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Basic digital competences of university students before and during the COVID-19 pandemic

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The objective of this study was to compare the digital competences of university students before and during the COVID-19 pandemic, and to determine the impact of internet use on these competences, specifically those related to social communication, collaborative learning, as well as information searching and processing. The sample comprised 415 Spanish students who began university studies between 2019 and 2022. The instrument used was the COBADI. The results indicate an increase in internet use to talk with friends in social networks and work with classmates, such as in collaborative homework. In terms of digital competences during the pandemic, there was an increase in competences related to social communication, collaborative learning, and information searching and processing. The study also found that academic and recreational internet use predicted basic digital competences, as determined by a MANCOVA analysis. The role of the pandemic context in increasing basic digital competences in university students is discussed.

1. Introduction

The objective of this study was to compare the basic digital competences of university students before and during the COVID-19 pandemic, and to determine the impact of internet use on these competences, with a focus on those related to social communication, collaborative learning, and information searching and processing. The sample consisted of 415 university students who began their studies between 2019 and 2022. A didactic instrument called COBADI 2.0 (Basic Digital Competences 2.0 of university students) with registered trademark 29.706.648 at the SPTO (Spain) was used to gather information. Greater academic and recreational internet use was found to improve competences related to social communication, collaborative learning, as well as information searching and processing. However, the study did not find a significant effect of social internet use (i.e., social network use) on the development of digital competences. The findings suggest that the pandemic context has led to an increase in digital competences among university students. It is observed that a greater academic and recreational use of the internet improves digital competences oriented to social communication and collaborative learning, and to searching and processing digital information. The social use of the internet (use of social networks) would not have a significant effect on increasing digital competences.

The study concludes by discussing the significance of the pandemic context in promoting the development of digital competences, also including the discussion of collaborative work strategies and metacognitive processes among students.

1.1. Basic digital competences

To begin with, it is important to define the concept of digital competences to gain a better understanding of the topic at hand. In order to achieve quality education that provides the necessary skills and competencies for the challenges of the 21st century, it is necessary to invest in education (Comisión Europea, 2020). Of all the competencies required for an integral education, digital competence has been the one that appears with greater prominence in various reports (Comisión Europea, 2006, 2018; UNESCO, 2011; INTEF, 2017). The DigComp report of the European Commission provided the community with a series of dimensions and descriptors that determine digital competences to reformulate and adapt educational policies to current needs. In this sense, the European Commission suggests that an integral approach should be considered, and these competences should be organized in the curriculum to allow the progressive achievement of them, as mentioned in the framework of teachers' ICT competences (UNESCO, 2019).

Competencies are a process by which the acquisition and use of knowledge are demonstrated in service of problem-solving, with skills development. This collectively articulate a "know-how" skill and adaptability in a demanding environment. Over a decade ago, it became imperative for higher education programs and graduate profiles to incorporate competences as a foundational basis for all teaching endeavors. In this sense, when we refer to digital competences in the year 2023, we are considering bringing into play and into action all types of personal and inter-subjective resources: network resources, transmedia methodologies, and gamification. This can be leveraged to address specific contexts and generate innovative solutions. This need has already been corroborated in various studies, such as the one by Fernández-Martínez et al. (2017). Equally, it is necessary to be able to manage knowledge and learning that the major challenges imposed by the era of knowledge and technology (along with the use of Information and Communication Technologies, hereafter referred to as ICT) generate (Sabrina and Ferlino, 2020).

ICTs have become necessary and central resources for both society and education. New ways of learning and teaching must be established, along with innovative approaches to make the necessary social changes that are coherent with current needs. In the search for information about the importance of digital education and the development of related skills, Pirela-Espina (2022) focuses on educational inequalities and the digital divide in times of COVID-19. The author considers that the gaps in terms of equity and opportunities increased because the access and use of materials is different for each student, locality, and establishment. Addressing this challenge requires a change in the understanding of the benefits of information technology literacy. Kuric Kardelis et al. (2021) analyze the digital gaps and the main profiles and problems experienced by high school (compulsory and post-compulsory) and university students to face the academic year during the confinement of COVID-19 pandemic. Social inclusion depends on the participation of citizens, as recognized by Gumbau (2006), while the digital divide is worsened by factors such as access, use, and material conditions, as highlighted by Gonzales (2015).

The COVID-19 pandemic presented a complex and challenging context that highlighted the importance of ensuring digital competence and literacy for all citizens. Prior research has examined the differences between students' and teachers' perceptions of distance education before the pandemic and during confinement (García Aretio, 2021).

