



Digital competence and transition to Secondary Education: a longitudinal students' study

Competencia digital y transición a Secundaria: estudio longitudinal del alumnado

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Abstract

Technology plays a key role in the educational transition from primary to secondary education. This longitudinal study analyses the development of students' digital competence during this period. To this end, a mixed methodological design was implemented in three phases: diagnosis and intervention in sixth grade of primary education (pre and post intervention application of a questionnaire to assess students' digital competence) and follow-up of students in their transition to secondary education (re-application of the digital competence questionnaire and an educational transition questionnaire, administered in the classroom using focus group dynamics). The results show that the difference between the stages of primary and secondary education lies in the cognitive function of the digital tools used. In primary education, their use is mainly linked to teacher-guided activities aimed at motivation, practice, and understanding of specific content. In secondary education, however, the focus shifts more towards learning management, including information search, use of virtual platforms and content production, moving from performing digital tasks to managing a digital learning environment. This transformation explains part of the perceived difficulty in adapting to the secondary stage and suggests the need for explicit work on digital competence during the transition between both stages. The conclusions suggest that digital literacy should be approached as a pedagogical progression, starting from guided to independent and critical use.

Keywords: digital skills, education, school, high school, digital competence, transition.

Resumen

La tecnología juega un papel clave en la transición educativa de primaria a secundaria. Este estudio longitudinal analiza la evolución de la competencia digital del alumnado en ese periodo. Para ello, se implementó un diseño metodológico mixto siguiendo tres fases: la primera y la segunda consistieron en el diagnóstico e intervención en 6.º de Primaria de unos talleres formativos con una aplicación pre y post de un cuestionario para evaluar la competencia digital de los estudiantes, la tercera se basó en el seguimiento del grupo participante en su transición al IES (Instituto de Educación Secundaria), aplicándose nuevamente el cuestionario de competencia digital y un cuestionario de transición educativa, administrados en el aula con dinámica de focus group. Las principales técnicas de análisis parten de un enfoque mixto, alternando instrumentos cuantitativos (cuestionario ECODIES) y cualitativos (cuestionario reflexivo). Los resultados muestran que la diferencia entre etapas se encuentra en la función cognitiva de las herramientas digitales utilizadas. En primaria, su uso se vincula principalmente con actividades guiadas por el docente y orientadas a la motivación y la comprensión de contenidos concretos. En secundaria, se orienta más a la gestión del aprendizaje incluyendo el uso de plataformas virtuales y pasando de ejecutar tareas digitales a gestionar un entorno digital de aprendizaje. Las conclusiones sugieren que la alfabetización digital debe plantearse como una progresión pedagógica, partiendo de un uso guiado a un aprendizaje autónomo y crítico.

Palabras clave: alfabetización digital, educación, escuela, instituto, competencia digital, transición.

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1. Introduction

In recent years, digital competence (DC) has established itself as one of the key competencies for lifelong learning and full participation in the knowledge society. In education, this competence is not limited to the instrumental use of technologies but it encompasses an integrated set of knowledge, skills, attitudes, and values necessary to use digital technologies critically and responsibly (Redecker, 2017).

During the transition from elementary to secondary school—specifically for students—the acquisition of adequate digital competence is particularly important, as the use of digital technologies is part of their daily lives from an early age. Research on students' digital competence has grown significantly over the past decade. However, cross-sectional studies predominate, offering a static view of digital competence levels at a given point (Godaert et al., 2022; Timotheou et al., 2022; Van Laar et al., 2017; Zakir et al., 2025; Zhao et al., 2025); hence the need to implement longitudinal designs that allow for an analysis of the actual evolution of this competency (Ma et al., 2025).

This gap is particularly relevant in the context of the transition from elementary to secondary school, a period marked by changing organizational, methodological, and technological demands, yet one that has been scarcely explored from a digital development perspective (Aesaert et al., 2014; Guitert et al., 2021; Hatlevik et al., 2015). In this regard, this research provides empirical evidence in a largely unexplored area by conducting a longitudinal analysis within the context of the transition between educational stages.

To contextualize the study, three closely linked conceptual axes are outlined below: students' digital competence from a multidimensional perspective; the gender dimension as a variable influencing the development of this competence; and, finally, the transition from elementary to secondary school as a process of transformation.

1.1 Students' Digital Competence

The expansion of digital environments both in and outside of school has established digital competence as part of the core knowledge that students must acquire during compulsory education

(Real Decreto 157/2022). In Europe, the Digital Competence Framework for Citizens (DigComp 2.2) has become a key benchmark for research, curriculum design, and assessment. This framework updates performance descriptors across the five areas of digital competence: Information and Data Literacy (Area 1), Communication and Collaboration (Area 2), Digital Content Creation (Area 3), Safety (Area 4), and Problem Solving (Area 5) (Vuorikari et al., 2022). In addition, it has recently begun to incorporate emerging phenomena, such as systems based on Artificial Intelligence (Bekiaridis and Attwell, 2024).

In the Spanish context, current legislation has developed its curriculum framework along these lines, establishing operational descriptors that clarify progression across educational stages (Ministerio de Educación y Formación Profesional, n.d.; INTEF, n.d.). In turn, the Reference Framework for Teachers' Digital Competence contextualizes DigCompEdu within the Spanish system, focusing on aspects such as digital well-being, which directly impacts students' learning environments (Ministerio de Educación y Formación Profesional, 2022). The PISA 2022 framework for ICT questionnaires provides indicators on students' technological practices and familiarity, enabling a connection between digital use, well-being, and academic performance, while offering an international perspective for analyzing transitions between educational stages (OECD, 2023). Godaert et al. (2022), among other methodological reviews, highlight an imbalance in students' digital competence levels, noting that areas related to safety and problem-solving appear to be less frequently addressed. Empirical evidence shows that familiarity with technology does not guarantee its competent or educational use, and therefore explicit training is required (Erwin and Mohammed, 2022; Hatlevik et al., 2015).

