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Family supervision and digital competence in primary education students

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Abstract

This study examines the extent to which family supervision influences the digital competence of primary school children in the use of information and communication technologies (ICT). The research interest stems from the limited investigations carried out to date at this level of education into students' digital competence with regard to their immediate future. Digital competence across the five DigComp areas (Information, Communication, Content Creation, Safety, and Problem Solving) was assessed and its association with family supervision examined in a sample of 379 pupils from 11 Andalusian schools. The methodology employed was quantitative, using a survey. To achieve the study's objectives, descriptive and inferential analyses (ANOVA) were conducted. A satisfactory level of digital competence was observed; moreover, significant differences were identified based on analysis of the family supervision variable. The results emphasize the need to address the opportunities and limitations of the technological resources provided by a networked society, both in family and institutional scenarios. In a broader context, the findings can help us understand the impact of family supervision on the development of digital competence in primary education students.

Keywords: Digital competence, Information and communication technologies, Family, School, Primary education

1 Introduction

The speed of digital transformation in the education sector has had a significant impact on the development of students' technological skills in both school and university contexts (Addimando et al., 2021; Aliyyah et al., 2020). But this acceleration has also revealed major opportunities and deficiencies in the development of digital competence (Watterston et al., 2024). Not only do digital gaps continue to exist, but they have also evolved towards new forms of digital inequality which now require urgent attention (Du & Wang, 2024; Li, 2022). Up until now, education policies have mainly focused on providing schools and universities with technological resources but have neglected the training of pupils and families in school contexts, so it is now necessary for citizens to adapt and learn to use those resources. In primary education, this situation poses its own specific challenges. The latest international reports published by the European Commission (2022) and the OECD (2023a, b) suggest that digital competence is a decisive factor in future employability and effective citizen involvement. Moreover, according to

a report produced by the Digital Economy and Society Index, 36% of Spain's population is lacking in basic digital skills, with minors from underprivileged socio-economic backgrounds being particularly affected (European Commission, 2023). This situation is especially worrying in the group known as the "Alpha Generation", children born after 2010, who have major shortcomings in critical, creative and safety-related skills (Forma, 2025; Lissitsa, 2025; Vissenberg et al., 2023).

The conceptualisation of digital competence has evolved markedly over the last ten years, in both theoretical and structural terms. Following the initial versions of the European Framework for Digital Competence (DigComp 1.0, 2.0 y 2.1), the publication of DigComp 2.2. (Vuorikari et al., 2022) represents a significant change, incorporating 250 new examples of knowledge, skills and attitudes better adapted to the current technological situation. These include artificial intelligence, the Internet of Things, and data verification. This latest version is a step forward from a competency model focused on the instrumental use of technology to one oriented towards critical thinking and responsible digital citizenship (Falloon, 2024; Xu et al., 2025). DigComp 2.2. reinforces the five previously established areas of competence but adds emergent categories such as digital sustainability, digital identity and reputation management, and digital wellbeing. These elements are particularly relevant for an understanding of how minors develop digital competence over time in ever more complex environments (Machackova et al., 2024).

Such an ecosystemic approach is of key importance for the present study insofar that it addresses pupils' digital competence not as an isolated, individual process but as the result of interaction and interrelationships between multiples contexts where the family plays a major role (Flynn et al., 2024). The impact of family on the development of digital competences has become increasingly more important, moving from restrictive parental mediation to more complex models of digital co-responsibility (Livingstone & Blum-Ross, 2020). Longitudinal studies like those of Vissenberg et al. (2023) and Long and Qin (2025) have shown that the presence or absence of family supervision with regard to the control and use of technology is insufficient as a variable with which to understand the acquisition and development of digital skills, and it is therefore necessary also to study the quality, consistency and type of parental mediation exercised. Another thing to be taken into account is the digital mentoring divide, marked by families' very limited capacity to provide their children with effective guidance about how to use technology (Heunis et al., 2022).

