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INDICATORS OF KNOWLEDGE, USEFULNESS, AND USE OF ICT AMONG PRIMARY SCHOOLTEACHERS

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Abstract

This paper presents a study on the perceptions of primary school teachers regarding their knowledge, usefulness, and use of Information and Communication Technologies (ICT) in education. Likewise, the relationship between sex, age, working time and the educational center in which it is found with the perceptions about ICT is obtained. To answer these questions, a battery of 14 categorical closed questions is designed, divided into four blocks: socio-demographic information; knowledge of ICT; usefulness of ICT; and use of ICT. In the context of measuring the knowledge, usefulness and use of ICT in education, the novelty of this work relies on the design of an indicator for each of the ICT-related blocks following the methodology of Human Development Indicators created by the United Nations Development Program. In this research, 119 teachers from Spanish primary schools were chosen as the study sample to answer the questions' battery. The results show a direct relationship between knowledge, usefulness, and use, although not significant. Although teachers are aware of the usefulness of ICT, and the Covid-19 pandemic has increased the use of technological tools for planning teaching in blended or distance learning lessons, this does not mean teachers have a greater knowledge of ICT. In addition, the findings indicate a greater knowledge by teachers in public schools, which contrasts with the finding that teachers in grant-assisted schools make the most use of ICT and find it the most useful. Finally, it is also suggested that the study's methodology and approach could be applied to other contexts or countries.

Keywords – Schoolteachers, Primary education, Knowledge, Indicators, ICT.

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1. Introduction

The use of Information and Communication Technologies (from now on ICTs or ICT in singular) has focused the attention of educators, researchers, and managers over the last 25 years (Bartolomé & Gallego, 2019; Sanz & López-Iñesta, 2022). Authors such as Bakar, Maat and Rosli (2020) defend the importance of incorporating ICTs in the classroom since they improve cognitive development, skills acquisition, and information processing through educational experiences and activities. UNESCO (2022) supports the use of digital innovation in the education area because it improves the relevance and quality of learning, builds ICT-enhanced lifelong learning pathways, strengthens education and learning management systems, and monitors learning processes. Definitively, considers that digital technology has

become a social necessity to ensure education as a basic human right, especially in a world experiencing more frequent crises and conflicts.

However, the incorporation of ICTs into the teaching-learning process does not only consist of having access to technology, but schools require classroom preparation (Rasheed, Kamsin & Abdullah, 2020; UNESCO, 2022) and effective training for teachers in the use and teaching of ICTs (Baran, Bilici, Sari & Tondeur, 2019; UNESCO, 2022). In this scenario, teachers are required to plan and develop appropriate materials and activities to use ICTs. Pierce and Ball (2009) and Drijvers (2015) highlight, teachers' practices and experiences, as well as their opinions and beliefs, are important factors that explain why ICTs work or why they did not. Lawrence and Tar (2018) create an adoption and integration of ICT model based on the diffusion of innovation theory (Rogers, 1995) and the Technology Acceptance Model (TAM) (Davis, 1989). This model includes factors related with a) teacher-level: teachers' ICT knowledge; b) technological-level: compatibility, benefit of using ICT, perceived usefulness of ICT and perceived ease of use of ICT; and c) institutional-level: leadership support and resources. Other authors as Area-Moreira, Hernández-Rivero and Sosa-Alonso (2016, 2019) or Garzón, Sola, Ortega, Marín and Gómez (2020) determine that the factors related with the integration of the ICT in the classrooms are related with the personal and professional teacher characteristics: gender, years of experience, educational stage, digital competence and degree of use of ICT in their daily lives.

The Covid-19 pandemic was a turning point in the use of ICT in the educational field. The teaching staff used all the technological tools at their disposal to plan the lessons and facilitate learning in blended or distance classes. The increase in the use of learning management systems, virtual tutors, and other tools such as Moodle, Socrative, and Kahoot (Sanz, López-Iñesta, Garcia-Costa & Grimaldo, 2020; López-Iñesta & Sanz, 2021), highlighted unresolved issues since pre-pandemic times, such as the lack of technological infrastructure, teacher training, or the digital transformation of educational resources (Area-Moreira et al., 2019; Area-Moreira, Rodríguez-Rodríguez, Peirats-Chacón & Santana-Bonilla, 2023; Tejedor-Tejedor & García-Valcárcel, 2006).

After the closure of schools due to Covid-19, Giannini (2020), UNESCO Assistant Director General for Education, stated that educational systems were no longer capable of guaranteeing inclusion, equipping students with the necessary skills for the 21st century and ensuring equitable treatment of teaching teams, without a correct implementation of virtual education. Likewise, the Organization for Economic Cooperation and Development (OECD, 2020, 2021) insisted on the idea that teachers need more training to make the most of digital advances. In this sense, the OECD (2020) pointed out that the adaptation of the Spanish educational system was more laborious than expected. For these reasons, the European Commission recently (2023) launched a proposal on key enabling factors to achieve successful digital education and training in the Digital Education Action Plan 2021-2027, which includes the recruitment, training and retention of specialized teachers and trainers with a special emphasis in terms of gender equality and diversity due to gender differences in ICT use and skills (Qazi, Hasan, Abayomi-Alli, Hardaker, Scherer, Sarker et al., 2022).

Given that ICT training is a requirement for the professional profile of teachers in line with current policies in education, this paper aims to establish the knowledge that Spanish primary schoolteachers have about ICTs as well as their perceived usefulness and the use teachers make of these technologies in the classroom, quantifying each of these three aspects through a specific indicator. In addition, the relationship between some sociodemographic variables and the three aspects considered in primary school teachers (knowledge, usefulness, and use) has also been studied.