Although longitudinal research on students' digital competence in Spain remains limited, the available results suggest some relevant conclusions. At the institutional level, longitudinal school-wide assessments show a consolidation of leadership and pedagogical support (Fernández-Miravete, 2024). Analysis from the teachers' perspective adds important context, highlighting that following the experience of the COVID-19 lockdown, the educational use of technology has stabilized, establishing learning routines that directly benefit students (Pozo et al., 2024; Wohlfart and Wagner, 2024).

1.2 The Gender Dimension in Students' Digital Competence

Studies on digital competence have shown that, while gender differences can be identified, they do not follow a single pattern. International reports distinguish between skills, attitudes, and access conditions to understand how these gaps are formed and to avoid oversimplified interpretations (Reichert et al., 2023; UNESCO-UIS/UNEVOC, 2018). Liaw (2024) showed in a longitudinal study of students transitioning from elementary to secondary school that, although the average level of digital literacy was increasing, there were significant variations within each group and gender differences that did not recur across all cohorts. In their study, Bueno-Baquero et al. (2025) highlighted significant improvements and higher final performance among 6th-grade girls participating in DigComp-based training.

The PISA 2022 ICT questionnaires also reveal differences between girls and boys in technology use, digital self-efficacy, and associated well-being, which helps explain part of what happens when students transition to secondary school (OECD, 2023). Similarly, in Spain, Casillas-Martín et al. (2020) and Iglesias Rodríguez and Hernández Martín (2020) have identified gender differences favoring girls in both attitudes and performance, underscoring the importance of interventions that address digital citizenship, safety, and problem-solving from an early age.

Studies conducted in elementary school, such as Godaert et al. (2022), have found that the least addressed areas—safety and problem-solving—are those where gender differences are most likely to emerge upon entering secondary school, especially when learning opportunities are unequal. The study by Passaretta and Gil-Hernández (2022) further confirms that gender gaps are compounded by socioeconomic inequalities. Other studies also point to gaps based on gender and rurality, highlighting the importance of conducting longitudinal tracking of the transition (ACARA, 2023).

Finally, research on teachers' use of technology shows that the way a school organizes its digital work and the teacher training available directly influence the opportunities that girls and boys have to develop their digital competence (Wohlfart and Wagner, 2024).

1.3 Transition from Elementary School to Secondary School

The transition from elementary school to compulsory secondary education is a key stage in students' educational trajectories. It involves an adjustment to school dynamics, characterized by greater academic demands, an increase in the number of teachers, and new forms of assessment, all of which can affect students' motivation, performance, and well-being (Eccles and Roeser, 2011). This transition occurs in parallel with the onset of adolescence, a stage in which students experience a progressive search for autonomy, greater influence from their peer group, and the development of abstract thinking—factors that directly influence their relationship with learning (Galton and McLellan, 2018).

In the school setting, these organizational and personal changes affect how students learn with technology, placing new demands on information management and leading to a more intense digital presence in students' lives (Bueno-Baquero et al., 2025). It has been observed that socioeconomic differences in ICT literacy arise early and tend to widen during adolescence if opportunities for use and support are not comparable (Passaretta and Gil-Hernández, 2022). Along these lines, longitudinal studies focusing on teachers' acceptance of technology highlight the importance of promoting ongoing support and reliable infrastructure as prerequisites for enabling digitally rich practices in secondary school (Wohlfart and Wagner, 2024).

The Spanish curriculum envisions this transition as a progression, positioning digital competence as a cross-cutting theme to avoid abrupt jumps between educational stages and specifying the competencies students must have acquired by the end of elementary school to minimize access gaps during the transition to secondary school (Real Decreto 157/2022).

1.4 Objectives and Approach of the Study

Based on these principles, the study presented here addresses the identified needs. By analyzing students' perceptions of technology use during this transition, the study aims to examine their adaptation to secondary school through a longitudinal study organized into three phases:

First, during the first phase, a baseline assessment of students' digital competence (DC) was conducted in sixth grade using ECODIES, an instrument based on the DigComp framework and psychometrically validated for compulsory education (knowledge, skills, and attitudes), making it ideal for obtaining a baseline profile before any intervention (Casillas-Martín et al., 2020). This instrument provides reported validity and reliability, using online tasks in situations that closely resemble real-world use. Furthermore, the ECODIES-40 version offers a compact structure based on DigComp that preserves sensitivity by area and reduces measurement noise, which is advantageous for pre-post designs (García-Valcárcel et al., 2021).

The second phase introduces training workshops in sixth grade. This initiative aligns with the recommendations of European curricula and frameworks, moving from information and communication tasks toward safety and problem-solving, which are typically covered less extensively in elementary school and progress more slowly (Godaert et al., 2022; Vuorikari et al., 2022). A second assessment was also conducted during this phase, which allowed evaluating the educational impact in specific areas, revealing significant improvements in several areas of digital competence (Bueno-Baquero et al., 2025).

