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TEACHERS' TRAINING IN ICT: ANALYSIS OF SPANISH UNIVERSITIES' SYLLABI

PROFESORADO Y TIC: ANÁLISIS DE LOS PLANES DE ESTUDIO EN UNIVERSIDADES ESPAÑOLAS

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ABSTRACT

The training of future educators in Information and Communication Technologies (ICT) is a key directive of the European Higher Education Area. In order to understand how teachers acquire and develop their digital skills, this paper analyses

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the integration of ICT as a specific course into the curricula of the Pre-primary and Primary Education Teaching degrees and the Master's Degree in Secondary Education, Vocational Training, and Language Teaching for prospective teachers at both public and private Spanish universities. This descriptive, quantitative research investigated the heterogeneous ways in which the different centres have integrated ICT and has confirmed that most of them largely confine themselves to training in ICT through optional subjects. This approach is reductionist, thereby restricting both access and training. In conclusion, the analysis confirms that ICT training largely remains an unresolved issue for many Spanish universities.

KEYWORDS: ICT (Information and Communication Technology), digital skills, pre-primary education, primary education, secondary education.

RESUMEN

La formación de futuros educadores en Tecnologías de la Información y Comunicación (TIC) es una directriz clave del Espacio Europeo de Educación Superior. Con objeto de conocer cómo el profesorado adquiere y desarrolla sus habilidades digitales, este artículo analiza la incorporación de las TIC en los planes de estudios de los Grados en Maestro en Educación Infantil y Primaria; y en el Máster en Formación del Profesorado de Secundaria, Formación Profesional y Enseñanzas de Idiomas en universidades españolas públicas y privadas. Esta investigación de corte descriptivo mediante una metodología cuantitativa ha examinado el modo heterogéneo en que los distintos centros han incorporado las TIC y ha confirmado que la mayoría se limita a enseñarlas a través de asignaturas optativas. Esto muestra un enfoque reduccionista que limita el acceso y la formación. En conclusión, el análisis confirma

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que la formación en TIC continúa siendo una asignatura pendiente para muchas universidades españolas.

Palabras clave: *TIC (Tecnologías de la Información y Comunicación), competencia digital, educación de la primera infancia, enseñanza primaria, enseñanza secundaria.*

1. INTRODUCTION

The 21st century has brought major changes in terms of technological development. All these breakthroughs aim at saving time when carrying out complex tasks. Thus, ICT (Information and Communication Technology) has revolutionized the way individuals elaborate, acquire, and convey their knowledge. All these advances have had a significant impact, not only on the social, political, and economic spheres but also on the pedagogical field. Educational institutions have realized the need to modify and adapt their methodologies to keep up with a society that changes rapidly and is increasingly dependent on ICT. There is no doubt that these tools allow teachers to update the content of their courses, and the didactic models used in the classrooms of any given country (Bilbao-Aiastui *et al.*, 2021).

As a result, different political systems around the world have encouraged the use of ICT in all fields, especially in education, as it provides students and future citizens with the necessary tools and knowledge required by the fast, social, technological, and communicational development of our current society. This competence has been defined as "digital competence" and it has been largely recognised as one of the key competences for lifelong learning (European Parliament and the Council, 2006; The Council of the European Union, 2018). It emphasizes the importance of possessing technological skills alongside other skills that were already part of the traditional

curriculum, such as competence in linguistic communication or basic competence in mathematics, science, and technology, namely the STEM competence (Science, Technology, Engineering, and Mathematics).

Following this European recommendation, Spanish legislation also decided to integrate this digital competence in the educational curricula for the first time in the Organic Law on Education 2/2006 of 3 May 2006 (LOE, 2006). This piece of legislation was intended to develop the values of democratic citizenship, coexistence, and social cohesion among students of different educational stages. It included a total of seven basic competences, digital competence being one of its main ones. It stated that the latter should be applied in a cross-curricular manner in all courses of the curriculum. In fact, it incorporated a whole article regarding ICT (point 6 of article 111 bis):

> After consulting the Autonomous Communities, the Spanish Ministry of Education and Vocational Training will draw up and revise the reference frameworks for digital competence that guide the initial and ongoing training of teachers and facilitate the development of digital culture in schools and classrooms (LOE, 2006, p. 68).