In view of the above, the aim of this study, which forms part of a broader project, is to identify the digital competence needs of Andalusian schoolchildren in their closest circles and establish a series of guidelines that will help alleviate any shortcomings and guarantee the wellbeing of the target population. The most solid justification for the study is its timeliness: access to the internet, and in particular the development of digital competence, are of vital importance for protecting the youngest members of the population from social exclusion, ensuring equality of access and the communication of cultural and educational assets. The work's innovation lies in the fact that in Andalusia no researchers have to date carried out this type of analysis in real contexts, even though international institutions like the OECD (2023a, b) and the European Commission (2023) have called for countries to implement and evaluate digital literacy programmes. According to the European Commission, by 2030 the demand for highly qualified

workers will account for 43% of the total demand for personnel. This demand can only be met if we are able to offer an education better geared towards digital competences and suitable ongoing training. The development of ICTs in Spain has been crucial in our area of interest. According to data from Spain's National Institute of Statistics, 67.6% of Andalusian children have mobile phones, 89.1% access internet frequently, and 85.1% have computers (INE, 2024). In this situation, present-day societies need their education systems to prepare citizens and professionals to meet the new requirements of a constantly changing labour market (López-Belmonte et al., 2020). ICTs are used in all sectors, including education (Gutiérrez-Castillo et al., 2017), and such a key competence as digital competence should be cultivated right from school. Different terms have been used to identify and analyse the items of knowledge, capacities and attitudes that make up digital competence. Apart from "digital competence" itself (Casillas-Martín et al., 2020; Holguin-Álvarez et al., 2020; Reisoğlu & Çebi, 2020), these include "digital literacy" Ivanovich et al., 2020; McDougall et al., 2019; Smith et al., 2020) and "media literacy" (De la Fuente Prieto et al., 2019; González-Fernández et al., 2019). The most frequently used terms are digital competence and digital literacy (Pöntinen & Räty-Záborszky, 2020). In its recommendation C 189, and with regard to the safe, responsible use of technology for learning, social involvement and interaction, the European Commission (2018) recognises digital competence as one of the eight key competences for the twenty-first century citizen (Recio-Muñoz et al., 2020). Among other things, the recommendation also covers literacy, communication and collaboration, the creation of digital content, safety, problem solving and critical thinking (p.9). To develop efficient education policies capable of integrating ICTs in education systems and encouraging the cultivation of digital competence, it is very important to know the extent to which different social variables can influence its acquisition and evolution, research already having been carried out into the influence of socio-family variables. In a study carried out with Russian students, Kozlov et al. (2019) showed that the barriers which prevent the development of digital competence depend on three things: geographic-regional factors, socio-economic factors and personal factors. In Norway it was found that family precedents with regard to language integration and the number of books in the home were predictors of digital competence levels among 7th-grade students (Hatlevik & Tømte, 2014). In Kosovo, Shala and Grajcevci (2018) concluded that inclusion in academic environments, good socio-economic circumstances and living in urban rather than rural areas all positively impacted the development of digital competence.

In the context of the compulsory education system for competency appropriation among primary school pupils, optimal digital competence as an object of study into citizenship is a highly relevant issue of concern, enabling children to address and adapt to the rapid changes being brought about by technological development in contemporary society (Colette & Da Silva, 2014; Martínez-Piñeiro et al., 2018) and thereby guaranteeing their social inclusion in the future. At present, the importance of digital competence for active participation in society is already unquestionable: low levels of digital competence restrict access to culture and impede the exercise of rights. As Martínez-Piñeiro et al. (2018) put it, possession of digital competence does not guarantee social inclusion but the lack of it may generate exclusion processes or make it difficult to escape from such situations (p.23). In primary education, few studies exist which propose evaluating

digital competence (Martínez-Piñeiro et al., 2019)—something that does not happen at the secondary and university levels of education. Also, most research is based on students' own perception of their competence (Freitas-Cortina et al., 2019), which may result in erroneous assessments of their true capacity. Students tend to overestimate their level of digital competence, especially at earlier ages (Hutchison et al., 2016; Kuhlemeier & Hemker, 2007; Paredes-Labra et al., 2019). Furthermore, the results obtained in these studies do not concur in their diagnoses of digital competence levels among primary school children: some affirm that they have an appropriate level of digital competence (Amor & Serrano, 2019; Zhang & Zhu, 2016), some suggest an intermediate level (Hutchison et al., 2016; Freitas-Cortina et al., 2019), and some a low level (Colás-Bravo et al., 2017; Martínez-Piñeiro et al., 2019). As institutions, schools can do more to prepare young people for their role as future citizens, although in a digital society it is families that constitute the broader environment which determines how children access, use and interact with the new technologies. Torrecillas-Lacave et al. (2017) say that families are a key factor in empowering the youngest ones in digital competence. This would explain the observation by Aguilar and Urbano-Contreras (2014) that families are open to receiving training to acquire an adequate level of digital competence and thus be able to close the obvious generation gap in the use of information and communications technology—a divide which results in both families and, sometimes, even schools themselves, not being able to offer guidance in the safe, responsible use of ICTs. This, as described by Plaza and Caro (2016), is now known as the "generational digital divide". The role played by families is therefore crucial for increasing children's knowledge and skills so that they can use ICTs safely and appropriately (Peñalva-Vélez et al., 2017). As indicated by Aguilar and Urbano-Contreras (2014), family and school should receive such training to offset the negative effects of this digital—and, at the same time, generational—divide in the use of ICTs. This situation is important mainly because it implies a reversal of the teaching–learning process that has evolved concerning the integration of ICTs. In the twentieth century it was the adults who provided the knowledge and the experience map necessary to train people, while in the twenty-first century it is the young people who know about the new codes of online activity—a microsystem in which families often find themselves lost (Garrido-Lora et al., 2016). One study, carried out for the European Commission by Chaudron et al. (2018) and looking at how children aged between 0 and 8 years interact with the new technologies, found that digital skills are acquired mainly at home. It also suggested that children in that age group are more aware of the risks associated with new technologies if their school integrates them meaningfully in the education process. Ortega et al. (2012) reported that ICTs are seen in a positive light by minors because, for them, the internet becomes a space where friendships are cultivated and improved, especially when accessed from mobile devices, which offer greater freedom, lack of parental control, intimacy and more flexible behavioural patterns. In this respect, there is much talk today about cyber safety, data protection, personal identity in digital environments, sexting, grooming, cyberbullying and people's own privacy. When these things are poorly managed, children become a vulnerable group susceptible to those types of threats. Such risks are mostly determined by poor use of ICTs, lack of training regarding their responsible, appropriate use, and lack of family supervision (Durak et al., 2024).