This work contributes to the growing interest in measuring the knowledge and use of ICT and its impact on education (Symeonaki, Filandrianos & Stamou, 2022; UNESCO, 2009). To this end, there are various surveys, such as PISA or PIRLS, that are applied periodically at an international level that collect data on ICT and other aspects of education. Although research in ICT applied to education has increased substantially in recent years, most of the studies carried out design ad-hoc questionnaires to study issues about ICT in specific educational institutions with limited applications or poor reproducibility. To deal with these issues, it is possible to use methodologies and indicators to better measure and compare the

effects of ICT in education. Even though there is no unique definition, an indicator can be defined as a function of one or more variables, which jointly measure a characteristic or attribute of the individuals under study.

One of the best-known methodologies is the one created by the United Nations Development Program (UNDP, 2019) to calculate the Human Development Index (HDI), a commonly used statistic as a measure of well-being in different countries (Engineer, King & Roy, 2008). The UNDP methodology is applied by institutions such as The World Bank or UNESCO and it is used by researchers in different areas to measure the impact of ICT through indicators in the educational field (Mominó & Carrere, 2016; Symeonaki et al., 2022; Wagner, Day, James, Kozma, Miller & Unwin, 2005). It should be highlighted that this methodology has the advantage that is accepted and validated internationally to establish comparisons.

In the context of measuring the knowledge and use of ICT in education, our research focuses on ICTs knowledge that Spanish primary schoolteachers as well as their use and perceived usefulness. We have designed a battery of 14 questions, but we go a step further by defining three indicators following the Human Development Reports methodology (UNDP, 2019) and herein lies its novelty. One of the key issues is that the methodology of the study can be easily applied and reproduced in different contexts or countries.

It is important to note that Spanish primary schoolteachers are generalists but may have a specialization as in other countries such as the United States (De Araujo, Webel & Reys, 2017) and some of the member states of Europe (Chionidou-Moskofoglou, Blunk, Siemprinska, Solomon, Tanzberger & Frutos, 2008). In particular, European university education has undergone several important modifications to build a uniform European framework for higher education (European Commission, 2019). These efforts are part of the so-called Bologna Process, which aims to create the European Higher Education Area (EHEA). Specifically, in Spain, primary schoolteachers receive training with four components: scientific, didactic, psycho-pedagogical and teaching practices or Practicum (Jiménez, Ramos & Ávila, 2012). In addition, primary schoolteachers choose a specialization. The range of training itineraries depends on each university, with the most common fields of specialization being Foreign Language, Physical Education, Music Education or Special Education. Only a few universities offer a specific training itinerary in Mathematics, Sciences and ICT as pointed out by Jiménez et al. (2012), but it is important to note that there are no specific jobs for teachers with these mentions, since all the positions are for generalist schoolteachers.

Despite all, there is a clear expectation about the integration of ICTs in the Spanish curriculum. This fact contrasts with the Spanish Order ECI/3857/2007, currently under review, which establishes that teachers must acquire 12 relevant competencies for the teaching profession in primary education, among which is the use of technology. However, according to TALIS (OECD, 2019), the proportion of Spanish teachers who feel good or very well prepared to use ICT in teaching is lower than the EU average once they finish their formal studies (36.2% vs 39.4%). This survey also revealed (OECD, 2019) that lack of incentives is the most important barrier to participation in continuing professional development (76.3% vs 51.9% at the EU level). Other recent research by Ruiz-Domínguez, Area-Moreira and Feliciano-García (2022), points out that although teachers have high hopes for the educational potential of digital tools, there is still little proof that these tools have a beneficial impact on students' learning processes.

In response to these needs and concerns, teachers must acquire greater digital competence (hereafter, DC). At the international level, there are different frameworks of DC for teachers (Cabero-Almenara, Romero-Tena & Palacios-Rodríguez, 2020) that expect to master DC will enable teachers to design, implement, and evaluate teaching actions. Among them, stand out, DigCompEdu (Redecker, 2017), ISTE Standards for Educators (Crompton, 2017) and UNESCO ICT Competency Framework for Teachers (UNESCO, 2018). In Spain, the National Institute of Educational Technologies and Teacher Training (INTEF, 2022) understands DC as the set of skills that 21st-century teachers must develop to improve their educational practice and so continuously develop as professionals.

Suárez-Álvarez, Vázquez-Barrio and Torrecillas-Lacave (2020) list the key issues that favour the integration of ICTs in education. Firstly, they state that management teams and teachers should be the social agents leading the educational transformation. In addition, they defend the idea that teachers should work on the design of curricular content. The scarcity of ICT training for teachers is revealed as one of the key difficulties. Although progress has been made in technological equitation, there are still unresolved technical problems. Finally, they highlight as Area-Moreira et al. (2019, 2023) or OECD (2021), the need to invest in methodology and pedagogy, since ICTs are being used to support the traditional teaching model and not as a new way of teaching. In this respect, the new European Digital Education Action Plan (2021-2027) seems to promote a sustainable and effective adaptation of the education and training systems of the EU member states to the digital age, including the design of digital activities, the digital confidence in teachers and students, and ICT-related teacher professional development.

2. Method

2.1. Objectives

The general objective of this study is to determine primary school teachers' knowledge about ICTs, their perceived usefulness and their use in the classroom quantifying each of these three aspects through a specific indicator.