This educational law was later amended or extended to other pieces of legislation. For instance, the Organic Law 8/2013 of 9 December (LOMCE, 2013) aimed at the improvement of educational quality whereas the current Organic Law 3/2020 in force since 29 December (LOMLOE, 2020) modified the previous Organic Law on Education 2/2006 of 3 May (LOE, 2006). It is worth mentioning that LOMLOE itself followed the guidelines set by its predecessor (LOE, 2006) and claimed:

> It is necessary for the education system to respond to this social reality and include a more modern and broader approach to digital competence in line with European recommendations regarding key competences for lifelong learning (LOMLOE, 2020, p. 122871).

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Taking all these European guidelines into consideration, educational authorities started to reflect upon the best way to train teachers and students in this regard. Thus, international organizations started to outline some proposals. The most relevant one was ICT competency standards for teachers: Competency Standards Modules released by the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2008). This proposal was followed by ISTE Standards for Educators: A Guide for Teachers and Other Professionals (Crompton, 2017) and ICT Competency Framework for Teachers (UNESCO, 2018).

As for European proposals, one of them is the Digital Competence Framework for Educators: DigCompEdu drafted by the European Union (Redecker, 2017). Nationally speaking, the Spanish Institute of Technology and Teachers Training also published the Common Framework in Teachers' Digital Competence (INTEF, 2014, 2017).

All these proposals present common pillars, although some of them differ on the areas that best guarantee teachers' digital training. However, it can be generally concluded that the most important area is the pedagogical dimension of the digital competence, as teachers should know how to design, teach, and evaluate their lessons and other formative processes through the use of technology.

As Marín-Suelves *et al.* (2022, p. 4) point out: "All proposals include, in one way or another, the promotion of students' digital competence through teachers' digital competence". Hence, teachers must possess a sufficient level of digital skills to contribute to and ensure the further development of technological skills and abilities in their students. Likewise, it is noteworthy that the Spanish Ministry of Vocational Training recently published the Resolution of 4th May 2022. The Spanish General Board of Territory Evaluation and Cooperation approved this resolution and updated the Reference Framework of Digital Competence (MEFP, 2022). This framework

followed the agreement reached by the Spanish Sectorial Educational Conference which underlines:

> In the educational context, its presence [ICT] must be seen from a dual perspective. On the one hand, as an object of learning itself together with literacy and numeracy since it is part of the basic literacy of all citizens in the compulsory educational stages [...] By virtue of the foregoing, this institution agrees on approving and considering within the scope of their competences, the update of the reference framework for teaching digital competence described in Annex I (MEFP, 2022, p. 67979).

This last framework update describes the relation among areas, competences, stages, levels, and indicators of achievement through a set of tables, descriptors, and statements that measure the level of performance reached on each level of digital competence.

Lastly, three additional pieces of legislation should be examined. They delve into the educational implications of ICT, transforming them into knowledge and applying them to the learning and different teaching stages of Early Childhood, Primary, and Secondary Education in Spain.

The first one is the Spanish Order ECI/3854/2007 of 27 December which establishes the necessary requirements to assess and deem university degrees of Early Childhood Education official in compliance with national educational standards. These requirements guarantee that all teachers are properly trained nationwide so they can work in such a category. Similarly, the Spanish Order ECI/3857/2007 of 27 December lays down the requirements for Primary Education Teachers, while the Order ECI/3858/2007 of 27 December outlines the requirements for Compulsory Secondary Education, Bachillerato (two years after Secondary Education from 16 to 18 years old), Vocational Training and the Teaching of Languages. All these Orders

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were published by the Spanish Ministry of Education and Sciences respectively (MEC, 2007a, 2007b, 2007c).

