JOURNAL OF E-LEARNING AND KNOWLEDGE SOCIETY
Vol. 20, No. 3 (2024), pp. 90-100

Comparison of digital research skills between Spain and Ecuador

Juan José Victoria-Maldonado[a,1], Yosbanys Roque-Herrera[b], Blanca Berral-Ortiz[a], Alejandra Salomé Sarmiento Benavides[c]

[a]*Universidad de Granada (Spain)*

[b]*Escuela Superior Politécnica de Chimborazo (Ecuador)*

[c]*Universidad Nacional de Chimborazo (Ecuador)*

(submitted: 30/8/2024; accepted: 13/10/2024; published: 7/11/2024)

Abstract

The idea of the university as a mere transmitter of knowledge has long been obsolete. In the context of educational research and innovation, it is university teachers who fulfill these roles. This shift, along with the technological advancements of the 21st century, highlights the need for a thorough investigation into how well university teachers are equipped to face these new challenges. Consequently, various tools have been developed to provide a research framework that allows for comparisons between countries. Tools such as DigCompEdu have been used to assess teachers' digital competencies and to facilitate cross-country comparisons.

However, this study does not focus on teaching competencies but rather on exploring research competencies related to ICTs. In this context, a comparison is made between Spain and Ecuador to examine how two institutions from different countries operate, as well as how they function in relation to gender and the stage of academic career development. This aims to identify aspects that can serve as distinguishing factors.

The results show that there are no significant differences in the comparison of researchers from the two universities, finding significant changes only for specific aspects, establishing as differentiating factors the idea of a greater intention to use ICT for research by researchers at the University of Granada and showing how during the training of university teachers, confidence is acquired to train new researchers, establishing the ideal time for training once they have more than 10 years of research and with a permanent university link.

KEYWORDS: ICT, Research Competences, Digital Competences, Correlation, Education Research.

DOI
https://doi.org/10.20368/1971-8829/1136031

CITE AS
Victoria-Maldonado, J.J., Roque-Herrera, Y., Berral-Ortiz, B., & Sarmiento Benavides, A.S. (2024). Comparison of digital research skills between Spain and Ecuador. *Journal of e-Learning and Knowledge Society*, *20*(3), 90-100.
https://doi.org/10.20368/1971-8829/1136031

1. Introduction

Technology in the educational environment has seen significant development, especially since the Covid pandemic (Romero-Rodríguez et al., 2022). As a result, various technology-based projects have been proposed within educational institutions, gaining essential relevance (Paiva et al., 2018).

Therefore, different frameworks have been designed to identify which digital competencies are being developed. One notable framework is DigComp, which outlines basic competencies that all individuals should possess (Van Audenhove et al., 2024). This reference framework was proposed by the European Joint Research Center (JRC) to ensure that societies have a minimum level of technological knowledge.

1.1 ICT in educational context

In the educational context, reference frameworks such as DigComp have been insufficient. Although DigComp outlines some essential knowledge, teachers cannot limit themselves to these skills alone. They need not only a basic understanding of technologies

[1] corresponding author - email: jvictoria@ugr.es

but also the ability to apply various tools in the classroom and effectively transmit these competencies. For this reason, the TPACK model was developed, which is based on three fundamental, intertwined elements (Saubern et al., 2020). These elements are content knowledge (theoretical knowledge of the tool), technical knowledge (the ability to apply a tool), and pedagogical knowledge (the capacity to integrate all variables), collectively known as the TPACK model, which stands for Technological Pedagogical Content Knowledge (Mishra & Koehler, 2006).

Recognizing the need for teachers to work with both technology and pedagogy, the JRC developed an extension of DigComp focused on education, resulting in the DigCompEdu reference framework (Mora-Cantallops et al., 2022). This framework is particularly impactful, as it has been adopted not only in Europe but also in several Latin American countries, becoming a benchmark across much of the continent (Vergara et al., 2023).

1.2 University as institution for educational research

These teaching frameworks have been utilized in multiple research studies in higher education to highlight elements that differentiate this institution from others. Firstly, it is important to note the ability to access a diverse sample, which helps in testing various elements. For instance, Alonso-García et al. (2024) use DigCompEdu to evaluate digital competencies in future teachers, while Moreira et al. (2023) use the same tool to assess the digital competencies of university teachers. This has enabled comparisons between different countries, such as the research conducted by Vergara et al. (2023).

The results from comparing the digital competencies of Spain with those of countries in Latin America do not show significant differences (Carranza-Yuncor et al., 2024; Pin-Posligua, 2022).

However, this perspective only takes into account the part of teaching digital competence, i.e. the ability to teach with technology and through it, transmitting different skills (Palacio et al., 2018). Universities, on the other hand, no longer have the sole function of training, since the university is not only focused on the transmission of content, but also has the function of generating new knowledge in such a way that the teachers of the universities themselves are the researchers to generate scientific content (García & Aznar, 2017).