The results presented in this study correspond to the final phase of the research: the follow-up of students in the subsequent school year, during their first year of secondary school, thereby adding the longitudinal component that is often lacking in this field. The aim is to evaluate the retention and transfer of learning in the real-world context of secondary school—a period that, as indicated, the literature identifies as a critical window due to increased autonomy, methodological reorganization, and the potential widening of achievement gaps (OECD, 2023). Repeating the ECODIES assessment in the first year of secondary school—with an analysis limited to the subgroup that received training in the sixth grade of elementary school—allows us to estimate intraindividual trajectories. The inclusion of a transition questionnaire contextualizes the observed changes, in line with UNESCO's recommendations on integrating measures of practices and attitudes alongside performance assessment (Reichert et al., 2023).

The main objective of this study is to follow the cohort of 6th-grade students who participated

in the DigComp training program into the entry to secondary school to analyze their progress. The aim is to identify which factors might explain greater or lesser retention and transfer of the training received. The operational design—featuring a sample matched by anonymous codes and repeated measures across DigComp domains—allows analyzing intra-individual changes and changes by sub-competencies. Additionally, by contextualizing their transition experience as reported by the students, the study sought to identify the extent to which experiences during the transition might be related to their trajectories in digital competence.

2. Methodology

2.1 Methodological Design

The study was conducted using a mixed-methods approach, combining quantitative and qualitative techniques, with the aim of analyzing the evolution of students' digital competence and exploring their experiences during the transition. A longitudinal design was chosen for the quantitative phase and a descriptive-interpretive design for the qualitative phase, allowing for a more in-depth understanding of the phenomenon under study. Students' DC was assessed at two points in time: first, when they were in their final year of elementary school (2023–2024 school year), and second, one academic year later (2024–2025 school year), when they were enrolled in the first year of secondary school.

2.2 Participants

The sample for this study consists of 51 students from two schools in Albacete, Castilla-La Mancha, Spain, who could be fully tracked throughout the study period via anonymous pairing. To this end, the most common destination high schools were selected, allowing for the observation of performance in receiving environments that share organizational characteristics; this reduces contextual heterogeneity without compromising the ecological validity required by a study on the transition from elementary to secondary school (Fernández-Miravete, 2024; INTEF, n.d.). It should be noted that although the initial sample consisted of 148 students, after

the identification process, only those cases with both pre-test and post-test measurements (51) were analyzed. Of the selected sample, 16 voluntarily participated in the sixth-grade DC training, compared to 35 who did not. From an ethical and technical standpoint¹, anonymous cross-wave matching was performed using a code that respects confidentiality and enables longitudinal analysis without identifying individuals, in line with how online platforms and instruments are implemented to assess digital competence in compulsory education (Casillas-Martín et al., 2020). The analysis of these data was conducted using RStudio.

2.3 Techniques and Instruments

Data collection in this study was structured into two complementary phases. First, a quantitative phase was conducted, focused on measuring students' levels of DC. Second, a qualitative phase was incorporated to provide a deeper interpretation of the results obtained.

In the quantitative phase, the ECODIES questionnaire was used, a validated instrument proposed by Iglesias Rodríguez et al. (2023) designed to measure the level of digital competence among elementary school students. This questionnaire consists of 57 items distributed across six sections (Iglesias Rodríguez and Hernández Martín, 2020). These sections include Section 0, which collects sociodemographic information, and five additional sections corresponding to the areas of the DigComp framework. The items are rated on a 5-point Likert scale, where 1 corresponds to "strongly disagree" and 5 to "strongly agree."

In the qualitative phase, a questionnaire consisting of closed-ended and open-ended questions was used, inspired by other studies that advocate for educational research as a way to give students a voice by taking an interest in their firsthand experiences and ideas (Jiménez Andújar et al., 2025; Bueno-Baquero et al., 2025). The questionnaire consists of seven open-ended questions designed to facilitate the expression of students' opinions, perceptions, and experiences regarding the use of technology

during their transition to high school. To encourage student participation and foster a climate of trust, the session began with an introductory video related to the study. Subsequently, a guided discussion group was held using a structured presentation, which guided students in reflecting on the content and facilitated the exchange of ideas among participants, as well as the completion of the individual questionnaire.

2.4 Procedure

Data collection took place in a controlled and secure environment, ensuring consistent conditions for all participants. The anonymous coding system facilitated the matching of data collected at both time points without compromising the students' identities.

First, the DC questionnaire was administered online via the LimeSurvey platform, within a secure environment provided by the University of Castilla-La Mancha. To ensure data confidentiality, the dataset was anonymized by assigning a unique code to each participant, following the procedure described by Lippe et al. (2019). This code was randomly generated by the students and allowed for individual tracking across the different phases of the study.

On the other hand, the questionnaires for the qualitative phase were administered on paper and collected by the research team. Additionally, the session was audio-recorded for subsequent analysis. Both the remarks recorded during the session (focus group) and the open-ended responses from the questionnaire were transcribed in full. Subsequently, the collected data were organized and prepared for further analysis using ATLAS.ti, with the aim of gaining a comprehensive understanding of the phenomenon under study and ensuring compliance with the ethical principles of educational research. In this analysis, the coding addressed the five areas of digital competence outlined in this study.

3. Results

This section presents the study's results, organized into two complementary levels of analysis. First, we present the quantitative results obtained

¹ This research was conducted with the approval of the Social Research Ethics Committee at University of Castilla-La Mancha, under registration number CEIS-732398-P6K6.