In addition to these normative documents, the scientific literature also supports the idea that digital competence should be integrated into the syllabi of different universities so as to provide future teachers with the digital skills and abilities required in the 21st century (Pérez-Díaz, 2019; Padilla-Hernández *et al.*, 2020; Gabarda Méndez *et al.*, 2021). In this respect, the research conducted by Losada Iglesias *et al.* (2012) examines the type and usage of educational technology in the Education degrees of 48 public universities in Spain after implementing the parameters of the European Higher Education Area. Comparably, the research conducted by Peirats Chacón *et al.* (2018) searches the ICT courses that are being offered in the syllabi of 37 Spanish public universities. As for Secondary Education, similar studies have been carried out. One of them conducted by Sánchez-Vera & Solano-Fernández (2023) displayed how ICT had been included in the syllabi of 45 public universities within the MAES degree (Master's degree in Teacher Training for Compulsory Secondary and Bachillerato Education, Vocational Training and Language Teaching).

Other studies revealed that after the COVID-19 pandemic, more institutions became aware of the importance of offering proper training in ICT skills (Leiva-Guerrero *et al.*, 2021; Pérez García, 2021; Alférez-Pastor *et al.*, 2023; Larrañaga *et al.*, 2023; Massouti, 2023), whereas several studies focused on analysing the perception future teachers have of themselves once they finish their degrees (Zhao *et al.*, 2021; Cañete Estigarribia *et al.*, 2022; Gutiérrez Porlán & Serrano Sánchez, 2016; Suyo-Vega *et al.*, 2022; García *et al*., 2023). Overall, these investigations demonstrated that despite being digital natives, ICT courses are still a sticking point when it comes to the skills future teachers should acquire (Cabero Almenara & Gutiérrez Castillo, 2015; Pérez-Escoda *et al.*, 2021; Markauskaite *et al.*, 2023).

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It is also evident that the educational system does not seem to guarantee a suitable development of the digital competence in future teachers of Early Childhood, Primary, and Secondary education (Jiménez-Hernández *et al.*, 2020; Pozo Sánchez *et al.*, 2020). A plausible solution might be combining new models and pedagogical methodologies with the digital competence as teachers demand training in a more specific and didactic application of ICT in the classroom (Gallardo-Fernández *et al.*, 2021).

Studies like the one conducted by Martín-Párraga *et al.* (2021) also prove that most teachers welcome being trained in gamification and being explained how this methodology can be implemented in the classroom from a didactic point of view. Alongside this positive feedback, teachers also evidence to benefit from a more mature acquisition and mastery of digital skills. Generally, the most requested topics are gamification, project-based learning, the creation of content and digital resources as well as the implementation of the flipped classroom dynamics (Turpo Gebera *et al.*, 2021).

This increasing interest in innovative methodologies linked to the use of ICT reaffirms the need to set clear benchmarks to assess how those digital competences are both acquired and applied by the teachers' community.

In this sense, specialised literature has approached this assessment from multiple angles, including the analysis from the institutions' perspective, the students' point of view as well as the results provided by peer-assessment (Kamandhari & Ponce, 2021).

Several studies have dwelled on the criteria and instruments used by universities and quality agencies to assess teachers' performance, highlighting methodologies such as BARS (Behavioral Anchored Rating Scales) and Likert scale-based questionnaires in face-to-face and online contexts (Matosas-López & Bernal-Bravo, 2020; Matosas-López *et al.*, 2024).

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These studies emphasise the importance of taking into account pedagogical aspects associated with the use of ICT to guarantee a more effective teaching process. Likewise, investigations such as those carried out by Nowell *et al.* (2010) have demonstrated the usefulness of students' quality reviews regarding teachers' performance. Other authors have stressed the need to define clear and coherent criteria to improve institutional certification and quality appraisal processes (Arnăutu & Panc, 2015; Matosas-López *et al.*, 2023).