There are various indications that suggest university teachers may lack necessary skills. Alonso-García et al. (2022) highlight that, from the students' perspective, university teachers have deficiencies when working with technology. This view is supported by other research, such as Al-Daihani et al. (2018), which notes that social networks focused on research are underutilized by some university teachers. Guillén-Gámez et al. (2024) emphasize that while the average level of digital competence use at universities is moderate, the most notable strength is researchers' ability to search efficiently. They effectively manage different databases such as WOS, Scopus, and Google Scholar, including writing search equations. However, this proficiency does not extend to knowledge dissemination, as scientific social networks are not being effectively developed by this group of teacher-researchers.

2. Digital competences for research

Although the digital competencies of teachers are well researched, the use of ICT tools for research purposes is less developed. In the scientific literature, ICT tools are considered fundamental, since one of the indices that determine quality in university teaching is the ability to conduct research (Sanchez, 2021).

Various essential elements are identified as necessary to understand how scientific knowledge is constructed. The management of bibliographic references and databases are key digital competencies considered fundamental for the development of scientific knowledge (Nuñez et al., 2020).

Database management requires a range of skills, including the ability to define data using specific software, determine how they are categorized, labeled, and synthesized, and organize them into relational and non-relational categories (De Aparicio & Barrios, 2020).

Database management has traditionally been applied to research with quantitative data. However, current research trends have a mixed-methods approach, making the management of qualitative data equally important. Managing qualitative data also requires specific skills, as highlighted by Rojano et al. (2021).

As mentioned earlier, empirical research and specific interventions are not the only approaches to consider; systematic reviews and meta-analyses are two methodologies that support such research. In this context, the inclusion of technology has been crucial, particularly with the use of bibliography management tools (Roa et al., 2022). Bibliographic managers such as Zotero, Mendeley, and EndNote not only assist in generating references for scientific articles but also function as document and information management tools.

On the other hand, the capacity for transmission and dissemination of knowledge has expanded through various online platforms. The open science model has had positive effects, as it has made research more accessible. Often, publishing a paper in open access

leads to greater impact and increased knowledge transfer through citations (Ronal, 2016).

However, this open-access diffusion has also led to a distortion of science, with some journals accepting papers despite dubious research quality due to the cost of publication, ultimately leading to the creation of the so-called Black List (Alonso-Arévalo et al., 2020).

2.1 Country comparisons

This study compares the competencies of researchers in Spain and Ecuador. The comparison is based on differing viewpoints found in the scientific literature, suggesting that Spain, compared to Latin American countries, has greater economic and infrastructural development. This provides greater access to technology, resulting in higher technological competence (Hampton et al., 2021). This could explain the results presented by Martín-Párraga and colleagues (2023).

In contrast, studies comparing Hispanic American countries with Spain highlight a key difference in approach. While Spain demonstrates greater problem-solving abilities, its network communication is weaker than in other countries (Rueda, 2023). For instance, despite Spain's near-total access to various technological resources, countries like Brazil, classified as developing nations, show significantly higher digital competencies among students. Moreover, when compared to Portugal, a country with a similar context, the digital competencies of both Spanish students and teachers are found to be relatively low (Romero-Rodríguez et al., 2019).

This comparison is particularly interesting as Spain, represented by the University of Granada, conducts the most research on digital teaching competencies (Betancur Chicué & García-Valcárcel, 2022), while Ecuador, represented by the National University of Chimborazo, has less focus on this subject. One might assume that Spain has a higher level of digital teaching competencies; however, Guillén-Gámez et al. (2023a) argue that the number of publications on the subject is limited and should not be considered reliable predictors.

2.2 Gender digital divide

Another important aspect to consider is the gender gap and how it manifests. Given the population under study, it is important to examine whether there are gender differences in research. The starting point is the disparity in the number of male and female researchers in both countries.

In Spain, national reports indicate that while the ratio of male to female researchers is currently close to 50%, men still hold the majority of research positions (Ministerio de Ciencia e Innovación, 2023). In Ecuador, this disparity is even more pronounced, with 65% male and 35% female researchers (Zambrano, 2019).

Given the disparity in the number of male and female researchers, it is essential to understand the factors driving this difference. For the purpose of this research, it is important to focus on the concept of the Gender Digital Divide, which stems from differences in how technology is used.

In the different regions where, significant differences have been found, women tend to a more monotonous use, leisure and through smartphones, while men tend to make a broader search and focused on the search for knowledge through active listening of different audiovisual materials (Ali & Oystein, 2023). Despite this idea, it is worth mentioning that the review by Ali & Oystein (2023), although it generally concludes with the aforementioned results, it is noteworthy that for the contexts on which this study focuses, it mentions that for Spain this digital divide does not seem to be so evident and in the case of Latin America the role is reversed, with men having a greater use of social networks and dedicated to leisure than women, although there are no differences in terms of the ability to use them.

Specifically, in relation to digital competence in teaching, Guillén-Gámez and colleagues (2021) highlight a disparity across all dimensions, showing that male researchers exhibit greater digital competence in research compared to their female counterparts. In 2024, Guillén-Gámez and colleagues reaffirm this finding, emphasizing the need for further research in various contexts to identify areas where more focused efforts are required to mitigate this gap.

2.3 Career development as a researcher

The final key point in this discussion is the development of a research career. This involves two fundamental aspects of university operations: positions and ranks, which largely determine one's role within the institution. Therefore, the position held at the university and the time dedicated to publishing are crucial factors in this context.

