	0.18	0.382		
Using basic programmation	Male	439	0.20	0.399	3.351	0.001
	Female	3432	0.14	0.345		

D—How do teachers' practices using digital technologies explain their perceptions and practices in the development of students' digital skills?

(a) Teachers who performed a higher number of pedagogical activities (four or more activities) (n = 2667) evidence higher scores in the CP+ Cp- and EX+ factors, related to the mastery of digital skills, easy control of difficulties, and effective exercise in the classroom of activities that use digital technology, when compared with those who performed fewer such activities (1204).

A similar result was obtained among teachers who performed more (2557) diverse activities (four or more different activities) using digital technologies when compared with those who performed fewer activities (1314) (Table 9).

Table 9. Statistical analysis concerning variables among teachers' practices.

Quantity of Activities Developed Using Digital Resources						
	Activities n	N	Mean	Standard Deviation	t Value	*p* Value
Factor CP+ (items 1, 3 & 5)	>=4	2557	13.77	0.029	14.210	0.000
	<4	1314	12.98	0.054		
Factor CP− (items 2, 4 & 7)	>=4	2557	11.57	0.059	13.108	0.000
	<4	1314	10.23	0.087		
Factor EX+ (items 8, 9 & 10)	>=4	2557	12.23	0.044	20.868	0.000
	<4	1314	10.55	0.072		
Fator IG+ (items 16, 17 & 19)	>=4	2557	6.11	0.059	−2.171	0.030
	<4	1314	6.34	0.083		

4. Discussion

How do Portuguese primary teachers understand, and put into practice, digital skills promotion among pupils, namely, boys and girls?

From previous reported findings, one may highlight the following key issues:

1. Teachers perceive themselves as digitally competent to develop the essentials of their teaching tasks. This result is expected due to two concurrent phenomena: the influence of Dig Comp—The Digital Competence Framework for Citizens (Dig Comp, Brussels, Belgium) [15] that provides a common understanding of what digital competence is. Additionally, since 2018, in Portugal, such framework was responsible for a changing

paradigm concerning the development of digital competences among teachers [16]. Also, due to the COVID-19 pandemic lock down, teachers were forced to develop their digital skills to an unimaginable level, in order to deal with the circumstances [17].

2. Most teachers from the sample have already carried out a diverse set of pedagogical practices and activities using digital resources. Again, this result was expected, like the previous one, namely due to the training teachers received. This result is positively correlated with the self-perception of teachers concerning the quality and effectiveness of their training, also reported in this study.

3. Another finding correlates personal perceptions concerning the importance given to digital competences, to be developed among pupils, and the level of teachers' practices. Also, such an issue seems to be also correlated with the digital resources available at schools and the quality of training teachers receive. Such an interconnection illustrates the present explanation by Scherer et al. [18] regarding the understanding of teachers' professional access and use of ICT, attitudes toward technology, and digital knowledge and skills. Such an interconnection appears to be a fruitful approach to explain differences among teachers.

4. The number and the diversity of effective digital pedagogical practices explain differences among teachers' perceptions regarding their digital skills and their perceived competence to implement differentiated pedagogical practices. This is a result that could be explained by the relevance of practice in the way teachers learn by doing. In such an explanation, the same reasoning is adopted as that presented by Bachmann and Hertweck [2] to talk about the gender gap from upper secondary education onwards. They document that teenagers' access to digital devices is associated with higher digital skills, and we do the same for teachers. As it was reported, also, teachers who perform more activities in the classroom using digital technology show a greater concern for gender equity in their pedagogical practices. Again, this issue could be explained by the relevance of the practice factor [18].

Looking to the implemented digital practices and pedagogical principles, the study findings reveal that teachers give more importance to using the digital as a tool to teach and to learn, namely, to promote differentiated teaching and learning, rather than to performing assessments.

Furthermore, it was found that male teachers rather than female teachers give more importance to their capacity to face difficulties related with pedagogical digital uses. Such a conclusion frames the gender digital divide among teachers from the sample in accessing the digital educational ecosystem. In addition, it is possible to identify the lack of some of the factors pointed out by Peláez-Sánchez et al. [6] concerning the digital inclusion of women, namely, the mode of technology-mediated teaching and learning, and digital competencies in the workplace.

Additionally, we also found that age (and time worked) also explains differences among teachers' digital skills, which is expected. However, it was also found that the same variables explain different levels of awareness of gender equity concerning digital issues. Searching for an explanation for that finding, it is possible to refer to the digital competency of younger teachers, but also to the educational history lived by older teachers. Educated in dictatorship times when gender was objectively a reason to discriminate against girls in their access to education, these teachers react by stating that universal access is a goal.

5. The overwhelming majority of teachers did not find differences between the uses that boys and girls make of digital technology. Therefore, they do not act in a way to promote digital skills differently among girls. However, they seem to be worried about differences among students and said that they work to reach all students in spite of any differences. The possible explanation for such a result could be partially based on the fact that teachers do not distinguish digital access, quality level of digital use made by students, and quality achievement concerning the digital skills attained by boys and those attained by girls. Such an explanation is corroborated by the other finding of this study: that male teachers perform more digital activities than female teachers (digital competencies in the workplace [18]) and activities that include the effective use of digital technology are

more recognized as being more effective among boys. It means that in addition to these statements, female teachers effectively use digital resources in the classroom less often and with less variety. The small group of teachers who recognize differences between boys and girls (n = 173) still use activities most frequently perceived as favoring boys. Thus, even these teachers do not contribute to gender equality in terms of digital skills. It seems to be one of the reasons that justifies the emerging concept of professional digital competence [19].

5. Conclusions

As a conclusion, we argue that a teacher looks to his/her job concerning digital skills promotion and allowing access, which they provide equally to all—boys and girls. However, the digital gender divide must not be treated only regarding digital access, but also regarding effective use and effective achievement. Therefore, our recommendations are as follows:

1—Increase effective training on digital pedagogical uses for teachers emphasizing the need for improving activities in classrooms led by teachers who are women.

2—Identify and differentiate effective indicators of digital access, digital effective uses, and the digital impact or achievement goals that could drive teachers' practices and training.

This study has limitations due to two types of reasons. The first relates to the instrument, as the survey did not ask how many of the digital activities implemented by teachers favor girls. The second order of reasons relates to the small number of respondents that did not recognize differences between boys and girls in their use of digital technology.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/digital4030036/s1, Instruments: Questionnaire description.

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