Thus, this study has taken into account the existing theoretical and methodological literature to analyse how the digital competence is incorporated into teachers' initial training syllabi. It has also paid close attention to the role that this competence plays in the teachers' assessment and professional development processes.

Nonetheless, despite the growing literature corpus regarding the integration of ICT in teachers' training, there is still a significant shortcoming, since no comprehensive study has yet analysed the three key degrees required to become future teachers in Spain jointly— that is, the Degree in Early Childhood education, the Degree in Primary Education and the Master's Degree in Teacher Training for Compulsory Secondary and Bachillerato Education, Vocational Training and Language Teaching (MAES)—including both public and private universities.

This omission excludes a considerable part of the Spanish higher education system and limits the capacity to fully understand the real landscape of the implementation of the digital competence within the syllabi of Spanish universities.

To address this shortcoming, this study aims to analyse the level of digital competence among future teachers pursuing these three degrees by using a quantitative approach based on the systematic search for subjects that incorporate ICT in the syllabi of all Spanish universities.

In doing so, this study manages to broaden the scope of previous investigations and offers a holistic and up-to-date overview of the entire Spanish territory. Ultimately, this could contribute to improving training policies that are more equitable, coherent and aligned with the European recommendations advocating for the transferability of the digital competence in teachers' initial training.

Nevertheless, it should be noted that there might be level differences in digital competence depending on the type of the centres (public or private), ECTS credits (European Credit Transfer and Accumulation System), courses typology, or the stage at which these courses are taught. All these variables will give an insight into the heterogeneous way each educational centre has conceived the implementation of ICT in Spain.

After making up the corpus and following European Union guidelines on introducing ICT in a cross-curricular manner, the data and the findings will shed light on the way this competence is taught, whether it is partially or completely. To be precise, the study aims to confirm whether the teaching of ICT still needs to be improved at many Spanish universities.

2. METHOD

In order to conduct the research, an articulate quantitative exploration methodology has been employed. To be more specific, this is non-experimental cross-sectional research (Hernández-Sampieri & Mendoza Torres, 2018). It involved searching for, downloading, sorting, and analysing data on the Spanish universities that are offering ICT courses in the Early Childhood, Primary Education, and MAES degrees nowadays.

To accomplish this part of the study, an extensive search was carried out by looking at the database of the Registry of Universities, Centres, and Diplomas (RUCT, Registro de Universidades, Centros y Títulos in Spanish). This data is open and available to the public and can be found on the Spanish Ministry of Education and Vocational Training website.

Therefore, the sample selection was made using a convenience sampling method, as it included all universities offering these degrees and available in the RUCT database. This approach is appropriate for a descriptive analysis like the one described, as it allows to access a wide and easily accessible sample, which, by extension complies with the goals of the analysis.

The inclusion criteria to elaborate the matrices of the data are shown below (Table 1).

Table 1. Inclusion criteria in the RUCT search engine to collect the data

University	Type	Programs
All	Public and Private	Early Childhood Education Degree
All	Public and Private	Primary Education Degree
All	Public and Private	MAES

Source: Author's own elaboration.

Once the data was downloaded, it was analysed according to the following exclusion criteria: extinguished degrees and degrees that are about to be extinguished as this study only focuses on the university degrees that are being offered nowadays.

Once the list of educational centres that offer those degrees was cleared out, the study moved on to looking at all the university websites that offer those degrees. This task aimed at examining their syllabi as well as the number of ICT courses currently offered.

For that purpose, a matrix was filled out by collecting the following data: RUCT degree code, university, public or private university type, number of ICT courses offered, list of courses, link to its syllabus online, and remarks.

3. RESULTS

Data showed that 65 universities offer the Degree in Early Childhood Education whereas 60 universities offer the Degree in Primary Education. 40 public universities and 25 private universities offer the Degree in Early Childhood Education while 33 public universities and 27 private ones offer the Degree in Primary Education. As for Secondary Education, 77 universities offer MAES (42 of them public and 35 private).