Broadly speaking, researcher competencies can be grouped into three categories (Rivas, 2011):

1. Competences on philosophy and epistemology.
2. Competencies on the research process.
3. Competencies in research techniques.

To these competencies must be added the aforementioned research dissemination skills.

These competencies are not immovable or innate characteristics; rather, it is necessary to design and carry out specific training that focuses on developing these skills.

Thus, teachers who have obtained a certification or a contract with a permanent link are the teachers who

have achieved a greater capacity for the development of research (Antúnez & Veytia, 2020). Despite the fact that there are specific proposals for teacher training during university degrees and master's degrees such as those proposed by (Reynosa et al., 2020 and Soto & Hanna, 2020), there seems to be a global consensus on the training that accredits these competencies, establishing the doctorate and doctoral thesis as the result of research as a before and after in terms of research (Vásquez et al., 2020).

This means that, depending on the number of years a research line has been developed, it means a higher category, since after the completion of the doctoral thesis, the first five years of a researcher's work are usually completed.

3. Objective

This literature review identifies factors that may contribute to differences in the use of technology for research. Therefore, the objective of this study is to compare the digital competencies for research of educational researchers in Spain and Ecuador while identifying factors that may influence their development. Therefore, the following specific objectives have been generated.

O1. Determine whether the countries and universities where research is conducted have an impact on digital research skills.

O2. To assess the relationship between a researcher's institutional position and their digital competence for research, with the aim of determining whether the position has any impact on their digital skills.

O3. To evaluate the relationship between a researcher's gender and their digital competence for research, with the aim of determining whether gender has any influence on their digital skills.

O4. To examine the relationship between the time spent in research and competence in using ICT for research, with the aim of determining whether the duration of research experience influences ICT skills.

To achieve these objectives, the following hypotheses are proposed, which will address the study's overall objective:

H1: The university in which the researcher is located does not influence the digital competencies for research.

H2: The researcher's position within their institution has no effect on digital competence for research.

H3: The researcher's gender has no influence on digital competence for research.

H4: The time spent in research has no influence on the competence to use ICT in research.

4. Methodology

An ex post facto retrospective design was used for the study, aiming to determine which independent variables affect a previously defined dependent variable – in this case, the digital research competence of university teacher-researchers (Ato et al., 2013).

It is important to mention that the sample collection employed non-probability convenience sampling. This method was chosen due to the difficulty of collecting a sample from the target population, as it is relatively small, and convenience sampling allowed for rapid sample collection (Otzen & Manterola, 2017).

4.1 Tools

Regarding the instrument used, the scale developed and validated by Guillén-Gámez and colleagues (2023b) was employed, which has undergone exploratory and confirmatory validation, demonstrating its validity and reliability. The questionnaire is a seven-point Likert scale with 29 items grouped into the following dimensions:

1. Digital skills
2. Digital Ethics
3. Flow Digital
4. Anxiety towards ICT
5. Quality
6. Intention to use ICT
7. Integration ICT

4.2 Sample

The sample is composed of a total of 340 educational researchers, ranging from master's students to teachers with permanent links to the University. This makes that groups are generated according to the time from less than 1 year developing their research to more than 10 years. In addition, a separation has been made according to men and women and to the University to which they belong, leaving the relative distribution of the sample defined in Table 1.

The questionnaire has been validated by Guillén-Gámez et al. (2023b), demonstrating the instrument's reliability and validity. To assess the reliability of the sample, Cronbach's Alpha yielded a result of 0.850. Additionally, composite reliability was calculated, confirming the instrument's reliability for the sample. The indicators in Table 2 were established for the questionnaire.

Finally, we calculated eta squared to measure the effect size relative to the total variance of the experiment. The calculated eta squared values were less than 0.001 for all variables, indicating a low effect size. To account for potential bias in the data, we calculated Cohen's D, which was less than 0.2 for all items, indicating a low effect of publication bias (Cohen, 1988). After establishing data consistency, we

applied the Shapiro-Wilk and Kolmogorov-Smirnov normality tests, indicating the need for nonparametric tests for group relationships.

Table 1 - Sample description.

University	Variable	Frequency	Percentage
National University of Chimborazo		193	56.76%
University of Granada		147	43.24
Total		*340*	*100%*
National University of Chimborazo	Women	92	47.7%
	Man	101	52.3%
University of Granada	Women	74	50.3%
	Man	73	49.7%
Total		*340*	*100%*
National University of Chimborazo	Less than a year	38	19.7%
	Between 1 and 5 years	72	37.3%
	Between 5 and 10 years	54	28.0%
	More than 10 years	29	15.0%
University of Grana	Less than a year	21	14.3%
	Between 1 and 5 years	45	30.6%
	Between 5 and 10 years	48	32.7%
	More than 10 years	33	22.4%
Total		*340*	*100%*
National University of Chimborazo	Degree Student	22	11.4%
	Master Student	24	12.4%
	PhD Student	11	5.7%
	Professor/ Researcher with no permanent bonding with the University	64	33.2%
	Professor/ Researcher with permanent bonding with the University	51	26.4%
	Not specified above	21	10.9%
University of Granada	Degree Student	5	3.4%
	Master Student	19	12.9%
	PhD Student	28	19.0%
	Professor/ Researcher with no permanent bonding with the University	56	38.1%
	Professor/ Researcher with permanent bonding with the University	37	25.2%
	Not specified above	2	1.4%
Total		*340*	*100%*

Table 2 - Reliability for the sample.