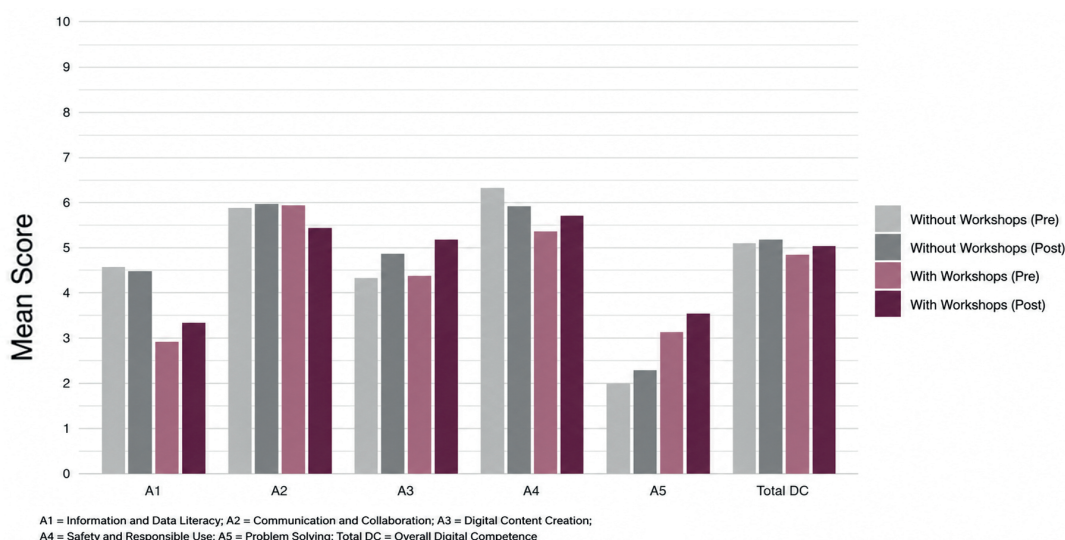
through the digital competence perception questionnaire administered at two time points (pre- and post-measurements), which allows us to observe the students' longitudinal progress and compare the impact of their participation in the training workshops. Next, we present the qualitative results derived from the open-ended questionnaire and the focus groups, which aimed to delve deeper into the students' experiences of transitioning to a new educational stage and to understand how they experience the use of digital tools during the transition from elementary to secondary school.

3.1 Level of Self-Perceived Digital Competence

To determine the students' levels of self-perception regarding digital competence in this study, a longitudinal analysis was conducted comparing the scores obtained during the 2023–2024 school year (pre-test, before the workshops were held at certain schools) and the 2024–2025 school year (post-test, in secondary schools), distinguishing between students who did not receive the specific training implemented and those who did participate in the aforementioned training workshops.

In the total sample analyzed in Figure 1, overall DC scores show a slight improvement in both groups. Although the differences are moderate, there is a general trend toward improvement over time.

Figure 1. *DC Analysis*



Regarding the analysis by gender, notable differences are observed. As seen in Table 1, in the group without workshops, female students improved their total score from 4.93 to 5.57, while male students' scores decreased from 5.13 to 4.58. By dimension, female students show notable increases in areas 1 and 3, while male students show declines in several dimensions, particularly in areas 1, 3, and 4—those related to information and data literacy, content creation, and safety.

It is worth noting that in the group that received training, the differences are even more pronounced.

Female students significantly increased their total score (from 4.52 to 6.00), with notable improvements in areas 3 (from 3.67 to 6.94) and 4 (from 5.31 to 7.14), corresponding to content creation and safety. In contrast, male students saw a decrease in their total score (from 4.96 to 4.21), with declines in areas 2, 3, and 4—those related to communication and collaboration, content creation, and safety—although they showed a notable increase in area 5 (from 2.92 to 5.00), problem-solving.

Table 1. *CD Analysis by Gender²*

Dimension	Gender	n	No workshops		n	With workshops	
			Pre	Post		Pre	Post
A1	Women's	18	4.63 (3.26)	5.19 (3.47)	7	2.86 (3.56)	4.29 (3.71)
A1	Male	16	4.17 (3.55)	3.54 (3.33)	8	2.92 (3.75)	2.92 (2.78)
A2	Female	18	5.78 (1.44)	6.22 (2.21)	7	5.57 (2.70)	6.29 (3.20)
A2	Male	16	5.88 (2.45)	5.50 (2.39)	8	6.00 (2.07)	4.62 (2.56)
A3	Women	18	4.05 (1.71)	5.63 (2.96)	7	3.67 (1.82)	6.94 (0.99)
A3	Male	16	4.38 (1.98)	3.93 (2.53)	8	5.00 (1.71)	3.75 (2.28)
A4	Female	18	6.27 (2.09)	6.27 (3.10)	7	5.31 (2.43)	7.14 (2.61)
A4	Male	16	6.25 (2.33)	5.27 (2.37)	8	5.18 (1.52)	4.29 (2.41)
A5	Female	18	1.30 (1.67)	2.04 (2.03)	7	2.86 (3.00)	1.90 (1.78)
A5	Male	16	2.71 (2.18)	2.50 (2.58)	8	2.92 (2.78)	5.00 (3.98)
Total DC	Women	18	4.93 (1.09)	5.57 (2.04)	7	4.52 (1.89)	6.00 (2.04)
Total DC	Male	16	5.13 (1.79)	4.58 (1.82)	8	4.96 (1.17)	4.21 (1.92)

Overall, the data from the quantitative analysis suggest a more consistent pattern of improvement among female students, especially when they participated in the training workshops, while male students show greater variability, including declines in some dimensions.