The specific objective is the analysis of the possible relationships between the sociodemographic variables and the indicators designed on ICT. To do this, we included sociodemographic variables of the participants such as gender, age, years of experience and the type of educational center in which they are located.

2.2. Methodology

The present study is a descriptive and exploratory investigation in which information is obtained through an online form in the third quarter of the 2019-2020 academic year. The empirical process was carried out with a total of 119 Spanish primary schoolteachers (96 women and 23 men) aged between 23 and 65. The selection of the participants was through a self-selecting convenience sample. Particularly, a short description of the research and the battery of questions were shared via social networks (including educational Instagram accounts).

The battery of questions was designed based on Ghavifekr and Rosdy (2015) which are based on two theories of Diffusion of Innovations by Rogers (1995) and Technology Acceptance Model (TAM) by Davis (1989), adapted to the context of Spanish generalist schoolteachers.

A total of 14 questions related to the knowledge, usefulness, and use of ICT were selected and sociodemographic characteristics of the participating teachers was included (Area-Moreira et al., 2016, 2019).

Finally, an indicator was constructed for each of the three ICT-related blocks, following the methodology described in the Human Development Reports (UNDP, 2019). All questions were quantified and the resulting values were normalised. The normalisation of the data enables us to compare results between the different indicators without concern for the associated magnitudes.

The normalization of the results was carried out through the MinMax Scaler applying the formula in (1), where the minimum (min) and maximum (max) value for each variable is detailed in the explanation of each indicator.

$$normalisated\ value = \frac{real\ value - min}{max - min} \quad (1)$$

The indicators were calculated using the geometric mean of the normalized values of each question. According to UNDP (2019, 2022), the geometric mean is a useful statistical measure to calculate mean scores or indices and is less sensitive than the arithmetic mean when there are extreme values. In our study, the geometric mean was considered, since, when quantifying categorical questions, the value 0 was required then it was changed by 0.01 (UNDP, 2022).

Due to normalisation, the indicators oscillated in the interval [0,1], with values close to 1 indicating positive results and values close to 0 indicating negative results (see Table 1).

Scale	[0, 0.2[	[0.2, 0.5[	[0.5, 0.75[	[0.75, 1]
	Scarce	Medium	High	Very high

Table 1. Scale of the knowledge, usefulness, and use indicators

2.3. Battery of Questions and Indicators by Block

This section details the questions designed for each block, as well as their quantification and construction of the indicators.

2.3.1. Sociodemographic

Four questions explore the respondent's teaching profile. The questions are about gender, age, years of teaching experience, and type of center (public, grant-aided and private) (Area-Moreira et al., 2016, 2019). It should be remarked that only one option must be checked.

2.3.2. Knowledge of ICT

This block consists of three questions and is designed in order to teachers' ICT knowledge (Rogers, 1995) and digital competence (Area-Moreira et al., 2016, 2019).

Question Q5 asks for a definition of ICT.

Q5. Do you know what the term Information and Communication Technologies (ICT) refers to? Please define it.

The evaluators/reviewers value with 1 a correct answer and 0 an incorrect answer. This question is already standardised in terms of one-for-one through the term concept in Equation (2), and so no additional calculation is needed for entry in the knowledge indicator ($I_{knowledge}$).

Question Q6 scores from 0 to 11 the computer knowledge of a teacher. From 11 possible answers teachers must mark those options that they consider appropriate.

Q6. Which computer skills do you have? Please select the options that apply to you.

Spreadsheet
Word processor
Video editing
Hardware basics
Basic functions of the operating system
Multimedia presentations
Search for information
Videoconference
Lists, discussion forums, and chat
Email
File transfer and storage

In this case, the quantified answer (knowledge) is not a percent, and so it will be modified by normalisation, using 0 as the minimum for this question ($min_{knowledge}$) and 11 as the maximum ($max_{knowledge}$).

Question Q7 about ICT training is quantified by the number of responses selected by the respondent.

Q7. What type of ICT training have you received? (Select all that apply).

None
Technical (Windows, Linux, networks, maintenance, etc.)

Office automation (word processing, spreadsheet, database, etc.)

Telematics (internet, email, web page design, etc.)

Multimedia (sound, image, video editing, etc.)

Curricular (ICT for the classroom, ICT for the subjects, etc.)

Note that not all the answers are considered in the same way as in Q6; in this case, those who mark the first option (None) are directly quantified with a 0, while the remaining respondents are evaluated according to the total number of options marked – with a minimum of 0 ($min_{training}$) and a maximum of 5 ($max_{training}$). For this question, the value 0 will not be normalised, the rest will be normalised following the quotient ($\frac{training-min_{training}}{max_{training}-min_{training}}$) present in Equation (2).

The ICT knowledge indicator is summarised in Equation (2).

$$I_{knowledge} = \sqrt[3]{concept \cdot \frac{knowledge-min_{knowledge}}{max_{knowledge}-min_{knowledge}} \cdot \frac{training-min_{training}}{max_{training}-min_{training}}} \quad (2)$$

2.3.3. Usefulness of ICT in the Classroom

Three questions evaluate the usefulness of ICT in the classroom. They are related with leadership support and resources, the benefit of using ICT and perceived usefulness of ICT (Rogers, 1995). In these questions, only one option should be marked.

The first and second questions in this block (Q8 and Q9) seek to evaluate the need for investment in ICT training for teachers and students.

Q8. Do you think it is necessary to invest more in ICT training for teachers?

Yes

No

Maybe

Q9. Do you think it is necessary to invest more in ICT training for students?