Alpha Cronbach	AVE	CR
0.850	0.565	0.973

Table 3 - Shapiro-Wilk and Kolmogorov-Smirnov normality tests.

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	gl	Sig.	Statistic	1020	<.001
A	.191	1020	<.001	.915	1020	<.001
B	.244	1020	<.001	.814	1020	<.001
C	.161	1020	<.001	.899	1020	<.001
D	.133	1020	<.001	.929	1020	<.001
E	.168	1020	<.001	.919	1020	<.001
F	.204	1020	<.001	.819	1020	<.001

3. Results

To enhance the clarity of this document, the results are organized according to the hypotheses outlined above.

3.1 Contrasting hypothesis H1

The Mann-Whitney U test is conducted to determine if there is a comparation between ICT competencies for research and the university where the research is conducted. This highlights a significant difference between the two universities in two of the areas. The comparisons between the universities and the items are now developed (Table 4).

For the present sample, there is only one area where a significant difference between the universities is observed. The area where these differences have been found is “Intention to use ICT,” which relates to the attitude toward the use of technology.

In this case, although differences are observed when measuring the items individually, differences are found when measuring individual items. (Table 5). The collected sample indicates that the Spanish university has a better evaluation of technology use, as participants consider it more enjoyable to use (Table 6).

3.2 Contrasting hypothesis H2

To test Hypothesis 2, the Kruskal-Wallis test will be conducted, which is used to determine whether there are significant differences between the groups, as shown in Table 7. None of the universities showed significant differences between the defined groups.
Having found differences in the area of Intention to use ICT for the Universidad Nacional del Chimborazo and Integration ICT, we compared them by performing a Mann-Whitney U test comparing all the possibilities, although we will only point out the significant differences between doctoral students, staff with permanent and non-permanent links with their university, since the sample of bachelor's and master’s degree students is small, limiting their scientific interest.

Table 4 - Mann-Whitney U divided by areas.

Null Hypothesis	Test	Sig.a, b	Decision
The distribution of A is the same across categories of Universidad.	Independent-Samples Mann-Whitney U Test	.725	Retain the null hypothesis.
The distribution of B is the same across categories of Universidad.	Independent-Samples Mann-Whitney U Test	.061	Retain the null hypothesis.
The distribution of C is the same across categories of Universidad.	Independent-Samples Mann-Whitney U Test	.100	Retain the null hypothesis.
The distribution of D is the same across categories of Universidad.	Independent-Samples Mann-Whitney U Test	.135	Retain the null hypothesis.
The distribution of E is the same across categories of Universidad.	Independent-Samples Mann-Whitney U Test	.873	Retain the null hypothesis.
The distribution of F is the same across categories of Universidad.	Independent-Samples Mann-Whitney U Test	.006	Reject the null hypothesis.
The distribution of G is the same across categories of Universidad.	Independent-Samples Mann-Whitney U Test	.978	Retain the null hypothesis.

Table 5 - Mann-Whitney U divided by items.

	F1	F2	F3	F4	F5
Mann-Whitney U	13121.500	13009.000	13107.500	13662.000	13234.500
Wilcoxon W	31842.500	31730.000	31828.500	32383.000	31955.500
Z	-1.241	-1.384	-1.266	-.616	-1.107
Asymp. Sig. (2-tailed)	.215	.166	.206	.538	.268

Table 6 - Mean and SD divided by university.

		F1	F2	F3	F4	F5
Universidad Nacional del Chimborazo	N Valid	193	193	193	193	193
	Mean	5.76	5.85	5.85	5.91	5.76
	Std. Deviation	1.215	1.207	1.272	1.246	1.241
Universidad de Granada	N Valid	147	147	147	147	147
	Mean	5.97	6.08	6.10	6.06	5.92
	Std. Deviation	.968	.940	.924	.960	1.095

Having compared all possible groups, no statistically significant differences have been found except when comparing permanent and non-permanent teachers of the National University of Chimborazo, so we understand that the difference previously found in the Integration ICT section is due to the influence of the undergraduate and master students who have participated from the University of Granada (Table 8).

3.3 Contrasting hypothesis H3

For the analysis of differences between the sexes, the areas of the questionnaire are once again used as a reference to identify where significant differences exist. Pearson's correlation test reveals that, despite the absence of differences noted in the literature, significant differences are found in some items (Table 9).

After identifying a significant difference with respect to sex, we propose using the Mann-Whitney U test to determine between which groups the difference occurs, given that in this case, there is a significant difference regarding the question, "I enjoy using software for data analysis, both quantitative (SPSS, JAMOVI, R...) and qualitative (Atlas.ti, NVivo...) when planning my research." Men have an average score of 5.31, while women have an average score of 4.99. This indicates that men have a more positive attitude toward using software for both quantitative and qualitative data analysis (Table 10).

Table 7 - Krustal-Wallis for categories and Universities.