3.2 Students' Experiences During the Transition

The results of the qualitative analysis are presented below, organized according to the areas of digital competence considered in this study.

Regarding Area 1 (Information and Data Literacy), one of the most recurring themes in students' responses is the difficulty of finding reliable and appropriate information. Students are aware that searching for information online is not just about knowing how to use a search engine; they want to understand how to select sources and evaluate their validity, even mentioning copyright: "I'd like to get better at searching for things because I almost never

find what I'm looking for, and I'd also like to know if it's protected by copyright" (Student 1).

The need to develop effective search strategies seems to intensify in secondary school, where research projects and independent information searches increase. Students refer to the speed of access to information, openly acknowledging that they use artificial intelligence tools for this purpose: "Digital tools have made my transition to high school easier because searching for things isn't as stressful anymore; before, it used to take me 30 minutes to look up a word in a dictionary, and now, with ChatGPT, it takes 2 minutes" (Student 15).

The transition to high school also involves a shift in social relationships and academic communication channels, which are associated with Area 2 (Communication and Collaboration) of digital competence. Students acknowledge that digital interaction is part of their socialization and learning, highlighting the institutional digital environment used by schools in the region where the study was conducted—in this case, EducamosCLM—as the

² The sum of participants by gender does not exactly match the total sample size because two students did not report their gender and were excluded from this analysis.

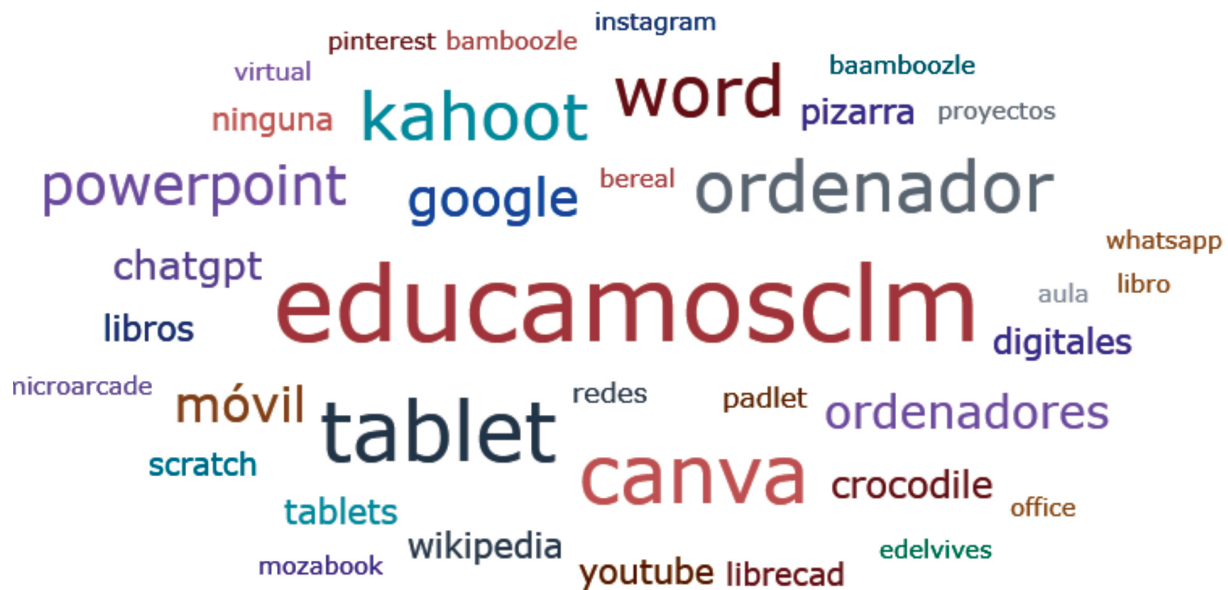
central communication platform, though they admit they need specific training: “Virtual classrooms are fine, but you have to learn how to use them” (focus group participant).

Regarding Area 3 (Digital Content Creation), it is worth noting that the production of digital projects increases during the secondary school years. This change represents a break from elementary school that students perceive as unfamiliar: “The transition to secondary school has been more difficult because I wasn’t as used to doing projects on

devices, but now I’m learning better” (Student 5). In this area, inequalities stemming from family background emerge, highlighting the critical need for training: “I have a really big problem. At home, if I have questions about digital tools, I can’t ask because nobody knows how to use things like Canva” (focus group participant).

Below (Figures 2 and 3) are two word clouds created from the students’ responses, which reveal significant differences in the use of digital tools between the elementary and secondary school levels.

Figure 2. *Digital tools students used in elementary school*



Note: Created by the author using Atlas.ti.

Since the size of each term reflects its frequency of occurrence, these representations not only show which tools are used but also the pedagogical role they play at each level.

On the one hand, in elementary school (Figure 2), there is a smaller variety of digital tools in use. Terms associated with specific devices predominate, notably words such as “tablet” or “cell phone,” as well as recreational digital tools such as Kahoot, YouTube, and Microarcade. Basic content-creation applications such as PowerPoint, Word, and Canva also feature prominently. This suggests that technology at this stage is integrated primarily as a teacher-mediated methodological resource. Students do not view technology as an autonomous learning environment, but rather as part of pre-designed activities.