Yes

No

Maybe

The quantification has been scaled on the understanding that an opinion that involves a need for investment has a positive impact on the usefulness of ICT in the classroom. Thus, a 'yes' answer is quantified with 1, a 'maybe' with 0.5, and a 'no' with 0. The raw values obtained in these two questions are not a multiple of one, which is why they will be normalised. The minimum and maximum for both questions are 0 and 1 –see in Equation (3)– the terms inv.teac and inv.stud that correspond to investment in ICT training of teachers and students).

Question Q10 covers the importance of using ICT to support teaching.

Q10. How important is the use of technological resources as teaching support?

Very important

Quite important

Little

Not important.

In this case, there is a Likert-type scale with four options, and they are quantified from 0 (not important) to 3 (very important), considering that marking 'Not at all' shows no perceived usefulness for ICT. When entering this question in the usefulness indicator in Equation (3), the value obtained must be normalized, using 0 as the $min_{su.teaching}$ and 3 for $max_{su.teaching}$.

$$I_{uselfulness} = \sqrt[3]{\frac{inv.teac - min_{inv.teac}}{max_{inv.teac} - min_{inv.teac}} \cdot \frac{inv.stud - min_{inv.stud}}{max_{inv.stud} - min_{inv.stud}} \cdot \frac{su.teaching - min_{su.teaching}}{max_{su.teaching} - min_{su.teaching}}} \quad (3)$$

2.3.4. Use of ICT

Of the four questions, two are aimed at establishing the frequency of ICT use, which are related with the degree of use of ICT in teachers' daily lives (Area-Moreira et al., 2016, 2019). The other two seek to discover why teachers do not use them as much as they wish as well as the advantages and disadvantages found in their use. Both are related with the perceived ease of use of ICT in order to Rogers (1995).

It should be noted that only the first two questions (Q11 and Q12) are included in the use indicator in Equation (4), since questions Q13 and Q14 are not considerations of use, but rather opinions that will lead to a more detailed descriptive analysis of ICTs.

Q11 and Q12 are the same question, but with different nuances: one evaluates the frequency of ICT use qualitatively (Likert scale) and the other in percentage intervals.

Q11. How often do you use ICT tools to support your teaching?

Never

Almost never

Sometimes

Almost always

Always

Q12. How often do you use ICT in your classes?

Never

Between 0% and 25% of classes

Between 25% and 50% of classes

Between 50% and 75% of classes

Between 75% and 100% of classes

Only one response option must be selected. Thus, it is possible to confirm a concordance if the data distribution is similar. To determine this, firstly, a bar chart is made to visually determine if the distribution is the same. Secondly, to observe whether there is an association between both variables, a chi-square and a Fisher test are performed, and if a p-value <0.05 is obtained then both variables are related.

If an association is not made, the question is eliminated from the study; otherwise, we would keep Q11 for the design of the use indicator in Equation (4) where $min_{use} = 0$ and $max_{use} = 4$.

The ICT use indicator is summarized in Equation (4).

$$I_{use} = \frac{use - min_{use}}{max_{use} - min_{use}} \quad (4)$$

Finally, Q13 and Q14 are assessed categorically in the subsequent analysis and provide more information on the perceived ease of use of ICT. Q13 allows several response options to be selected; Q14 asks for one option to be checked in each of the rows.

Q13. Why do you not use ICT more often in the classroom? (Select all that apply)

Lack of time

Lack of material

Lack of training

Lack of resources among families

Fear of failure

Poor faculty support

A high percentage of students with learning difficulties

Q14. From your point of view, what are the advantages and disadvantages of using ICT in the classroom? (Check one option per row).

	Advantage	**Disadvantage**	**Both**
Availability of equipment and materials			
Teacher-family communication			
Time optimisation			
Distractions			
Visual aids			
Student motivation			
Specialised teachers			

2.4. Data Analysis Process

After data collection, all responses were downloaded into a spreadsheet and processed using the open-source software R (R Core Team, 2020). The reliability or validity of the scores obtained with the measurement instrument in the sample of this study was analyzed, since this is not an inherent (immutable) property of the test or measurement instrument (Sánchez-Meca, López-Pina & López-López, 2008). For this, Cronbach's alpha coefficient is constantly used in the social sciences as an estimator of the internal consistency of scores. However, the assumption of continuity on which this statistic is based and the fact that the scales in the battery of questions must have at least 6 response options, is not fulfilled in our case, so we must use the McDonald ω coefficient.

Likewise, the validity of the three indicators is determined. In this case, the typical error of the measurement was estimated for the indicators that incorporated more than one variable, and after this, a model was estimated through a confirmatory factor analysis with a factorial extraction of minimum residues, the definition of the number of factors to be through the based on parallel analysis and a Simplimax factorial rotation as oblique rotation. For this, the KMO value, the Barlett test, the correlation between factors, as well as the test of the model through the $\chi 2$ of the proposed model, its degrees of freedom, the associated probability and the parsimony fit (Hu & Bentler, 2009) were obtained.

For the descriptive analysis of the different variables, frequencies and percentages were used for the case of categorical variables, both nominal and ordinal.

An attempt was made to observe the consistency of the responses of the participants through questions Q11 and Q12, and for this, the existence or not of equality in the distribution of the data is observed. For this, the graphical representation was used, as well as the Fisher test.