	Sig.[a,b]	Decision
The distribution of A is the same across categories of Categoría.	.938	Retain the null hypothesis.
The distribution of B is the same across categories of Categoría.	.190	Retain the null hypothesis.
The distribution of C is the same across categories of Categoría.	.170	Retain the null hypothesis.
The distribution of D is the same across categories of Categoría.	.507	Retain the null hypothesis.
The distribution of E is the same across categories of Categoría.	.942	Retain the null hypothesis.
The distribution of F is the same across categories of Categoría.	.339	Retain the null hypothesis.
The distribution of G is the same across categories of Categoría.	.906	Retain the null hypothesis.
Universidad Nacional del Chimborazo		
The distribution of A is the same across categories of Categoría.	.135	Retain the null hypothesis.
The distribution of B is the same across categories of Categoría.	.677	Retain the null hypothesis.
The distribution of C is the same across categories of Categoría.	.925	Retain the null hypothesis.
The distribution of D is the same across categories of Categoría.	.688	Retain the null hypothesis.
The distribution of E is the same across categories of Categoría.	.657	Retain the null hypothesis.
The distribution of F is the same across categories of Categoría.	.757	Retain the null hypothesis.
The distribution of G is the same across categories of Categoría.	.383	Retain the null hypothesis.
Universidad de Granada		

Table 8 - Mann-Whitney U for the areas where differences were found.

	Comparative groups	Sig.	Sig. adjust.
ITEM A2	PhD Student-Professor/Researcher with permanent bonding with the University	.015	.232
ITEM B2	PhD Student-Professor/Researcher with no permanent bonding with the University	.030	.455
	PhD Student-Professor/Researcher with permanent bonding with the University	<.001	.009
ITEM C1	PhD Student-Professor/Researcher with no permanent bonding with the University	.014	.217
	PhD Student-Professor/Researcher with permanent bonding with the University	<.001	.005
ITEM C2	PhD Student-Professor/Researcher with no permanent bonding with the University	.005	.080
	PhD Student-Professor/Researcher with permanent bonding with the University	<.001	.007
ITEM C3	PhD Student-Professor/Researcher with no permanent bonding with the University	.012	.183
	PhD Student-Professor/Researcher with permanent bonding with the University	.002	.030
ITEM D4	PhD Student-Professor/Researcher with no permanent bonding with the University	.009	.140
ITEM G4	PhD Student-Professor/Researcher with no permanent bonding with the University	.042	.624

Table 9 - Correlation between gender by area.

	Statistic	A	B	C	D	E	F	G
Sex	**Pearson's correlation**	-.009	.021	-.111	-.058	-.010	.047	-.018
	Sig. (bilateral)	.864	.698	.042	.286	.853	.389	.740
	N	340	340	340	340	340	340	340

Table 10 - Mann-Whitney U for items by gender.

	C1	C2	C3
Mann-Whitney U	13464.500	12655.000	13637.500
Wilcoxon W	27325.500	26516.000	27498.500
Z	-1.110	-2.023	-.912
Asymp. Sig. (2-tailed)	.267	.043	.362

3.4 Contrasting hypothesis H4

The Kruskal-Wallis test is performed again to compare the different areas and identify the statistical differences between the groups. However, no significant differences were found between the groups, except for purchasing at extreme points, such as less than 1 year and more than 10 years. In these instances, no significant differences were identified. Consequently, we selected all items from the questionnaire and compared cases where researchers had been working for more than 1 year, excluding undergraduate students due to their limited scientific interest. Only the significant differences will be indicated, highlighting the most relevant results (Table 11).

Table 11 - Comparative according to the time period under investigation.

	Comparative groups	Sig.	Sig. adjusts.
ITEM A1	Between 1 and 5 years - More than 10 years	.008	.050
ITEM A2	Between 1 and 5 years - Between 5 and 10 years	.009	.057
	Between 1 and 5 years - More than 10 years	.001	.007
ITEM A4	Between 1 and 5 years - Between 5 and 10 years	.005	.031
ITEM D1	Between 1 and 5 years – Less than a year	.023	.141
ITEM F1	Less than a year - Between 5 and 10 years	.001	.007
ITEM F3	Between 1 and 5 years - More than 10 years	.033	.200

Thus, the significant differences are primarily observed between researchers with a doctorate and those with more than 10 years of research experience (Table 12). These results are similar to those presented earlier, where individuals with 1 to 5 years of research experience received lower evaluations in all items except for D1, where a higher mean indicates a worse evaluation.

Table 12 - Mean and SD according to the time period under investigation.

		A1	A2	A4	D1	F1	F3
Between 1 and 5 years	Mean	5.03	5.31	5.15	3.43	5.78	5.87
	N	117	116	117	117	117	117
	SD	1.200	1.145	1.302	1.516	1.060	1.200
Between 5 and 10 years	Mean	5.28	5.69	5.56	3.25	6.04	6.07
	N	102	102	102	102	102	102
	SD	1.396	1.266	1.651	1.681	1.033	.967
More than 10 years	Mean	5.50	5.90	5.37	3.11	6.10	6.26
	N	62	62	62	62	62	62
	SD	1.251	1.067	1.571	1.812	1.003	.940

4. Discussion

The results extracted from the sample reveal an ambiguous comparison with the existing scientific

literature, as findings both support and challenge previous research.