Several studies have examined the digital technology use of young university students in various contexts. For instance, Hernández González (2017) found differences in the way students interact with their peers in age-specific activities and academic activities, considering that the school context of digital use may be mediated or influenced by teachers. Studies also consider the school space as a social and cultural context that provides an environment for interaction (Gómez-Galán et al., 2021). Young people interact with their peers through the internet, sharing information and communicating, which they also use when working on academic tasks. They resort to the knowledge they have developed and engage in a dialog between what they handle socially and what they need to achieve academically. Gupta (2012), it is also suggested that teachers should support academic work by allowing young people to navigate directly in the digital universe (Hernández-Romero, 2021).

Nevertheless, when citizens have access to technology, it is important that its use supports education (MINSAL, 2020). Maldonado Berea et al. (2019) highlights the need for education to address pressing issues such as ecology, resource scarcity, waste reduction, climate change, and the impact of corporations on local economies. Kali (2019) expresses that ICT affect our life from the point of view of the relationship with others, because it allows the subject to have access, build networks, share information, search and organize data, and know other realities from different scenarios, using virtuality. Considering this, it becomes even more critical to equip university students and teachers with digital competences that allow them to foster relationships with others.

When we analyze reality from the use of information technology, we can identify that ICT have become an important mechanism for inclusion, both social and relational. The way we interact with ICT shapes our social identity, and it is manifested in "bits," that is to say, the possibility of connection through the speed of bits keeps us either online or offline, determining the difference between inclusion or exclusion (Alba, 2009).

Calderón (2019) and McCarthy et al. (2020), manifests that the inequality variable also increases in the era of communication technologies and knowledge. The author expresses that inequality is central in the analysis of education issues because it is an unavoidable condition before, during and after the pandemic. Digital inequality concerns all academics and national and international policy makers (Van Deursen, 2020). This reality that implies inequality also translates to the didactic use of ICT because the methodological and practical aspects are determinant in education (Jiménez, 2019).

According to Alcántara (2020) and Gómez et al. (2015) the use of digital platforms in distance education has transformed the logic of thoughts and, therefore, the student-teacher relationship and the communication modes between students. Similarly, Maldonado Berea et al. (2019) indicates that the impact of ICT on social and academic networks leads to changes in university behavior and interpersonal relationships. Consequently, to effectively incorporate new languages into the classroom, it is crucial to understand students'

perceptions of social networks as an educational tool and their preferences for collaborative work. Cabero (2019) and Contreras and Pérez Villalobos (2014) conducts research and asserts that the internet is a technology integrated into universities, and students utilize it for educational purposes. The student is depicted as a generator of didactics through their use of networks, and collaborative work is recognized as one of the strategies that promotes learning and is closely related to the use of social networks. In the same sense, Tejedor (2011) addresses the changes occurred in a shifting society, where the value of information technologies grows, not only in education, but also in the labor market, to which university teachers must respond. This generates new learning scenarios, where the student can recognize learning objectives pursued by the teacher. Moreover, it is crucial to recognize that technology should complement learning scenarios rather than change or improve them. As such, technology can support teaching work and create new learning environments, but it is important for teachers to create a welcoming space that encourages student participation and the development of necessary competences.

The post-pandemic era has brought to light several crucial aspects that need to be considered in primary and university education. It has provided an opportunity to reflect on the true meaning of education and the curriculum, and to design public policies that address the issue of inequality as well as other cross-sectional issues, such as gender violence. The concept of learning as a praxis and a dialectical relationship has also gained prominence. As a result, there is a need to rethink didactics and develop diversified routes that allow for the inclusion and participation of all curricular subjects. To achieve this goal, professors and teachers need to create spaces for exchange that highlight the subjective while making use of technology.

In that regard, it is necessary to evidence certain classroom strategies and methodologies that, with the use of technologies, are emphasized and have an impact on the students' learning. When discussing digital competencies, as we have mentioned before, it is important for our study to establish how these competencies are interconnected and give meaning to learning. Accordingly, we are interested in mentioning the relationship between the collaborative work strategy and the metacognitive process of students. Considering the state of confinement, we explore how this networked and collaborative work uses digital skills and competences, thereby developing metacognition.

1.2. Integration of collaborative work and metacognition

When approaching collaborative work as a methodological strategy, it is important to clarify that it is theoretically supported by a conceptual frame that considers different theories and approaches that support its conception (Solovieva et al., 2021).

1.2.1. Activity theory

This theoretical framework provides insights into how individuals interact with their environment to achieve a task or activity. In the context of collaborative work, individuals work together to accomplish a common goal, and their interactions with one another can have a significant impact on the outcome of the activity. This theory offers a

dialectical view on the structure of the teaching and learning processes, and on the roles that each participant needs to fulfill. The theory is also inspired by and related to the cultural historical approach of Vigosky (1995).