Finally, to obtain relationships between the indicators built, as well as the possible differences according to the demographic variables studied, different analyses were carried out. In the first place, the normality of the distribution of the three indicators was determined through the Kolmogorov-Smirnov test, and after observing that normality in the data distribution was not accepted, the study was carried out through non-parametric statistical tests. Secondly, to obtain the correlation between the three indicators, the Spearman Rho test correlation is used. And thirdly, to evaluate the existence of statistically significant differences between the categories of each of the four sociodemographic variables, the Kruskal-Wallis test was used for the difference in means in the case of Age, Teaching experience and Type of centre and U Mann Whitney test in the case of Gender. Also, the effect size is measured through Cohen's values (Cohen, 1992), where a value near 0.2 is small, a value near 0.5 is a medium effect and near 0.8 is a large effect.

3. Results

The instrument presents a ω McDonald's equal to 0.624 which is considered medium. In the case of Knowledge and Usefulness Indicator, their ω McDonald's are equal to 0.556 and 0.742, and their typical

error of the measurement are 0.1519 and 0.0629, and they are near to 0 and it represents that the validation of the indicators is accepted.

The confirmatory factor analysis, where we divided the questions into three factors,

- Factor 1 the Knowledge indicator, Q5, Q6 and Q7.
- Factor 2 the Usefulness indicator, Q8, Q9 and Q10
- Factor 3 the Use indicator, Q11

Shows a KMO=0.613, a Bartlett test ($\chi 2$=28.4; p-value=0.005) and the parsimony fit=2.37<5. Then, we concluded that these model is validated.

3.1. Descriptive Analysis

Results are detailed in a descriptive way for each of the questions in the battery, thus obtaining a generic view of the ICT reality in the classroom. Since all the questions are closed-ended, the absolute frequencies of each category will be included in the tables.

It can be seen in Table 2 that the study is based on female teachers (80.67%), teachers work mostly in public schools (75.63%) with teaching experience of between 10 and 20 years (42.86%).

Concerning ICT knowledge, Table 3 shows that there is no difference between the teachers surveyed who understand the term ICT (54.6%) and those who do not (45.4%). Regarding computer knowledge, a quantitative analysis of the responses shows that none has less than three areas of knowledge, while 29.4% claim to possess all the 11 items in the question. Similarly, regarding the types of training, 16% say they have received none, while 28.6% say they have received only one type of training. The maximum is five types of training and this was received by only 10.1% of respondents.

The teachers surveyed consider ICT in the classroom to be useful, since, as shown in Table 4, 94.1% of teachers consider that investment should be made for ICT training for teachers and students. Teachers also consider ICT very important the use of ICT as teaching support, i.e., they perceived the usefulness of ICT (62.2%) for teaching primary children.

		Frequency (%)
Gender	Female	96 (80.67)
	Male	23 (19.33)
Age	[23-30[	22 (18.49)
	[30-35[	16 (13.45)
	[35-40[	23 (19.33)
	[40-45[	15 (12.61)
	[45-50[	12 (10.08)
	[50-55[	14 (11.76)
	[55-65]	17 (14.29)
Teaching experience	[0-5[	21 (17.65)
	[5-10[	17 (14.29)
	[10-20[	51 (42.86)
	[20-30]	13 (10.92)
	[30-40]	17 (14.29)
Type of centre	Public	90 (75.63)
	Grant-assisted /Private	29 (24.37)

Table 2. Numerical analysis of the sociodemographic block

		Frequency (%)
Concept	Yes	65 (54.6)
	No	54 (45.4)
Knowledge	3	2 (1.7)
	4	1 (0.8)
	5	7 (5.9)
	6	8 (6.7)
	7	14 (11.8)
	8	10 (8.4)
	9	23 (19.3)
	10	19 (16)
	11	35 (29.4)
Training	0	19 (16)
	1	34 (28.6)
	2	16 (13.4)
	3	23 (19.3)
	4	15 (12.6)
	5	12 (10.1)

Table 3. Numerical analysis of the ICT knowledge block

		Frequency (%)
Investment in teacher training	Yes	112 (94.1)
	No	1 (0.8)
	Perhaps	6 (5)
Investment in training for students	Yes	112 (94.1)
	No	2 (1.7)
	Perhaps	5 (4.2)
Teaching support	Quite important	45 (37.8)
	Very important	74 (62.2)

Table 4. Numerical analysis of the ICT usefulness block

According to the use of ICT, as explained in the methodology, the relationship between the two questions is studied. Figure 1 shows a similar distribution of data, which coincides with the relative frequencies. The Fisher test is applied (p-value<0.0001) and the result shows that the distribution of the data in both questions can be considered the same, and therefore we are left with the question about the percentage, as previously mentioned. The results reflect that 80%, approximately, use ICT frequently.

The final two questions (Q13 and Q14) were answered by 115 teachers – as 4 of the 119 teachers initially surveyed did not answer these questions. Figure 2 confirms that the main reasons given for not using ICTs correspond to: lack of material (59/115); lack of time (48/115); lack of training (39/115); and lack of family resources (37/115).

Figure 3 shows that the main advantages that teachers see in the use of ICT are as: visual aids (110/115); student motivation (104/115); communication between teacher and family (96/115); and time optimisation (91/115). As drawbacks, participants remark the use of ICT in the classroom as a potential distractor, the availability of equipment and materials and the lack of specialised teachers.