Firstly, differences between countries must be highlighted. The literature presents two distinct viewpoints: one suggests that countries like Ecuador, with lower developmental status compared to Spain, face challenges in accessing and effectively using ICTs (Hampton et al., 2021). The other viewpoint acknowledges that while Spain is a leader in researching digital competencies (Betancur Chicué & García-Valcárcel, 2022), it still experiences significant shortcomings. Interestingly, some less developed countries exhibit better digital competencies (Romero-Rodríguez et al., 2019).

From our sample results, we can draw a conclusion that reconciles both perspectives. No significant differences were found between the two universities, aligning with Romero-Rodríguez et al. (2019). However, a notable difference emerged regarding the intention to integrate ICTs for research. This suggests that while some differences may exist, others may not, depending on the context.

After examining the differences between countries, it is important to address the controversial issue of the gender digital divide. The collected data indicate that there were more male researchers than female researchers in the sample. As previously noted, the gender digital divide is influenced by technology use, varying by region (Ali & Oystein, 2023).

In this study, no significant differences were observed, except for the item: 'I enjoy using software for data analysis, both quantitative (SPSS, JAMOVI, R...) and qualitative (Atlas.ti, NVivo...) when planning my research.' This item revealed that female researchers reported less enjoyment in using technology, which may help explain the differences observed in certain contexts.

Finally, it is essential to discuss the development of a research career. This academic journey evolves over the years, fostering confidence in one's abilities. Both the duration of one’s research experience and the classification of professional categories are crucial factors, particularly concerning confidence and the ability to mentor others, as indicated by Antúnez and Veytia (2020).

The findings suggest that once individuals achieve a certain level of stability, their research capabilities significantly improve, including their ability to train other researchers. The doctoral thesis represents an initial stage where individuals begin to understand research but may lack the skills to teach it effectively, as noted by Vásquez et al. (2020).

This scenario illustrates that the evaluation and promotion system for university faculty, despite potential shortcomings and the presence of individuals who do not meet standards, appears to function effectively. It incorporates a training phase through advanced degrees, such as master's programs (Reynosa et al., 2020; Soto & Hanna, 2020), followed by courses with research contracts like University Teacher Training or Research Staff Training (Antúnez & Veytia, 2020). Finally, researchers reach a stage of stability where they can focus on mentoring new researchers, having already acquired the necessary competencies identified by Rivas (2011).

5. Conclusion

The main conclusion of this research is that there are no significant differences between teachers from different countries regarding digital competencies necessary for research development. While this conclusion is based on reliable and representative results, it may not encompass all possible alternatives.

Despite Spain being a leader in research on digital competencies for university teachers, there is a pressing need for more targeted interventions and specific planning to enhance these skills. When compared to countries that theoretically have lower performance levels, Spain's strengths in this area are not clearly demonstrated.

Interestingly, the intentions of Spanish teachers and educational researchers are positive, showing a willingness to use digital resources. However, enhanced training on effectively utilizing these digital tools could further empower Spanish researchers.

Emphasizing the need for improved specific training in digital competencies is crucial. The current training system appears to effectively initiate research careers, as leading university figures excel in training capacities. Nevertheless, the dissemination of knowledge and engagement with social research networks do not seem to be limiting factors for those who began their research careers before these networks existed. Thus, young researchers should be encouraged to leverage these modern tools for their advancement.

Finally, it is essential to highlight the issue of the gender digital divide. While the data appears to accurately represent reality, it raises important questions. Despite no significant differences being observed in this sample, a possible explanation for the gender digital gap may lie in the greater interest that men typically show toward technology. This interest could contribute to their improved digital competencies.

To address this gap, it is crucial to focus on promoting the development of digital skills, particularly among women. Continued efforts in this area are necessary to foster greater equity in technology usage and digital competency.

References

Acilar, A., & Sæbø, Ø. (2021). Towards understanding the gender digital divide: a systematic literature review. *Global Knowledge Memory and Communication,72*(3), 233-249. https://doi.org/10.1108/gkmc-09-2021-0147

Al-Daihani, S. M., Al-Qallaf, J. S., & AlSaheeb, S. A. (2018). Use of social media by social science academics for scholarly communication. *Global Knowledge, Memory and Communication, 67*(7), 412-424. https://doi.org/10.1108/GKMC-11-2017-0091.

Alonso-Arévalo, J., Saraiva, R., & Flórez-Holguín, R. (2020). Revistas depredadoras: fraude en la ciencia. *Cuadernos de documentación multimedia, 31*, 1-6.