In recent years, international evidence has mapped domain-specific and gendered profiles of pupils' digital competence. The UNESCO Global Education Monitoring 2024 Gender Report calls for gender-responsive approaches to technology in education, noting that girls' experiences online shape confidence, participation and opportunity structures in learning (UNESCO, 2024). In parallel, OECD (2023b) shows substantial cross-system variation in students' confidence and use of technology for learning, with gender intersecting access and practices (OECD, 2023a, b). ICILS 2023 further indicates that average gender differences in computer and information literacy (CIL) and related domains are small yet systematic and context-dependent (International Association for the Evaluation of Educational Achievement (IEA), 2025). Cross-country analyses corroborate links between knowledge, attitudes and skills (Campos & Scherer, 2024). Complementary monitoring documents gendered confidence profiles and distinct practices already in childhood (Ofcom, 2025). In Spain, recent work reports dimension-level differences in youths' digital competence, especially between informational and technical facets, underscoring the value of examining upper-primary pupils and the role of family supervision (Estanyol et al., 2023). Finally, programme evidence suggests schools can lift competence and that girls may benefit strongly when tasks align with their starting profiles (Bueno-Baquero et al., 2025).

In the present study, the primary research objective was to determine whether family supervision is associated with 6th-grade pupils' digital competence across the five DigComp areas (Information, Communication, Content Creation, Safety, and Problem Solving). The specific objectives of the study were as follows:

1. To assess 6th-graders' digital competence across the five DigComp areas within their school environments.
2. To analyse the link between family supervision and the level of digital competence acquired by 6th grade primary school pupils.

2 Methodology

This research was non-experimental and descriptive. Data were collected using the survey method, with a purpose-designed questionnaire providing the basic procedure for gathering information about the schoolchildren. The instrument was designed to identify the pupils' needs regarding the evolution of their digital competence and an expert-opinion-based validation process was developed for it. A total of 10 experts in digital competence and professionals working in different educational contexts assessed the importance, relevance and clarity of the indicators using an online Likert-type questionnaire with a scale of 4 possible answers (1—not at all, 2—a little, 3 – quite a lot, and 4—a lot). To check the questionnaire's internal consistency, an instrument reliability analysis was carried out, obtaining a Cronbach's alpha value of 0.906. This is considered a very good score. In the different dimensions, the following values were obtained: Information—0.741; Communication—0.782; Content Creation—0.848; Safety—0.836; Problem Solving—0.787.

The study was carried out in the Autonomous Community of Andalusia, province of Jaén. A convenience (cluster) sampling of intact 6th-grade classrooms was used: headteachers were contacted and, upon agreement, the online questionnaire was

administered in class to all pupils in the classes, with all 6th-grade pupils invited to participate. Written authorisation was obtained from the school management teams; active parental consent was sought and obtained, and pupils provided assent prior to completing the survey; the participants were at all times kept informed regarding the purpose, confidentiality and anonymity of the study.

The questionnaire was administered electronically using a digital tool for creating online questionnaires (https://tinyurl.com/yevlffwk), and the information was collected between May and July 2023.