1.2.2. Communication theory

We find this theory at the core of collaborative work. This focuses on how communication influences team collaboration and performance. In collaborative work, effective and clear communication is essential to coordinate and synchronize the actions of team members and avoid mistakes or misunderstandings. Communication theory is a field of study that focuses on understanding how information is transmitted and interpreted between individuals and groups. This area of study ranges from interpersonal communication to mass communication, and draws on a variety of disciplines, such as psychology, sociology, anthropology, linguistics, and information theory. There are different models of communication that have been proposed to understand how this process works, one of the best-known being Shannon and Weaver's model (Becker, 2017). This model describes communication as a linear process consisting of a sender transmitting a message by means of a channel to a receiver. Other more recent models of communication, such as the transactional model, emphasizes the bidirectional and interactive nature of communication. Lomov (1989) suggests that the main goal of this area is to understand how communication works so that it can be improved and made more effective, in this case, for the relevant teaching and learning processes.

We can identify the psychological and social influence in the theory of collaborative work, which emphasizes the importance of group learning and social interaction in the learning process. In collaborative work, team members can learn from each other, share knowledge and skills, and build together a deeper understanding of the problem or task.

Collaborative learning theory is an approach to teaching and learning that emphasizes teamwork and cooperation among students. There are several current representatives of this theory. Elizabeth Cohen is an American psychologist and one of the founders of this theory. Cohen's work explores how students can learn more effectively by working together in groups (Cohen et al., 2004). In her book "Designing Groupwork: Strategies for the Heterogeneous Classroom," she offers guidance on how to design and implement collaborative learning projects in the classroom. Research has shown that collaborative learning can improve students' understanding and performance in science.

In an experience conducted by the effectiveness of collaborative work in developing students' skills was demonstrated. The study found that providing support for collaborative tasks in a subject area was effective in achieving this goal. Abellán (2018) presents a study on the topic, where the author manifests that this type of work is the most successful educational practice in recent decades. Slavin (2014) has conducted studies where it is shown that peer interaction during collaborative work is of utmost relevance to increase reflection and motivation for the task.

Elizabeth Cohen has published several books on collaborative learning. In her book "Cooperative Learning and Science Education," Cohen delves into the benefits of collaborative teaching, particularly in improving student comprehension and success in science. In "Making Cooperative Learning Work:

Student Teams in K-12 Classrooms," she offers a variety of examples of group projects and activities that have been tested and found to be effective in classrooms. Additionally, in "Reaching Out to Latino Families of English Language Learners," Cohen provides insightful strategies for building relationships and fostering an inclusive educational community, using collaborative learning, effective classroom teaching, and a focus on diversity and inclusion.

In addition, Elliot Aronson, American social psychologist, and author of the book "The Theory of Cooperative Learning," focuses on how teamwork and cooperation can improve learning and reduce destructive competition among students. Similarly, David Johnson and Roger Johnson, two American psychologist brothers who have been collaborating on cooperative learning research and theory since the 1960s, have developed numerous teaching strategies and techniques that are now widely used worldwide. Likewise, Robert Slavin, an American psychologist, has contributed to the development of cooperative learning programs and has been actively promoting the use of collaborative teaching techniques in schools.

1.2.3. Online collaboration theory

This theory focuses on how technology and digital media can improve collaboration and communication in teamwork. In online collaborative work, team members can collaborate and communicate through digital tools and in real time, which can improve team efficiency and effectiveness.

Teaching strategies are varied and are considered essential for meaningful learning. From the school organization, collaborative learning is known as the exchange and generation of knowledge within small groups, directed towards an academic objective (Martín-Moreno Cerrillo, 2004).

Collaborative work refers to a type of teamwork in which multiple individuals actively participate and contribute their knowledge, skills, and resources to achieve a shared objective. It relies on open communication and constant interaction among team members, facilitated by digital tools and online resources. This approach can be implemented in online or in-person settings and may involve real-time or asynchronous collaboration.

Other useful digital tools for collaborative work in education include video conferencing tools, such as Zoom or Microsoft Teams, which allow students and teachers to communicate in real time, as well as instant messaging and social networking tools, such as WhatsApp or Twitter, which can be used to communicate and collaborate more informally.

Using technology in collaborative work in education can have many benefits, including fostering teamwork, improving communication skills, and promoting active learning and critical thinking. However, it is important for teachers to be mindful of students' safety and privacy when using these tools, and to provide the guidance and support necessary for students to collaborate effectively and responsibly online (Villa, 2021).

In the field of research, according to (León and Mesa, 2020), technologies collaborate and enhance the work of interpretation and information gathering because they systematize and are effective for communication purposes.