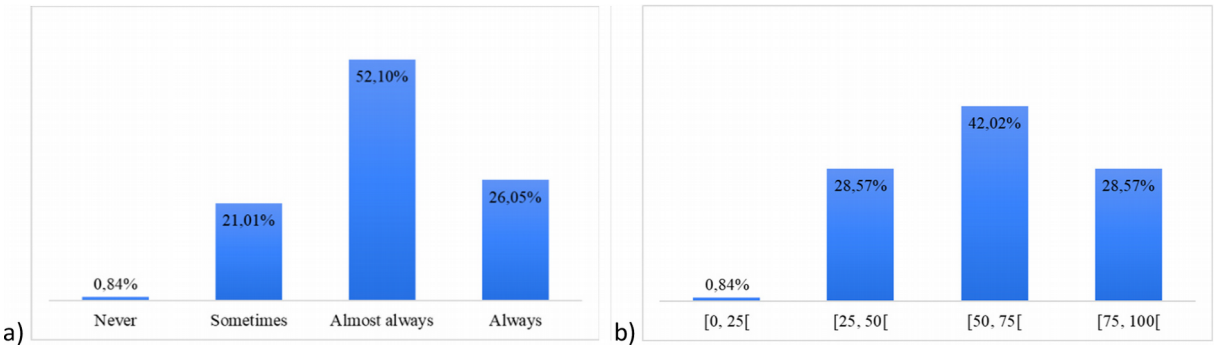

Figure 1. Distribution of responses to questions a) *Q11* and b) *Q12*

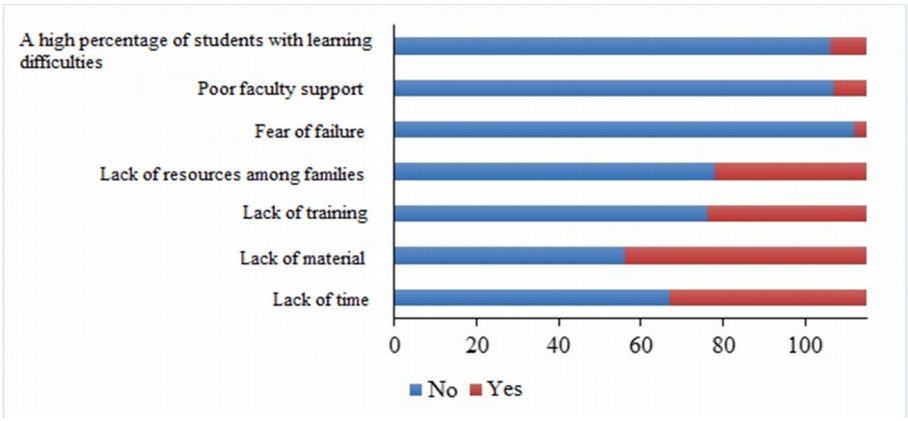

Figure 2. Numerical analysis of reasons for not using ICTs. Yes (red), No (blue)

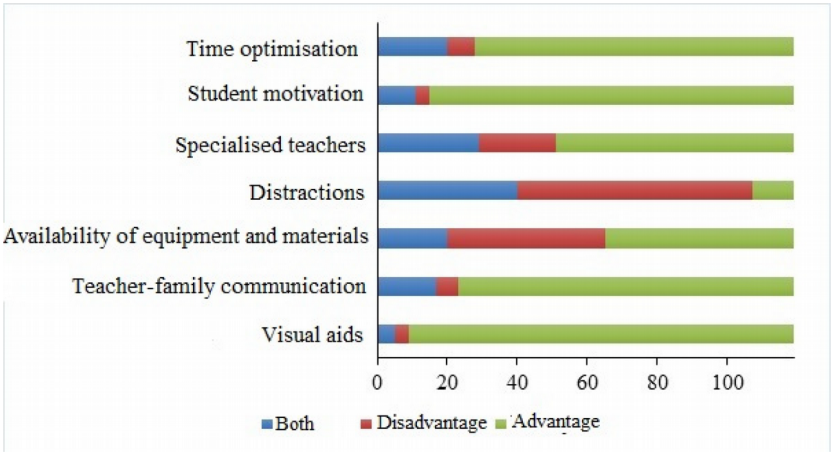

Figure 3. Numerical analysis of the advantages and disadvantages of using ICTs. Advantages (green), Disadvantages (red) and both (blue)

3.2. Inferential Analysis

After a descriptive analysis of each of the questions, this section includes an analysis of the indicators constructed, as well as their relationships between them and with the questions in the sociodemographic block.

Table 5 details the numerical analysis of the indicators created. Given the results obtained, it can be affirmed that teachers consider ICT to be useful, where the values of the indicator defined are in the interval 0.923±0.0133. However, this does not result in a strong understanding (0.398±0.0299) or use (0.724±0.0182) of ICT.

Indicator	μ (SE)
Knowledge	0.398(0.0299)
Usefulness	0.923(0.0133)
Use	0.724(0.0182)

Table 5. Numerical analysis of knowledge, usefulness, and use indicators -mean (standard error)-

3.2.1. Relationship between Knowledge, Usefulness, and Use

The linear correlation is determined through Spearman's correlation coefficient (see Table 6) and this reveals a positive correlation between all the pairwise categories, but none is significant in any case. Usefulness is an indicator with scores close to its maximum value (Table 5), but this does not have an impact on use, nor on the knowledge held by teaching staff.

Indicator	$r_{spearman}$ (p-value)
Knowledge vs. usefulness	0.065(0.484)
Knowledge vs. use	0.136(0.147)
Usefulness vs. use	0.154(0.099)

Table 6. Linear correlation between the knowledge, usefulness, and use indicators.
Spearman correlation and p-value adjusted with Holm method (Haynes, 2013)

If we focus on the knowledge that teachers claim to have regarding ICT, it is not related with the use of ICT. Furthermore, it can be affirmed that men, with statistically significant differences, claim greater knowledge than women. Similarly, teachers working in public schools or with teaching experience of between 0 and 5 years show the highest levels of knowledge (Table 7).