Participants were recruited from 11 schools in the province of Jaén. All 6th-grade classes in participating schools were invited; no exclusion criteria other than grade level and parental consent were applied. The real sample generating the data comprised a total of 379 6th-grade primary school children from schools in the province of Jaén; 68.5% of pupils came from urban catchments and 31.5% from peri-urban catchments. 50.4% of the children were boys and 49.6% were girls. 94.7% of the total number were younger than 12 years old; 4.2% (16) were 12 years old; 0.8% (3) were 13 years old; and 0.3% (1) were older than 13. Based on school-catchment information, 73.5% of the sample came from medium–high socio-economic contexts and 26.5% from medium–low contexts. The whole process was carried out in compliance with the ethical standards in accordance with the Declaration of Helsinki (last revised in 2013) (1975).

The data was processed using the SPSS statistical package for Mac, version 24. An analysis was carried out covering the principal statistical parameters such as the mean ($\bar{x}$), standard deviations (SD) and standard error of the mean (SEM). The data was subjected to an analysis of variance (ANOVA) to find out whether there were any statistically significant differences between the five dimensions included in the instrument that would throw light on the link between the pupils' digital competence, gender (girls vs. boys) and family supervision. To find out whether any statistically significant differences existed between the pupils' own perception of their knowledge of the areas identified in DigComp, a multivariate analysis of variance (ANOVA) was performed based on the general linear model and taking into account family supervision.

3 Results

The results provided information about the schoolchildren's levels in each of the five areas of digital competence, and also about the possible differences between those levels that may be associated with family supervision. With regard to supervision by parents or tutors of the time their children spend using the described devices, 60.2% of the children said they were always supervised by parents or tutors when using those devices (frequency: 228); 36.7% said they were supervised sometimes (frequency: 139); and 3.2% said they were never supervised (frequency: 12). Turning to with whom the children use their devices, 86.8% said they use them in the family environment; 68.3%; said they use them with their group of friends; over half of them said they use them with their classmates; around 40% said they also use them with teachers; and 14% said they did not use them with anyone else. Under 1% of the respondents reported using devices with brothers or sisters, at school or alone. Regarding the place where the schoolchildren use their devices, 99.2% of the total sample said they use them at home, 16.2% said they use them outdoors and 18% said they use them at

school. A small percentage of the children (under 1%) also said they use their devices in other families' or friends' houses, in restaurants, and even in the car. One important thing to consider is the children's possibility of accessing internet from home. According to the information obtained, 98.9% of the children had an internet connection at home and 1.1% said they did not.

To establish the children's levels in each of the five areas of digital competence, overall standard deviations and means were analysed by dimension. Specific frequencies and response percentages were also analysed. It should be noted that the first dimension (Information), with ($\overline{x} = 2.83$), was made up of items designed to obtain information that would reveal whether the pupils were capable of identifying, localising, retrieving, storing, organizing and analysing digital information and then evaluating its purpose and relevance. In principle, the pupils obtained high scores for knowing how to find information online using search engines ($\overline{x} = 3.53$) and, having found it, successfully selecting it ($\overline{x} = 3.38$). However, with regard to their ability to compare different sources of information ($\overline{x} = 2.63$) and be certain that all the information they find is reliable ($\overline{x} = 2.90$), the trend became negative.

In dimension 2 (Communication) ($\overline{x} = 3.4$), the idea was to find out how the schoolchildren communicate in digital environments, how they use online tools to share resources, connect and collaborate with others, and how they interact and participate online. From the typical deviations and mean values of the items included in this dimension, it can be seen that most of the pupils' scores lay close to the positive slopes of the established scale, with the children's highest levels of competence being found in the items addressing awareness of the risks of sharing information online ($\overline{x} = 3.51$) and the safeguarding of privacy on the internet ($\overline{x} = 3.71$).

To learn more about the 6th-graders' competence in Content Creation, ($\overline{x} = 2.90$), we analysed their capacity to create and edit new digital content, and to integrate and recreate previously acquired knowledge and content. We also considered their ability to create new artistic products, multimedia content and computer programmes, and to always know how to deal with issues related to intellectual property and use permits. The results obtained reflect a general tendency towards the lower end of the scale when talking about digital content creation via presentations ($\overline{x} = 2.88$), or using audio files ($\overline{x} = 2.29$), video ($\overline{x} = 2.80$), or cloud-based tools ($\overline{x} = 2.33$).