On the other hand, in secondary school (Figure 3), a shift in the use of digital tools is evident. In general, the use of recreational tools seems less prominent, and terms linked to academic processes in specific subjects—such as LibreCAD or Crocodile—emerge, along with information-search tools like Google, Wikipedia, or ChatGPT. This transformation indicates that students no longer use applications on an *ad hoc* basis but rather interact with a continuous digital ecosystem where they can consult materials, submit assignments, review content, and resolve questions. Thus, the focus shifts from the device to the process. This reflects a higher level of autonomy in which students’ digital literacy involves making decisions such as selecting sources and interpreting information.

integrated as a more common part of the learning environment. However, the analysis by dimension suggests differences across areas. The most pronounced improvements in the group that received training are concentrated in Area 3 (Digital Content Creation) and Area 5 (Problem Solving). This evidence supports the literature indicating that digital competence does not develop automatically through exposure alone but requires explicit and structured instruction (Erwin and Mohammed, 2022). The analysis by gender is particularly relevant. On the one hand, female students show more consistent progress, especially when they have participated in the workshops. These results partially align with research at other educational levels, indicating that when structured training contexts are provided, gender gaps can be reduced (Liu et al., 2021). In contrast, male students exhibit greater variability and declines in some areas, which could be interpreted from different perspectives, such as differences in academic motivation or in how they interact with technology. Although students in the workshop group show a significant increase in Area 5 (Problem Solving), setbacks are observed in other dimensions, suggesting that the impact of the intervention is not uniform within this group. These results contrast with those of the study by Niño-Cortés et al. (2023), which indicate gender gaps favoring boys and highlight the need to develop training that promotes digital competence among girls.

Second, after analyzing students' transition experiences, it can be observed that they do not perceive secondary school as more difficult academically, but rather as more demanding in terms of digital autonomy. In general, the main needs identified relate to search strategies, the use of educational platforms, and the creation of academic digital content, requiring an ethical and responsible use of information, as well as structured training before the transition to high school. Although students mention artificial intelligence as a useful tool for searching for information, this does not guarantee their understanding of it or their ability to critically evaluate it.

Therefore, information literacy remains a key educational need. Regarding content creation, the results show that schools must serve as the primary setting for digital equity, since learning in this area cannot depend solely on the family environment but must be supported by formal education.

The results obtained show a developmental pattern consistent with the literature on information literacy, as students increase their instrumental mastery of technology as they progress through school, transforming the pedagogical significance of its use. This progression aligns with the European DigComp framework, which describes the development of information literacy as a gradual process moving from functional interaction to the critical and creative use of information (Ferrari, 2013). Regarding the differences observed between the two stages, it can be seen that in elementary school, digital competence develops primarily in structured contexts. Technology acts as a teaching facilitator and motivational tool (Urcid, 2023), but not as a system for organizing learning. It is at the secondary school level that programs linked to specific subjects emerge, suggesting a more profound digitization of the curriculum. In line with studies such as that by Godaert et al. (2022), technology evolves from a methodological tool into an academic requirement.

Given all this, digital literacy emerges as an essential element in this transition to a new stage, as well as a prerequisite for equal opportunities. The educational transition, therefore, should include systematic training in digital literacy during the final cycle of elementary school. We encourage future studies to develop and implement workshops aimed at improving students' digital literacy, such as the one developed in this study (Bueno-Baquero et al., 2025). As seen in this research, it is not merely a matter of learning to use digital tools, but of reducing academic uncertainty and supporting students during this pivotal moment.

It should be noted that this study must be interpreted with certain limitations in mind. Some of the data presented are partially based on students' perceptions, which introduces a subjective component linked to their own experiences; however, this has been accounted for in previous studies, such as De Pablos et al. (2016). Furthermore, due to the longitudinal nature of the study, the sample is limited and focuses on a specific educational context; therefore, school technology practices depend largely on the school's organizational culture, teacher training, and the availability of resources. Therefore, it would be appropriate to interpret the presented results while considering and avoiding overgeneralizations, as well as to expand the analysis to different schools

and socio-educational contexts to verify whether the identified trend holds true in different settings.

Looking ahead to future lines of research, it would be interesting to examine in greater detail the connection between digital competence and the process of adapting to the transition to secondary school. The findings suggest that some of the difficulties associated with the transition to secondary education may be related to students' insufficient preparation in terms of technological skills. Studying this issue using variables such as academic well-being, academic performance, or anxiety would provide valuable information for designing transition programs between educational stages, complemented by the role of teacher training in this process.