3.2.2. Relationship between Indicators and Sociodemographic Variables

Table 7 presents the descriptive numerical analysis by category for the sociodemographic questions and various indicators. The mean and standard error show possible differences in the knowledge and use indicators for the variables of gender, age, teaching experience and type of centre, but are not evident for the usefulness indicator.

Teachers between [45,55] years and those with more experience and professional seniority are the most active users – and not those between [30, 40] years.

The type of centre is also a determining factor with grant-assisted centres having the highest use. Table 8 shows that there are significant differences at 99% confidence in:

a) The knowledge indicator was higher for men (see Table 7), the kind of effect size is d=0.2595 which is considered small effect;

b) The knowledge indicator reflects the difference between the age ranges [50, 55] and [55, 65] (Dwass-Steel-Chritchlow-Fligner and Conover-Iman tests and Table 7), but with small effect size f=0.1283;

c) Age for the use indicator for the ranges [30-35] and [50,55], but with small effect size f=0.1005;

d) Type of centre for the use indicator – with grant-assisted centres making the greatest use of ICTs (Table 7), but with small effect size f=0.0409. Also, type of centre is related with the usefulness indicator with a small effect (d=0.0747).

		Knowledge indicator μ (SE)	Usefulness indicator μ (SE)	Use indicator μ (SE)
Gender	Female	0.372(0.032)	0.918(0.016)	0.721(0.021)
	Male	0.508(0.078)	0.944(0.022)	0.739(0.039)
Age	[23-30[	0.460(0.077)	0.960(0.025)	0.750(0.031)
	[30-35[	0.344(0.073)	0.929(0.016)	0.625(0.046)
	[35-40[	0.334(0.062)	0.954(0.017)	0.682(0.037)
	[40-45[	0.450(0.089)	0.819(0.079)	0.733(0.052)
	[45-50[	0.345(0.011)	0.989(0.048)	0.771(0.095)
	[50-55[	0.625(0.089)	0.885(0.042)	0.821(0.048)
	[55-65]	0.261(0.015)	0.955(0.067)	0.721(0.061)
Teaching experience	[0-5[	0.449(0.072)	0.930(0.023)	0.787(0.038)
	[5-10[	0.405(0.081)	0.930(0.021)	0.719(0.050)
	[10-20[	0.384(0.044)	0.901(0.028)	0.690(0.025)
	[20-30[	0.362(0.110)	0.945(0.021)	0.673(0.077)
	[30-40]	0.401(0.081)	0.955(0.015)	0.794(0.044)
Type of centre	Public	0.419(0.034)	0.932(0.012)	0.705(0.021)
	Grant-assisted/private	0.300(0.047)	0.821(0.032)	0.823(0.030)

Table 7. Numerical analysis of indicators restricted to sociodemographic variables

	Knowledge indicator	Usefulness indicator	Use indicator
Gender	3.720(0.054)*	0.762(0.383)	0.108(0.742)
Age	11.862(0.065)*	9.500(0.148)	11.004(0.088)*
Teaching experience	1.486(0.829)	0.170(0.961)	6.596(0.159)
Type of centre	0.364(0.162)	8.820(0.012)*	3.642(0.056)*

*Significance level of 10%

Table 8. Kruskal-Wallis or U Mann Whitney test for independent samples between categories of sociodemographic variables. Statistic (p-value)

4. Discussion

The research presented in this article aims at contributing to the state of the art of studies that analyze the use of ICT in education, particularly related to teachers' professional practices and beliefs.

The results obtained indicate that practically all teachers believe that investment should be made in ICT training for both teachers and students. This fact supports the policies of the European Commission (2023) of the Digital Education Action Plan 2021-2027. In addition, teachers agree that the use of ICT in the classroom is useful and following the findings of Ghavifekr and Rosdy (2015), they also place great value on the application of ICT as a teaching resource for primary school students. Data analysis suggests that visual aids, student motivation, communication between teachers and families, and time optimization are the main benefits that teachers see in the use of ICT. But although teachers have high expectations about the educational potential of ICT, there is still little evidence to support their beneficial effects on student learning processes, as Ruiz-Domínguez et al. (2022) claimed. Improving these factors may increase the use of ICT in the classroom due to the technology's perceived usability. Studies such as Bakar et al. (2020) and UNESCO (2022) also report this opinion.

However, the expectations for training are at odds with how often they use the tools they employ. Even though teachers are aware of the value of ICT, and the Covid-19 epidemic has boosted the use of technology tools in blended and remote learning lessons (Bakar et al., 2020; Sanz et al., 2020; López-Iñesta

& Sanz, 2021), this does not imply that they are more knowledgeable about ICT. Besides that, the training of Spanish primary schoolteachers, mostly generalists, together with the fact that there are no jobs for the ICT speciality, is a factor that can affect motivation in preparing and improving their knowledge in ICT. These findings reinforce the need for educators to improve their Digital Competence to become effective teachers who provide students with greater access to knowledge through the strategic use of technology, as established in international frameworks such as DigCompEdu (Redecker, 2017) or UNESCO ICT Competence Framework for Teachers (UNESCO, 2018). In this sense, it is also important to meet the demand for ICT specialist teachers made for years by the educational community. The recent Digital Education Action Plan 2021-2027 (European Commission, 2023) indicates in its proposal that it contemplates the training and retention of specialized teachers.