Alonso-García, S., Victoria-Maldonado, J. J., García-Sempere, P. J., & Lara-Lara, F. (2023). Student evaluation of teacher digitals skills at Granada University. *Frontiers in education, 7.* 1-4, https://doi.org/10.3389/feduc.2022.1069245

Alonso-García, S., Victoria-Maldonado, J.J., Martínez Domingo, J.A., & Berral-Ortiz, B. (2024). Analysis of self-perceived digital competences in future educators: A study at the University of Granada. *Journal of Technology and Science Education, 14*(1), 4-15. https://doi.org/10.3926/jotse.2521

Antúnez Sánchez, A. G., & Veytia Bucheli, M. G. (2020). Desarrollo de competencias investigativas y uso de herramientas tecnológicas en la gestión de información. *Conrado, 16*(72), 96-102. http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1990-86442020000100096&lng=es&tlng=es

Ato, M., López, J.J., & Benavente, A. (2013). Un sistema de clasificación de los diseños de investigación en psicología. *Anales de Psicología, 29*(3), 1038-1059. https://dx.doi.org/10.6018/analesps.29.3.178511

Betancur Chicué, V., & García-Valcárcel Muñoz-Repiso, A. (2022). Necesidades de formación y referentes de evaluación en torno a la competencia digital docente: revisión sistemática. *Fonseca, Journal of Communication,* (25), 133–147. https://doi.org/10.14201/fjc.29603

Carranza-Yuncor, N. R., Rabanal-León, H. C., Villena Zapata, L. I., & Mora Mau, M. E. (2024). Competencia digital. Análisis comparativo pospandemia en maestros de instituciones urbanas y rurales. *Bordón Revista de Pedagogía, 76*(1), 31–48. https://doi.org/10.13042/bordon.2024.99045

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences.* Erbaum Press.

García, Z. del P., & Aznar, I. (2017). Childhood educator training, a challenge to educative innovation in higher education. *Innoeduca. International Journal of Technology and Educational Innovation*, *3*(2), 98–108.https://doi.org/10.24310/innoeduca.2017.v3i2.2451

Guillén-Gámez, F. D., Gómez-García, M., & Ruiz-Palmero, J. (2024). Competencia digital en labores de Investigación: predictores que influyen en función del tipo de universidad y género del profesorado de Educación Superior. *Pixel bit, 69*, 7–34. https://doi.org/10.12795/pixelbit.99992

Guillén-Gámez, F. D., Ruiz-Palmero, J., & Gómez-García, M. (2023b). Digital competences in research: creativity and entrepreneurship as essential predictors for teacher training. *Journal of Computers in Education.* 1-20. https://doi.org/10.1007/s40692-023-00299-3

Guillén-Gámez, Francisco D., Ruiz-Palmero, J., & García, M. G. (2023a). Digital competence of teachers in the use of ICT for research work: development of an instrument from a PLS-SEM approach. *Education and Information Technologies, 28*(12), 16509–16529. https://doi.org/10.1007/s10639-023-11895-2

Hampton, K. N., Robertson, C. T., Fernandez, L., Shin, I., & Bauer, J. M. (2021). How variation in internet access, digital skills, and media use are related to rural student outcomes: GPA, SAT, and educational aspirations. *Telematics and Informatics, 63*, 101666, 1-15. https://doi. org/ 10. 1016/j. tele. 2021.101666

Martín-Párraga, L.; Llorente-Cejudo, C.; Barroso-Osuna, J. Self-Perception of Digital Competence in University Lecturers: A Comparative Study between Universities in Spain and Peru According to the DigCompEdu Model. *Societies 2023, 13*(6) 142, 1-14. https://doi.org/10.3390/ soc13060142

Ministerio de Ciencia e Innovación. (2023). *Científicas en Cifras 2023.* Secretaría General Técnica del Ministerio de Ciencia e Innovación. https://www.ciencia.gob.es/dam/jcr:f4f6bb28-cae5-4da2-85f4-067508c410eb/CientiificasCifras2023.pdf

Mishra, P., & Koehler, M. J. (2006). Technological Pedagogical Content Knowledge: A Framework or Teacher Knowledge.*Teachers College Record, 108*(6), 1017-1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

Mora-Cantallops, M., Inamorato Dos Santos, A., Villalonga-Gómez, C., Lacalle Remigio, J. R., Camarillo Casado, J., Sota Eguizábal, J. M., et al. (2022). *Competencias digitales del profesorado universitario en España: Un estudio basado en los marcos europeos DigCompEdu y OpenEduThe Digital Competence of Academics in Spain: A study based on the European frameworks DigCompEdu and OpenEdu.* Luxembourg: Publications Office of the European Communities.

Nuñez Benítez, A., Wexell Machado, L. E., & Sotomayor Ortellado, R. I. (2020). Competencias TIC para investigación en docentes de la FOUNC con la implementación del Programa de Formación a Investigadores 2015-2018: Information Technology Communication Competences for research in FOUNC teachers with the implementation of the Training Program for Researchers 2015-2018. *Scientia Oralis Salutem 1*(1), 58–64. https://revistas.unc.edu.py/index.php/founc/article/view/13

Otzen, T., & Manterola, C. (2017). Técnicas de Muestreo sobre una Población a Estudio. *International Journal of Morphology, 35*(1), 227-232. https://dx.doi.org/10.4067/S0717-95022017000100037

Paiva, A. de F., Romero-Rodríguez, J. M., & Gómez-García, G. (2018). Desenvolvimento profissional e formação contínua de professores: uma análise do contexto da educação em Angola. *Innoeduca International Journal of Technology and Educational Innovation, 4*(1),71–78. https://doi.org/10.24310/innoeduca.2018.v4i1.4081