Regarding the courses included in their syllabi, Table 2 shows a comparative analysis between the Degree in Early Childhood Education, the Degree in Primary Education, and the MAES degree, making a distinction between public and private universities in Spain.

On the one hand, it can be observed that category O refers to Obligatory courses in Table 2. BT refers to Basic Training and C to Core courses. All categories have been merged into the same category since students must take all these courses compulsorily.

Table 2. Comparative analysis of data collection

Program	Type	NU	ICT	Σ Sub.	O+BT+C	E	M
Early Childhood	Public	40	32	76	28	48	3
	Private	25	22	54	25	29	4
	Total	**65**	**54**	**130**	**53**	**77**	**7**
Primary	Public	33	28	50	23	27	2
	Private	27	21	49	22	27	2
	Total	**60**	**49**	**99**	**45**	**54**	**4**
MAES	Public	42	11	15	4	11	-
	Private	35	4	4	2	2	-
	Total	**77**	**15**	**19**	**6**	**13**	**-**

Source: Author's own elaboration.

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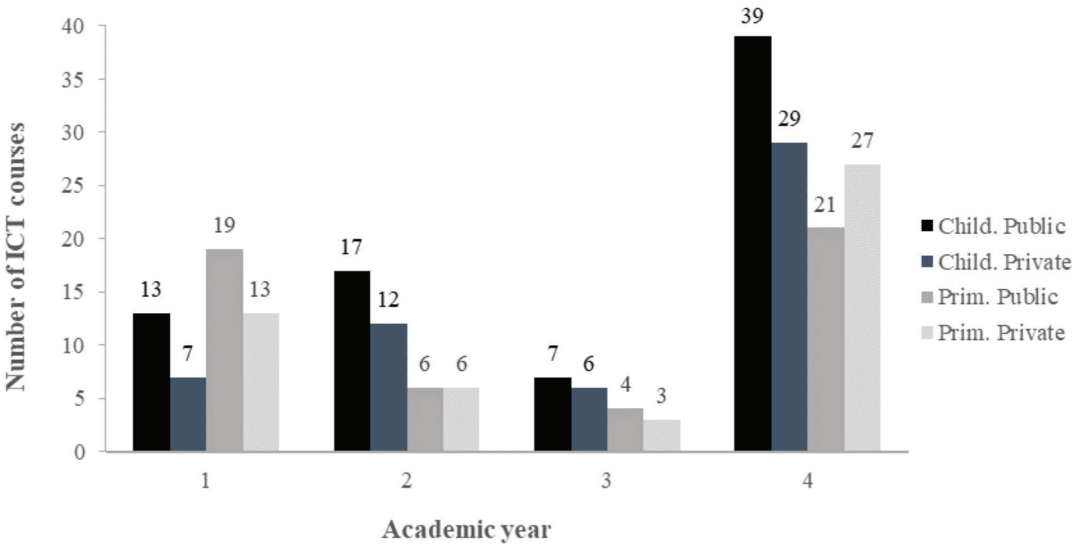
On the other hand, category E refers to those Elective courses that students choose depending on the academic path of their liking, training profile, or learning pace.

Furthermore, the table displays the number of Spanish universities (NU) that offer those degrees; the number of them that incorporate ICT in their syllabi (ICT); the total number of courses found (Σ Sub.) as well as the universities that offer a major related to ICT (M). Majors are those curricular specializations that integrate more specific courses and allow students to gain a deeper understanding of their area of study. They entail the completion of 30 ECTS credits of elective courses together with their corresponding teaching placements or internships.

Apart from the table, an additional figure has been created for a more appropriate discussion of the data (Figure 1). It presents the number of ICT courses per academic year, specific degree as well as university type (public or private).

Figure 1. ICT courses per academic year



Source: Author's own elaboration.

Notes. Child. means Degree in Early Childhood Education and Prim. means Degree in Primary Education.