Teachers that do not use ICTs argue that this is due to: lack of material; lack of time; lack of training; and lack of family resources. These results are according to OECD (2015; 2021) and, also, are consistent with the works by Pierce and Ball (2009), Drijvers (2015), Lawrence and Tar (2018), Baran et al. (2019) or Suárez-Álvarez et al. (2020). Regarding the lack of materials, it is necessary to analyze the transformation and transition of traditional educational resources to digital educational resources and study the potential of their didactic practices, as well as their functioning as didactic tools in the classroom (Area-Moreira et al., 2023). Other studies point to other reasons that hinder the use of ICTs. For example, González and De Pablos (2015) highlight time, ICT skills, or available resources. Tapia-Silva (2018) mentions conditions that may hinder the development of a positive attitude towards ICT and its integration in classes. Among them are the attitudes towards ICT shown by prospective teachers, the material or institutional conditions associated with the ICT training process, and the ICT knowledge and skills that are considered in the training curriculum.

Also, participants in this study remark on the use of ICT in the classroom as a potential distractor. For these reasons, teachers should be encouraged to apply in the classroom different digital learning solutions and understand how technology can be used to improve student learning (Drijvers, 2015; Hoyles, 2018). In this sense, it is interesting to stimulate teachers to think creatively about their role as facilitators of student learning and how technology can help them to do so to combine their experience with their profession to achieve the skills of the 21st century (Area-Moreira et al., 2019; Bakar et al., 2020; Rasheed et al., 2020). In fact, organizations such as the European Commission (2019) specify that digital competence implies a safe, critical and responsible use of digital technologies for learning, at work and for participation in society.

The relationship between the defined ICT-related indicators led us to discover that teachers knowledge they claim to have about ICT, it is not related with the use of ICT. This result is contrary to that obtained by Drijvers (2015) who found that technological skills are associated with the use of ICT in teaching. Men claim to have greater knowledge of ICT than women, a result that suggests stereotypes reported in the literature (López-Iñesta, Botella, Rueda, Forte & Marzal, 2020; Qazi et al., 2022) in a profession as feminized as primary education teacher. These stereotypes are related to the digital gender gap that has a significant impact on the Digital Society and the fourth and fifth sustainable development goals 2030 to achieve quality education and gender equality (López-Iñesta et al., 2020). On the other hand, teachers working in public schools or with teaching experience of between 0 and 5 years show the highest levels of knowledge, and this is in line with Garzón et al. (2020) who found that young people show the greatest interest in ICT training.

The most active users are not those between [30, 40[years, but rather those between [45, 55[years and those with higher experience and professional seniority, being a significant diffrences. This is also in line with a study on Spanish teachers from the region of Andalusia (Cabero-Almenara, Barroso-Osuna, Rodríguez-Gallego & Palacios-Rodríguez, 2020) that found that those with more than ten years of experience are the most active users of ICT. However, this study reveals that teachers with less experience have a value of the indicator of use almost equal to that of teachers with more teaching experience in the same vein as Area-Moreira et al. (2016).

Another finding relies on the type of centre that results also a determining factor in ICT use with grant-assisted centres having the highest use, obtaining significant differences. This fact may be related to investment in materials, resources and technological infrastructure. This result is in line with a study by Suárez-Álvarez et al. (2020) and Area-Moreira et al. (2023) that examined the obstacles encountered by teachers regarding the material needed to integrate ICT in the classroom.

It should be noted that the effect size is small (Cohen, 1992) in all those cases in which significant differences of the indicator were found with respect to sociodemographic variables, indicating that the magnitude of the effect of the sociodemographic variables is small on the indicators studied.

With regard to the limitations of the study and future research, this study could be complemented with interviews with teachers, thus applying a mixed methods research methodology that combines elements of quantitative and qualitative research to enrich the quantitative analysis that we have carried out. Another limitation is that the analysis focuses on the available data we have from Spain, but this opens an opportunity to extend the analysis to other countries to allow international comparisons.

Future research is needed to explore how the integration of technological resources in the classroom evolves with the transformation of educational materials, as well as the assessment of the main reasons that hinder teacher training in ICT disappear. Finally, it will be convenient to question to what extent teachers readjust their educational functions related to ICTs as the training plans included in the different international frameworks for digital competence progress.

5. Conclusion

This research presents a study where the general objective is to determine primary school teachers' knowledge about ICTs, their perceived usefulness and their use in the classroom quantifying each of these three aspects through a specific indicator.

The factorial analysis results confirm that the battery of questions designed is divided into three factors, each one of them related to an indicator, and this is validated quantitatively. This result allows determining that the questions can be replicated. In addition, the design of the indicators, in the context of Spanish primary school teachers, it can serve as an example of the use of UNDP methodology applied to the education field that has the potential to be replicated and adapted to international contexts to assess knowledge, perceived usefulness and practical use of ICTs.

This work confirms a direct relationship between indicators about ICT teachers' knowledge, usefulness, and application, although this relation is not significant, that is, the magnitude of the effect of some indicators on others is small. However, the perception that teachers transmit in their responses about their training in the use of ICT should be highlighted, given that the analysis of variables such as age, gender, years of experience and type of centre (public or private/grant-assisted), allows establishing a richer analysis. Our findings, show that in the study sample, men claim greater knowledge than women and teachers working in public schools or with teaching experience of between 0 and 5 years show the highest levels of knowledge. These results contrast with the finding that teachers in grant-assisted schools utilize ICT the most and find it the most valuable.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

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