With regard to their capacity to edit their own content or content produced by others, 12.9% of the schoolchildren said they were unable to do it; 22.2% said they weren't very capable of doing it; 33.4% considered themselves fairly capable and 33.5% considered themselves very capable. When asked about their ability to express themselves creatively using the new technologies, the positive trend increased, with 40.6% saying they were very capable and 38.8% saying they were quite capable, although, in contrast, 15.6% considered themselves not very capable and 5% did not consider themselves capable at all. Thirdly, and regarding awareness that certain content used online is subject to copyright, 46.6% of the children said they were aware, 30.6% said they were fairly aware, 13.7% said they were not very aware, and 9.2% said they were not aware at all. Finally, with respect to their ability to install, update and/or uninstall programmes on different devices, around 70% of the children said they were very capable, 18.5% said they were fairly capable, 7.4% said they were not very capable, and 5% said they were not capable at all.

Table 1 Descriptors Supervision*Dimension 1. Information

		N	Mean	Standard Deviation	Standard Error	95% confidence Interval for the mean		Minimum	Maximum
						Lower Threshold	Upper Threshold		
I reflect on the information I find	Always	228	3.18	0.742	0.049	3.08	3.27	1	4
	Sometimes	139	2.88	0.933	0.079	2.73	3.04	1	4
	Never	12	3.00	1.128	0.326	2.28	3.72	1	4
	Total	379	3.06	0.840	0.043	2.98	3.15	1	4

Table 2 ANOVA Supervision*Dimension 1. Information

		Sum of Squares	gl	Mean-Square	F	Sig.
I reflect on the information I find	Between groups	7.339	2	3.670	5.325	0.005*
	Within groups	259.141	376	0.689		
	Total	266.480	378			

*indicates a statistically significant difference (p .05)

The Safety area focussed on the protection of personal data, digital identity, and digital content and on security measures for the safe, responsible use of technology. The mean score obtained in this dimension was 3.56. At user level, one of the most important issues when using technology is the protection of devices that are used on a day-to-day basis—the key element in cyber safety in the face of the threats encountered during internet use. Here, 63.9% of the children said they protect their devices a lot in one way or another; 24.8% said they protected their devices quite a lot; 8.2% said they did not protect their devices very much; and 3.1% said they did not protect their devices at all.

The last dimension included in the instrument was Problem Solving, focussing on the schoolchildren's ability to identify needs associated with the use of digital resources, to meet those needs, and to identify shortcomings in their digital competence, their creative use of technology and their solving of technical problems. The results obtained reveal the existence of competence deficiencies among pupils with regard to taking the initiative in problem solving when technology does not work ($\overline{x} = 2.80$).

The results correlating the family supervision variable as recorded for the families of the children taking part in the study with the different dimensions in the instrument confirm that, in Tables 1 and 2, the dimension 1 no statistically significant differences exist in any of the items except the one referring to the children's reflection on the information they find online ($F = 5.325$; $p = .005$).

With regard to reflecting on the information found online, however, the results confirm that it is those pupils who are always supervised who have greater competence (mean score: 3.18), as opposed to those who are only sometimes supervised (mean score: 2.88).

With regard to supervision and dimension 2 in the instrument (Communication), the data obtained reveals two dependency relationships, manifested in the p value, which is lower than 0.05 in both items. Considering the means, and having applied Tukey's range test, differences can be seen between the mean values of the items

referencing communication-tools-based interaction with peers ($F = 4.979$; $p = .007$) and knowing how to share the files and content being used ($F = 6.162$; $p = .002$). In the first case, it is those children who are never supervised who seem to interact more using communication tools ($\overline{x} = 3.83$), in comparison with those who are always supervised ($\overline{x} = 2.96$). In the second case, it is those children who are never supervised who show greater competence in knowing how to share the content and files they are using ($\overline{x} = 3.92$). This seems to suggest that self-learning takes place in the use of technology to solve problems in the children's everyday situations (Table 3).

Table 3 Descriptors and ANOVA of Supervision*Dimension 2. Communication

		N	Mean	Standard Deviation	Standard Error	95% confidence interval for the mean		Minimum	Maximum
						Lower Threshold	Upper Threshold		
I interact with other companions using different communication tools (WhatsApp, Instagram, online forums)	Always	228	2.96	1.088	0.072	2.82	3.10	1	4
	Sometimes	139	3.16	0.995	0.084	2.99	3.33	1	4
	Never	12	3.83	0.389	0.112	3.59	4.08	3	4
	Total	379	3.06	1.051	0.054	2.95	3.17	1	4
I know how to share the files and content I use	Always	228	3.34	0.888	0.059	3.22	3.45	1	4
	Sometimes	139	3.10	0.958	0.081	2.94	3.26	1	4
	Never	12	3.92	0.289	0.083	3.73	4.10	3	4
	Total	379	3.27	0.915	0.047	3.18	3.36	1	4
ANOVA Supervision*Dimension 2. Communication									
		Sum of Squares		**gl**		**Mean-Square**		**F**	**Sig.**
I interact with other companions using different communication tools (WhatsApp, Instagram, online forums)	Between groups	10.775		2		5.387		4.979	0.007*
	Within groups	406.829		376		1.082			
	Total	417.604		378					
I know how to share the files and content I use	Between groups	10.047		2		5.023		6.162	0.002*
	Within groups	306.502		376		0.815			
	Total	316.549		378					