Palacio, J. A., Hinojo-Lucena, M. A., & García, S. A. (2018). Higher education in agricultural technology with a territorial approach. *Innoeduca. International Journal of Technology and Educational Innovation*, *4*(2), 159–171. https://doi.org/10.24310/innoeduca.2018.v4i1.2453

Peraza, C. X., & Zurita-Barrios, N. Y. (2020). Las bases de datos como estrategia didáctica para investigadores noveles. Análisis del comportamiento de las líneas de crédito a través de la corporación financiera nacional y su aporte al desarrollo de las PYMES en Guayaquil 2011-2015. *RECIMUNDO: Revista Científica de la Investigación y el Conocimiento4*(4), 19–29. https://doi.org/10.26820/recimundo/4.(4).noviembre.2020.19-29

Pin-Posligua, G. M. (2022). Análisis comparativo del desarrollo de las competencias digitales y uso de las TIC, en el docente ecuatoriano. *Código Científico Revista De Investigación, 3*(3), 349–366.

Reynosa, E., Serrano, E. A., Ortega-Parra, A. J., Navarro, O., Cruz-Montero, J. M., & Salazar, E. O. (2020). Estrategias didácticas para investigación científica: relevancia en la formación de investigadores. *Revista Universidad y Sociedad, 12*(1), 259-266.

Rivas, L. A. (2011). Las nueve competencias de un investigador. *Investigación Administrativa, 40*(108), 34-54. http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S2448-76782011000200034&lng=es&tlng=es

Roa, L. I., Díaz, T., & Estrada, L. (2022). Gestores de referencias bibliográficas y su impacto en las investigaciones. *e-Ciencias de la Información*, *12*(1), 96-113.

Rojano, Y., Contreras, M. & Cardona, D. (2021). El proceso etnográfico y la gestión estratégica de datos cualitativos con la utilización del aplicativo Atlas.ti. *Revista Saber, Ciencia y Libertad, 16*(2), 175 – 192. https://doi.org/10.18041/2382-3240/saber.2021v16n2.65001

Romero-Rodríguez, J. M., Hinojo-Lucena, F. J., Aznar-Díaz, I., y Gómez-García, G. (2022). Digitalización de la Universidad por Covid-19: impacto en el aprendizaje y factores psicosociales de los estudiantes. *RIED-Revista Iberoamericana de Educación a Distancia, 25*(2), 153-172. https://doi.org/10.5944/ried.25.2.32660

Romero-Rodríguez, L. M., Contreras-Pulido, P., & Pérez-Rodríguez, M. A. (2019). Media competencies of university professors and students. Comparison of levels in Spain, Portugal, Brazil and Venezuela / Las competencias mediáticas de profesores y estudiantes universitarios. Comparación de niveles en España, Portugal, Brasil y Venezuela. *C&E, Cultura y Educación, 31*(2), 326–368. https://doi.org/10.1080/11356405.2019.1597564

Rueda, G. (2023). Competencias digitales en educación superior en tiempos de pandemia COVID-19: Estudio comparativo Perú y España.*Revista Educación y Sociedad,4*(8), 56-66.https://doi.org/10.53940/reys.v4i8.161

Sánchez, L. (2022). Competencias TIC y uso de herramientas digitales para la investigación en docentes universitarios. *Conocimiento educativo, 9*(1), 25–41. https://doi.org/10.5377/ce.v9i1.14568

Saubern, R., Henderson, M., Heinrich, E., & Redmond, P. (2020). TPACK – time to reboot?. *Australasian Journal of Educational Technology, 36*(3), 1–9. https://doi.org/10.14742/ajet.6378

Snijder, R. (2016). Revisiting an open access monograph experiment: Measuring citations and tweets 5 years later. *Scientometrics, 109*(3), 1855–1875. https://doi.org/10.1007/s11192-016-2160-6

Soto, M., & Hanna, S. (2020). Desarrollo de competencias investigativas en participantes de maestría organizacional. *Gente Clave, 4*(1), 108-128.

Van Audenhove, L., Vermeire, L., Van den Broeck, W. and Demeulenaere, A. (2024), "Data literacy in the new EU DigComp 2.2 framework how DigComp defines competences on artificial intelligence, internet of things and data". *Information and Learning Sciences, 125* (5), 406-436. https://doi.org/10.1108/ILS-06-2023-0072

Vásquez, S., Vásquez, S. A., Vásquez, C. A., Alania, R., Díaz, M., & Gonzáles, M. del Águila. (2020). El perfil del docente investigador: hacia sus dimensiones y su fortalecimiento. *Apuntes Universitarios*, *10*(4), 69–88. https://doi.org/10.17162/au.v10i4.492

Vergara, D., Antón-Sancho, A., & Fernández-Arias, P. (2023). Engineering professors' habits: didactic use of Information & Communication Technologies (ICT). *Education & Information Technologies.* https://doi.org/10.1007/s10639-023-12110-y.

Zambrano, J. L. (2020). La sociedad del conocimiento: cantidad, categoría y género de los investigadores en Ecuador. *Mundos Plurales - Revista Latinoamericana de Políticas y Acción Pública, 6*(1), 73-92.

https://doi.org/10.17141/mundosplurales.1.2019.3855