4. DISCUSSION AND CONCLUSIONS

The results shown in Table 2 reveal that the Degree in Early Childhood Education is offered at more universities than the Degree in Primary Education. This finding is somewhat relevant insofar as children must attend Primary Education compulsorily in Spain by law. However, Early Childhood Education years are voluntary, and the decision is up to parents in most cases.

With respect to university type, the Degree in Primary Education is equally offered at public and private universities alike with no major difference. However, 60 % of public universities offer the Degree in Early Childhood Education in comparison to the smaller percentage of 40 % offered by private universities.

Moreover, when focusing on the research question of this study, it can be detected that 65 and 60 universities offer the Degree in Early Childhood Education and the Degree in Primary Education respectively. Nonetheless, only 22 universities (11 for each degree) do not offer ICT on their syllabi. Ultimately, this accounts for 17 and 18 % of the total number of universities analysed.

Similar data was found by Losada Iglesias *et al.* (2012). These authors verified that 87 % of public universities offered at least one ICT courses in their syllabi as opposed to 13 % of universities that did not offer any ICT courses.

Concerning the total number of ICT courses, the Degree in Early Childhood Education includes 130 courses related to this area as opposed to the 99 courses offered in the Degree in Primary Education.

Another noteworthy finding is that most ICT courses are offered as electives. To be precise, 77 courses are elective and 53 are mandatory within the Degree in Early Childhood Education whereas 54 courses are elective and 45 are mandatory

within the Degree in Primary Education. This accounts for 59 and 55 % of elective courses respectively.

With reference to the majors in the Degrees of Early Childhood and Primary Education, students usually must enrol in 5 courses to meet those 30 ECTS credits. Paradoxically, only 7 universities out of 65 and 4 out of 60 offer a major in ICT within the Degree in Early Childhood Education and Primary Education respectively.

Similar data was found by Peirats Chacón *et al.* (2018). Their research corroborated that only 20 % out of 30 universities analysed (this is 6 universities) offered a major in ICT.

Similarly, significant data is extracted from Figure 1. As can be observed in the graphic, most ICT courses are taken during the final fourth year of these degrees. As mentioned above, most syllabi offer those courses as elective courses, and this explains why most elective courses are taken during that final year.

When analysing degree and university type, universities usually offer more ICT courses within the Degree in Primary Education during the fourth year (27 private universities and 21 public universities) due to the reasons explained above. After that, a smaller number of ICT courses are offered during the first year of that degree (13 private universities and 19 public universities). However, the number of ICT courses offered during the second and third years is insignificant (<10 courses found).

As opposed to this trend, this tendency changes when looking at the Degree in Early Childhood Education. A higher number of ICT courses are offered during the fourth year following the same reasons stated before, but it then increases radically during the second year, followed by the first and the third year.

Furthermore, an interesting finding has been reported. Only one single university offers ICT courses throughout all the years of the degree in both Early Childhood and Primary Education degrees.

With regard to MAES, table 2 shows that it is the most widely offered degree in Spain (77 universities offer it in comparison to 65 and 60 universities that offer the Degree in Early Childhood Education and Primary Education respectively). It must also be pointed out that there is a higher number of public universities that offer it (42 public over 35 private universities). This circumstance also applies to Early Childhood and Primary Education, meaning that there are usually more public universities offering those degrees.

As for the MAES syllabus, it is important to bear in mind that it is delivered in one academic year so students must complete all courses, the master's final project as well as the internship in the educational centres altogether.

Once the corpus of universities that offer ICT in their syllabi was analysed, it was found that only 15 out of 77 institutions (11 public universities and 4 private) offer it. This accounts for a total of 19 % of Spanish universities that train future teachers of MAES, which means that 81 % of universities lack courses related to ICT.

Similar results were found by Sánchez-Vera & Solano-Fernández (2023). Their study only focused on public universities and when they reviewed their syllabi, they realized that more than half of the courses (56 %) failed to mention descriptors associated with ICT such as "Resources", "Digital", "Educational Technology", "Technology", "ICT", "Materials" and "Communication".