*indicates a statistically significant difference (*p* .05)

Although no statistically significant differences were found in the other items, some of the results obtained were nevertheless of interest. For example, those children who receive no type of supervision seem to be more aware of the dangers of the internet, and know what type of information to share, in comparison with those who are supervised. However, they are also more careless with regard to privacy. They are also the ones who seem to be better at using different technological tools to produce work, especially cloud-based applications. The data obtained can be described as characteristic of such children because most learning about how to use technology takes place experimentally, on a personal trial-by error basis.

With regard to family supervision of how technology is used and dimension 3, Content Creation, no statistically significant differences were found to exist. There were no significant differences between mean values in any of the items in this dimension.

For the supervision variable and dimension 4 (Table 4), Safety, two dependency relationships were identified, to do with knowing how to avoid cyberbullying and understanding teacher-imposed restrictions on the use of technology.

Looking at the statistically significant differences found (Table 5), it can be seen that it is those children who are never supervised who say they know more about how to avoid cyberbullying ($\overline{x} = 3.92$), as opposed to those who are supervised always ($\overline{x} = 3.20$) or

Table 4 Descriptors Supervision*Dimension 4. Safety

		N	Mean	Standard Deviation	Standard Error	95% confidence interval for the mean		Minimum	Maximum
						Lower Threshold	Upper Threshold		
I know how to avoid cyberbullying	Always	228	3.20	0.886	0.059	3.08	3.31	1	4
	Sometimes	139	3.28	0.933	0.079	3.12	3.44	1	4
	Never	12	3.92	0.289	0.083	3.73	4.10	3	4
	Total	379	3.25	0.899	0.046	3.16	3.34	1	4
I understand why my teachers limit my use of the new technologies	Always	228	3.68	0.627	0.042	3.60	3.77	1	4
	Sometimes	139	3.49	0.802	0.068	3.35	3.62	1	4
	Never	12	3.67	0.651	0.188	3.25	4.08	2	4
	Total	379	3.61	0.701	0.036	3.54	3.68	1	4

Table 5 ANOVA Supervision*Dimension 4. Safety

		Sum of Squares	gl	Mean-Square	F	Sig.
I know how to avoid cyberbullying	Between groups	6.095	2	3.047	3.831	0.023*
	Within groups	299.093	376	0.795		
	Total	305.187	378			
I understand why my teachers limit my use of the new technologies	Between groups	3.321	2	1.660	3.418	0.034*
	Within groups	182.664	376	0.486		
	Total	185.984	378			

*indicates a statistically significant difference (*p* .05)

sometimes ($\overline{x} = 3.28$). And with respect to the pupils' understanding of why teachers limit their use of technology, it is those children who are always supervised who better understand that situation ($\overline{x} = 3.68$), in comparison with those who are supervised only sometimes ($\overline{x} = 3.49$) or never ($\overline{x} = 3.67$).

Turning to the correlation between the supervision variable and dimension 5 (Table 6), Problem Solving, there were statistically significant differences with regard to reflecting on information found online ($F = 5.325$; $p = .005$).

Here, the mean values indicate that it is those pupils who are always supervised who seem to reflect more on the information they find online ($\overline{x} = 3.18$), in comparison with those who are supervised only sometimes ($\overline{x} = 2.88$) or never ($\overline{x} = 3.00$).

4 Discussion

This discussion reconnects our findings to the study aims. We set out to assess 6th-graders' digital competence across the five DigComp areas and to examine its association with family supervision using ANOVA. Interpreting the domain-level profile alongside recent international evidence clarifies where schools and families can act most effectively. The study confirmed the dimensions included in the instrument—Information, Communication, Content Creation, Safety and Problem Solving—as digital competence dimensions applicable to 6th-grade primary school children, thus coinciding with the analyses reported in the corresponding systematic review (Cabero-Almenara et al., 2018). In our data, dimension-level analyses revealed no statistically reliable gender differences in digital competence: all contrasts were non-significant and the corresponding point estimates were small in magnitude. OECD (2023b) underscores that technology-for-learning practices and self-beliefs vary across systems and groups (OECD, 2023a, b), and ICILS 2023 indicates that observed gaps, when present, cluster by domain and are sensitive to school-level conditions (International Association for the Evaluation of Educational Achievement (IEA), 2025). Related evidence documents gendered profiles in Spain (Estanyol et al., 2023), developmental trajectories through adolescence (Gnambs & Hawrot, 2025), and the influence of instructional design in computer-science contexts (Kwon et al., 2025). Programme-level evaluations further show that targeted activities can raise competence and at times narrow gaps, including girls' post-programme gains (Bueno-Baquero et al., 2025). Taken together, this literature suggests that any gender effects are modest and context-dependent, consistent with our null findings in this setting.