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Bibliographic References

- ACARA (2023). *Latest data reveals digital skills amongst young Australians*. <https://bit.ly/4tWFLP2>
- Aesaert, K., Van Nijlen, D., Vanderlinde, R. & van Braak, J. (2014). Direct measures of digital information processing and communication skills in primary education: Using item response theory for the development and validation of an ICT competence scale. *Computers & Education*, 76, 168-181. <https://doi.org/10.1016/j.compedu.2014.03.013>
- Bekiaridis, G. & Attwell, G. (2024). *Supplement to the DigCompEdu Framework: Outlining the Skills and Competences of Educators Related to AI in Education (WP3)*. <https://bit.ly/4tnW6BI>
- Bueno-Baquero, A., Del Olmo-Muñoz, J., González-Calero, J. A. & Sánchez Pérez, M. C. (2025). Boosting Digital Competence: Impact of an Educational Program on Primary-to-Secondary Transitioning Students from a Gender Perspective. *TechTrends* 69, 1221-1234. <https://doi.org/10.1007/s11528-025-01107-8>
- Casillas-Martín, S., Cabezas-González, M. & García-Valcárcel, A. (2020). Psychometric analysis of a test to assess the digital competence of compulsory education students (ECODIES). *RELIEVE. Revista Electrónica de Investigación y Evaluación educativa*, 26(2), 1-25. <https://doi.org/10.7203/relieve.26.2.17611>
- De Pablos Pons, J., Colás Bravo, P., Conde Jiménez, J. & Reyes de Cózar, S. (2016). La competencia digital de los estudiantes de educación no universitaria: variables predictivas. *Bordón. Revista de Pedagogía*, 69(1), 169-185. <https://doi.org/10.13042/Bordon.2016.48594>
- Department for Education. (2011). *How do pupils progress during Key Stages 2 and 3?* DfE Research Report DFE-RR096. <https://bit.ly/4uy3VWz>
- Eccles, J. S. & Roeser, R. W. (2011). Schools as developmental contexts during adolescence. *Journal of Research on Adolescence*, 21(1), 225-241. <https://doi.org/10.1111/j.1532-7795.2010.00725.x>
- Erwin, K. & Mohammed, S. (2022). Digital literacy skills instruction and increased skills proficiency. *International Journal of Technology in Education and Science*, 6(2), 323-332. <https://doi.org/10.46328/ijtes.364>
- Ferrari, A. (2013). DIGCOMP: A Framework for Developing and Understanding Digital Competence in Europe. En Y. Punie y Brečko, B.N (eds.), *JRC Scientific and Policy Reports*, 7-45. Joint Research Centre of the European Commission. <https://bit.ly/4u69ED5>
- Fernández-Miravete, Á. D. (2024). Evaluación longitudinal para la mejora de la competencia digital de un centro de Educación Secundaria. *Revista Iberoamericana de Evaluación Educativa*, 17(2), 11-26. <https://doi.org/10.15366/riee2024.17.2.001>
- Galton, M. & McLellan, R. (2018). A transition Odyssey: pupils' experiences of transfer to secondary school across five decades. *Research Papers in Education*, 33(2), 255-277. <https://doi.org/10.1080/02671522.2017.1302496>
- García-Valcárcel, A., Salvador, L., Casillas-Martín, S., Cabezas-González, M. & Martín del Pozo, M. (2021). *Prueba de Evaluación de la Competencia Digital de Estudiantes (ECODIES-40)*. GREDOSUSAL. <https://bit.ly/4tDuCs9>
- Godaert, E., Aesaert, K., Voogt, J. & van Braak, J. (2022). Assessment of students' digital competences in primary school: A systematic review. *Education and Information Technologies*, 27, 9953-10011. <https://doi.org/10.1007/s10639-022-11020-9>

- Guitert, M., Romeu, T. & Baztán, P. (2021). The digital competence framework for primary and secondary schools in Europe. *European Journal of Education*, 56(1), 133-149.
<https://doi.org/10.1111/ejed.12430>
- Hatlevik, O. E., Guðmundsdóttir, G. B. & Loi, M. (2015). Digital diversity among upper secondary students: A multilevel analysis of the relationship between cultural capital, self-efficacy, strategic use of information and digital competence. *Computers & Education*, 81, 345-353.
<https://doi.org/10.1016/j.compedu.2014.10.019>
- Iglesias Rodríguez, A., Martín González, Y. & Hernández Martín, A. (2023). Evaluación de la competencia digital del alumnado de Educación Primaria. *Revista de Investigación Educativa*, 41(1), 33-50.
<https://doi.org/10.6018/rie.520091>
- Iglesias Rodríguez, A. & Hernández Martín, A. (coords.). (2020). *Evaluación de las competencias digitales de estudiantes de educación obligatoria. Diseño, validación y presentación de la prueba ECODIES*. Octaedro.
- INTEF. (s. f.). *Competencia digital del alumnado*. Instituto Nacional de Tecnologías Educativas y de Formación del Profesorado.
<https://bit.ly/3OZcw5v>
- Jiménez Andújar, E., Candela Soto, M.P. & Bueno-Baquero, A. (2025). Cuando el alumnado toma la palabra: lo que aprendimos investigando la transición de primaria a secundaria. *Sociedad e Infancias*, 9(1).
<https://doi.org/10.5209/soci.100129>
- Ladrón de Guevara Rodríguez, M., López-Agudo, L. A. & Marcenaro-Gutiérrez, O. D. (2024). The impact of different uses of the Internet on students' performance progression throughout primary education. *Education and Information Technologies*, 29, 12457-12525.
<https://doi.org/10.1007/s10639-023-12354-8>
- Liaw, Y.L. (2024). On the cover: Gendered trajectories of digital literacy development: Insights from a longitudinal cohort study. *Educational Measurement: Issues and Practice*, 43(3), 6-7.
<https://doi.org/10.1111/emip.12625>
- Lippe, M., Johnson, B. & Carter, P. (2019). Protecting Student Anonymity in Research Using a Subject-Generated Identification Code. *Journal of Professional Nursing*, 35, 120-123.
<https://doi.org/10.1016/j.profnurs.2018.09.006>
- Liu X., He W., Zhao L. & Hong, J.C. (2021). Gender Differences in Self-Regulated Online Learning During the COVID-19 Lockdown. *Frontiers in Psychology*, 16.
<https://doi.org/10.3389/fpsyg.2021.752131>
- López-García, C., Sánchez-Gómez, M. C. & García-Valcárcel, A. (2021). Desarrollo de la competencia digital en estudiantes de primaria y secundaria en tres dimensiones: fluidez, aprendizaje-conocimiento y ciudadanía digital. *Revista Ibérica de Sistemas e Tecnologías de Informação*, (E47), 501-517.
<https://doi.org/10.17013/risti.44.5-20>
- Ma, H. & Ismail, L. (2025). Bibliometric analysis and systematic review of digital competence in education. *Humanities and Social Sciences Communications*, 12(185).
<https://doi.org/10.1057/s41599-025-04401-1>
- Ministerio de Educación y Formación Profesional. (s. f.). *Competencia digital en el currículo LOMLOE*.
<https://bit.ly/4naFDzi>
- Ministerio de Educación y Formación Profesional. (2022, 16 de mayo). *Resolución de 4 de mayo de 2022 sobre la actualización del marco de referencia de la competencia digital docente* (BOEA20228042).
<https://bit.ly/4daiJ6u>
- Ministerio de Educación y Formación Profesional. (2025). *ICILS 2023 -La competencia digital en España (Cap. 1.3)*.
<https://bit.ly/3P86nnp>
- Niño-Cortés, L.M., Grimalt-Álvaro, C., Lores-Gómez, B. & Usart, M. (2023). Brecha digital de género en secundaria: diferencias en competencia autopercebida y actitud hacia la tecnología. *Educación XXI*, 26(2).
<https://doi.org/10.5944/educxx1.34587>
- OECD. (2023). *PISA 2022 assessment and analytical framework (ICT Framework)*. OECD Publishing.
<https://bit.ly/4dsi41A>
- Passaretta, G. & Gil-Hernández, C. J. (2022). *The early roots of the digital divide: Socioeconomic inequality in children's ICT literacy from primary to secondary schooling* (JRC Working Paper 2022/04). Publications Office of the European Union.
<https://doi.org/10.4337/9781789906769.00026>
- Pozo, J.I., Cabellos, B. & Pérez-Echeverría, M. del P. (2024). Has the educational use of digital technologies changed after the pandemic? A longitudinal study. *PLOS ONE*, 19(12), e0311695.
<https://doi.org/10.1371/journal.pone.0311695>
- Real Decreto 157/2022, de 1 de marzo, por el que se establece la ordenación y las enseñanzas mínimas de la Educación Primaria. *Boletín Oficial del Estado*, 52, de 2 de marzo de 2022. <https://bit.ly/4tV5NIS>
- Redecker, C. (2017). *European framework for the digital competence of educators: DigCompEdu*. Joint Research Centre. <https://doi.org/10.2760/159770>