What is more, the same study claimed that 69 % of those universities failed to refer to the learning outcomes in their syllabi, which is usually expected since these are the contents students should have internalised by the time they end those courses.

When examining this topic in further detail, it is verified that out of those 15 universities that offer ICT courses (11 public universities and 4 private), only 19 courses take into account the digital competence in their syllabi. The same applies

to the degrees in Early Childhood and Primary Education, in which 68 % of these ICT courses are elective. The same results were collected by Sánchez-Vera & Solano-Fernández (2023). Their investigation confirmed that 64 % of analysed courses conceive ICT as mere elective courses. Similarly, only three public universities offered more than one ICT courses within the MAES degree, and these courses were elective as well.

Bearing these findings in mind as well as the literature review regarding this matter, it can be concluded that the digital competence has been integrated in a very miscellaneous way into Spanish universities' syllabi. This finding coincides with previous studies that have pointed out that educational institutions exhibit diverse approaches when it comes to integrating ICT in teachers' training programmes.

For instance, Arnăutu & Panc (2015) claim that assessments of teachers' performance must consider not only technical competences, but also pedagogical ones. This could explain why ICT subjects differ so much in terms of content and compulsory nature. This aspect is particularly relevant, as some universities offer majors in ICT, while others do not even include compulsory subjects in this area.

Moreover, it has been noted that more than half of Spanish universities, both public and private, incorporate ICT as elective courses exclusively, which reflects a similar trend observed in other international contexts. Kamandhari & Ponce (2021) state that the integration of ICT in the teachers' initial training is directly influenced by the way they perceive its value in the teaching process, a parameter that varies from one university to another. This could also be a reason why some universities opt for a more flexible approach, thus offering those subjects as elective courses.

Nevertheless, generally speaking, if we compare these approaches and ideas with the skills that have been contemplated in the different normative digital competence frameworks, it can be concluded that there is a remarkable gap between

the skills promoted by the European Union and their educational policies and the policies that have actually been implemented in most Spanish universities' syllabi.

In this regard, previous studies have shown that there is little alignment or correspondence between the academic training offered and the digital skills advised by European policies. Matosas-López & Bernal-Bravo (2020) suggest that universities tend to focus more on teachers' efficiency in face-to-face settings rather than on the digital competences that are needed in virtual or hybrid environments.

This ultimately reveals that important challenges persist in terms of teachers' training in both content updates and the coherent implementation of digital competences. This same challenge was also noted by Nowell *et al.* (2010) when assessing teachers' performance in different educational settings.

Despite the valuable contributions this study has made regarding the integration of the digital competence in the Spanish universities' teachers' training programmes, some limitations might be acknowledged. Firstly, the study has been carried out following a transversal design, which means that it sheds light on a particular situation at a particular point in time.

Given that the integration of the ICT in the syllabi can evolve, future investigations could benefit from a longitudinal approach to better understand the trends and advances throughout time. Additionally, this study used a convenience sampling, which means that the university selection took place at a specific point in time as well.

This can lead to biases, as some universities could have updated their syllabi after the data was collected, which in turn could affect the validity of the results. Consequently, future investigations could consider a more stratified sampling, as well as a longitudinal approach to provide a more compelling and updated overview of how the integration of the ICT has evolved in teachers' training programmes over time.

Another limitation has to do with the scope of the study as it solely focuses on Spanish universities. Although this provides a detailed insight into the Spanish higher education system, the results cannot be overgeneralised to other countries with different educational contexts or policies. An international comparative study could provide a wider overview of the way the digital competence is integrated into teachers' training programmes worldwide.

Lastly, the study mainly focuses on the presence of ICT subjects in the teachers' training programmes, but it fails to examine the teaching quality or the actual impact these subjects have on the development of the digital competence in depth. Future investigations could delve into the effectiveness of these programmes alongside the results demonstrating how future teachers acquire these digital competences.

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