With regard to Communication, we found that those children who are never supervised seem to engage more in communication-tool-based interaction with companions than those who are always supervised by their families. This concurs with the findings of Chaudron et al. (2018) in their study into how children aged between 0 and 8 years interact with the new technologies and acquire digital skills at home. A lack of supervision also makes children interact and share content more intensely. The fact that it is unsupervised children who display greater competence in this dimension suggests self-learning in the use of technology to solve everyday problems.

It is also possible that having greater communication skills with friends, classmates and other people online may constitute a useful resource with which to address the risk associated with disinformation. Social support and communicating with other

Table 6 Descriptors and ANOVA of Supervision*Dimension 5. Problem solving

		N	Mean	Standard Deviation	Standard Error	95% confidence interval for the mean		Minimum	Maximum
						Lower Threshold	Upper Threshold		
I reflect on the information I find	Always	228	3.18	0.742	0.049	3.08	3.27	1	4
	Sometimes	139	2.88	0.933	0.079	2.73	3.04	1	4
	Never	12	3.00	1.128	0.326	2.28	3.72	1	4
	Total	379	3.06	0.840	0.043	2.98	3.15	1	4

ANOVA Supervision*Dimension 5. Problem Solving

		Sum of Squares	gl	Mean-Square	F	Sig.
I reflect on the information I find	Between groups	7.339	2	3.670	5.325	0.005*
	Within groups	259.141	376	0.689		
	Total	266.480	378			

*indicates a statistically significant difference (*p* .05)

people after a negative online experience constitute an effective strategy for handling new interactions online (Cebollero-Salinas et al., 2025; Vandoninck & d'Haenens, 2015; Vandoninck et al., 2013).

With regard to Safety, it must be understood that pupils who are supervised are much less vulnerable to the risks and threats present on the internet, although, admittedly, supervision with no real training in the appropriate use of technology may result in children being enclosed in an overprotective bubble where, when they begin to use technology more frequently to socialise and communicate in digital environments, they will not really understand how to act appropriately, as described by Ortega, et al. (2012).

It can therefore be concluded that, with regard to Safety, the family supervision variable is influential in those children who do not receive supervision, who were generally found to know more about how to avoid cyberbullying than those who are supervised. Unlike unsupervised children, however, children who are supervised are more capable of understanding the limits imposed on their use of technology at school (Haddon et al., 2020; Helsper et al., 2020; Mascheroni et al., 2022).

Most children, according to their own perceptions, have an overall medium level in the five areas of digital competence (Hutchison et al., 2016; Kuhlemeier & Hemker, 2007; Freitas-Cortina et al., 2019). In Safety and Communication, their level is only satisfactory, and they score the lowest, on average, in Content Creation. The development of this last area of competence is influenced by the use of devices in the home environment and by connection to the internet rather than by gender, which is unrelated to any differences between the participants in the survey. This suggests that it may be conditioned by the children's socio-cultural background.

Addressing Objective 1, we assessed pupils' digital competence across the five DigComp areas. Overall, self-reported levels were medium, and the weakest domains were Content Creation and Information, with more responses clustering at the lower end of the scale, indicating vulnerabilities in creative production, copyright awareness, and source evaluation. Safety and Communication were satisfactory on average, although unsupervised pupils reported higher engagement with communication tools and greater awareness of cyberbullying alongside more careless privacy practices. Finally, Problem Solving revealed limited initiative when technology fails, while pupils who were always supervised reported more frequent reflection on online information. Taken together, this domain profile pinpoints concrete training needs at the end of primary school. This suggests a greater risk of disinformation and danger online (Haddon et al., 2020).

Turning to the second objective, "To analyse the link between family supervision and the level of digital competence acquired by 6th-grade primary school pupils", the results for Information suggest that those pupils who receive general supervision have greater digital competence and are able to reflect on the information they find online. The problem is that, according to Keeley and Little (2017) and El-Asam et al. (2021), they lack appropriate training in digital competences, and this makes it difficult to provide suitable support. Another associated concept, that of "sharenting" (overexposure of children on digital platforms by families) also forms part of the debate about child protection (Goggin & Ellis, 2020; Keeley & Little, 2017).