- Reichert, F., Pan, Q. & Chen, L. L. (2023). *Digital literacy assessment (Background paper for the 2023 Global Education Monitoring Report)*. UNESCO. <https://bit.ly/3PrPggy>
- Teach Computing. (2025). Key Stage 3 curriculum. National Centre for Computing Education. <https://bit.ly/4nb4yme>
- Timotheou, S., Miliou, O., Dimitriadis, Y., Villagrà Sobrino, S., Giannoutsou, N., Cachia, R., Martínez Monés, & Ioannou, A. (2022). Impacts of digital technologies on education and factors influencing schools' digital capacity and transformation: A literature review. *Education and Information Technologies*, 28, 6695-6726. <https://doi.org/10.1007/s10639-022-11431-8>
- UNESCO-UIS/UNESCO-UNEVOC. (2018). *Digital Literacy Global Framework (DLGF)*. <https://bit.ly/3P77HXG>
- Urcid, R. (2023). Uso de dispositivos móviles en el aula para dinamizar e incentivar el aprendizaje: Estudio de caso con alumnado de pregrado. *Alteridad. Revista de Educación*, 18(2). <https://doi.org/10.17163/alt.v18n2.2023.05>
- Van Laar, E., van Deursen, A. J. A. M., van Dijk, J. A. G. M. & de Haan, J. (2017). The relation between 21st century skills and digital skills: A systematic literature review. *Computers in Human Behavior*, 72, 577-588. <https://doi.org/10.1016/j.chb.2017.03.010>
- Vuorikari, R., Kluzer, S. & Punie, Y. (2022). DigComp 2.2: *The digital competence framework for citizens –with new examples of knowledge, skills and attitudes*. Publications Office of the European Union. <https://bit.ly/42XSfQV>
- Wohlfart, O. & Wagner, I. (2024). Longitudinal perspectives on technology acceptance: Teachers' integration of digital tools through the COVID-19 transition. *Education and Information Technologies*, 30, 6091-6115. <https://doi.org/10.1007/s10639-024-12954-y>
- Zakir, S., Hoque, M. E., Susanto, P., Nissa, V., Alam, M. K., Khatimah, H. & Mulyani, E. (2025). Digital literacy and academic performance: The mediating roles of digital informal learning, self-efficacy, and students' digital competence. *Frontiers in Education*, 10. <https://doi.org/10.3389/feduc.2025.1590274>
- Zhao, Y., Sánchez Gómez, M. C., Pinto Llorente, A. M. & Sánchez Prieto, R. (2025). Adapting to crisis and unveiling the digital shift: A systematic literature review of digital competence in education related to COVID19. *Frontiers in Education*, 10. <https://doi.org/10.3389/feduc.2025.1541475>

Authorship Statement – CRediT Taxonomy

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Statement on the Use of Artificial Intelligence

The authors DECLARE that, in the preparation of the article “*Digital Competence and the Transition to Secondary School: A Longitudinal Study of Students*,” the artificial intelligence tools Copilot and Perplexity were used to assist with the literature search.