With regard to Problem Solving, the study identified a lack of reflection about the information found on the internet. Here, children who receive general supervision were found to show higher levels of reflection than other children. Importance should therefore be attached both to family supervision and to digital empowerment and its associated problems (Flynn et al., 2024; Verdoodt et al, 2025). Families require specialised training to equip them with the digital skills they need to solve problems online (Martínez-Cao et al., 2021; Caton & Landman, 2022; Kalmus et al., 2022; Alfredsson et al., (2020).

On the other hand, current psychological research shows that children's digital behaviours, and the practices elicited by platforms, shape socio-emotional e-competencies and how pupils recognise, manage, and recover from online risks. Specifically, a meta-ethnography with 8–12-year-olds conceptualises digital resilience as relational and co-constructed across home and school, supporting school–family scaffolding in upper-primary (Hammond et al., 2024). Likewise, multicentre adolescent evidence links problematic use to escapism and coping repertoires, thereby underscoring the need to teach active, problem-focused strategies rather than avoidance (Demirdöğen et al., 2024). Moreover, complementary studies indicate that co-design with young people yields acceptable, context-fit resources that build digital (health) literacy and can be integrated into classroom tasks (Aloi et al., 2025; McGovern et al., 2025).

5 Conclusions

This study's biggest contribution is that it effectively answers the research question about whether family supervision affects the development of digital competences in primary school children.

Beyond the supervision–competence association, the study provides a domain-level profile of 6th-graders' digital competence: consistent deficits in Content Creation and Information should be prioritised in curriculum design and family guidance, while Safety and Communication require targeted reinforcement to consolidate practices into robust competencies.

From the evidence presented above, it can be concluded that the designed instrument is suitable for analysing DigComp's five dimensions in primary school children and their relationship with family supervision. Another contribution is the possibility of extending the study to cover a wider age range with the same instrument, and to look at secondary school pupils, taking into account other personal, social and family variables. It would also be interesting to know whether difficulties stemming from the generational digital divide exist at other educational levels when supporting the development of digital competence. This would help orientate education policies towards the eradication of inequalities and make progress in United Nations Sustainable Development Goal 10 (Reduced Inequalities).

The study provides a validated instrument that will allow researchers and professionals to familiarise themselves with the digital competence of primary school pupils in its five dimensions and compare results with pupils in the same age range. The results obtained are also useful both for the pupils, who will acquire a clearer view of their own competences, and for their educators and families, who can see how digitally competent their wards are in comparison with other children of the same age and thus place more emphasis on those areas where they still need to improve. Families will have opportunities to work with

their children at home on dimensions where additional support is needed. While gender-responsive approaches may be appropriate in contexts where robust local diagnostics identify gaps, our results show no gender differences in this setting. We therefore recommend a curriculum in upper primary that provides all pupils with balanced opportunities across information handling and collaboration, computational-thinking-rich tasks, critical evaluation, and the safe, purposeful use of technologies, alongside school-supported, discussion-based co-use at home.

The principal limitation concerns external validity: the study was conducted solely with pupils in the Spanish region of Andalusia and was not designed for statistical generalisation to other geographical contexts. Estimates relating to family supervision and teaching practice may therefore differ elsewhere, particularly because the instrument was intentionally tailored to real-world, context-specific issues. Nonetheless, the findings offer a useful starting point for understanding how family supervision relates to the development of digital competence in primary-school children beyond this setting.

Future research should employ longitudinal and mixed-methods designs (e.g., focus groups with pupils and families, semi-structured interviews with teachers, and classroom observations) to test whether targeted classroom tasks and supervision routines reduce domain-specific gaps, and to elucidate how family supervision interacts with dimension-specific competence and everyday platform practices.

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Authors' contributions
All authors contributed to the conception and design of the study. M.A.M conducted the data collection and statistical analysis. A.M.O.C & J.R.M drafted the initial manuscript. All authors reviewed, revised, and approved the final manuscript.

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Data availability
The datasets generated and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
Participation was voluntary, and all participants (and their legal guardians, in the case of minors) were fully informed about the nature, purpose, confidentiality, and anonymity of the research prior to their inclusion. Formal consent was obtained prior to data collection.

Consent for publication
All participants and their legal guardians provided informed consent for the anonymous publication of the data collected in this study.

Competing interests
The authors declare that they have no competing interests.

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