Metacognition is a concept that has been explored across multiple fields. In this article, we define metacognition as the point at which a student reaches a level of understanding in their own learning,

becoming aware of what they comprehend and how they can apply that knowledge.

John Flavell is considered one of the pioneers in metacognition research. The topic of metacognition has sparked advances in the field, as noted by Glaser (1994), creating new possibilities for learning strategies and meaningful learning. Flavell (1976) defines metacognition as a person's knowledge of their own understanding and how this knowledge can be applied to learning other things, regulated through the awareness and organization of cognitive processes. Metacognition develops through intentional and aware efforts, such as recognizing the difficulty of learning, verifying phenomena, or exploring alternatives to achieve desired outcomes. Metacognition is a process that gradually develops during childhood and adolescence, according to Jean Piaget. Children acquire the ability to reflect on their thinking and monitor their cognitive processes. Lev Vygotsky emphasizes the role of social interaction in knowledge development, stating that metacognition develops through dialog and interaction with others. Donald Schön asserts that metacognition involves reflecting on our own practices and adapting them to changing circumstances. Recent studies, such as Jeunet et al. (2020), continue to explore the complex nature of metacognition and its role in learning and development.

Alternatively, Brown (1980) distinguishes between regulatory cognitive function and cognition, the former refers to knowing how to do something during the cognitive act, and the latter refers to understanding and knowing that we know something, that we have cognitive resources. These are just some of the theorists who have contributed to the development of the concept of metacognition. There are many other approaches.

1.3. Relationship between collaborative work and metacognition

According to Osses and Jaramillo (2008), metacognition is involved when the student becomes aware of the difficulty of learning some content compared to others, describing and understanding phenomena before accepting them as facts, and selecting the correct alternative in a multiple-choice test. Metacognition is a personal process, but collaboration and teamwork can positively impact both personal and social performance.

Consequently, collaborative work can be understood as a form of teamwork where students work together to achieve a common goal. This type of work can be closely related to metacognition as it involves students reflecting on their own learning process and collaborating to improve their understanding. Metacognition is the ability of students to comprehend and regulate their own learning process, which can be promoted through collaborative work in various ways:

First, when students work together and collaborate, they are forced to articulate their own ideas and learning strategies, which can help them reflect on their own thinking and understanding. Working with peers enables students to share and discuss various approaches and learning strategies, leading to reflection on their own learning process.

Second, collaborative work can help students develop metacognitive skills such as planning and monitoring their learning. Through collaborating on shared assignments and goals, students learn to plan and organize their time and resources effectively. They

can also monitor their progress to ensure they are meeting their learning objectives.

Third, Collaborative work also enables students to evaluate their own learning process and understanding, as well as that of their peers. By working together on shared projects, students can provide constructive feedback and evaluation to their peers, which helps them improve their own learning.

In summary, collaborative work and metacognition are closely related, as both involve analysis, reflection, and self-knowledge. By promoting collaborative work in the classroom, teachers can help students develop metacognitive skills that enable them to gain a deeper insight into their learning process and improve their understanding of the world and others.

2. Materials and methods

2.1. Participants

The sample for this study consisted of a total of 415 first-year students enrolled at Pablo de Olavide University who started their studies between the years 2019 and 2022. Participants were students of the Social Education and Social Work degrees who completed a digital questionnaire. Of the total sample, 374 (90.1%) were women and 40 (9.6%) men, ranging in age from 18 to 48 years (M = 19.58; SD = 2.867). The sample was distributed across the years of entry as follows: 103 students from 2019 (24.8%), 99 from 2020 (23.9%), 121 from 2021 (29.2%) and 92 from 2022 (22.2%). It should be noted that the responses to the questionnaire were voluntary, and no financial or academic incentives were offered to the respondents.

2.2. Instruments

The data for this study were gathered through a questionnaire called "Basic Digital Competences 2.0 of University Students," COBADI® (Registered Trademark: 2970648). Four parts of the questionnaire were used in this research: Dimension I, assessed competences in knowledge and use of ICT in social communication and collaborative work, consisting of 13 questions; Dimension II, evaluated the competences in the use of ICT for information search and processing, comprising of 11 questions; Dimension III, focused on assessing interpersonal competences in the use of ICT in the university context. Additionally, a scale was administered to determine internet usage, where students reported the amount of time that they spent using the internet for activities such as academic research or watching TV (10 questions). The questions have a response system measured on a Likert-type scale from 1 to 4 points (1 = "I feel completely ineffective" to 4 = "I feel I have completely mastered it"). The questionnaire in its full version has shown adequate reliability (α Cronbach = 0.9, ω = 0.75) (Vázquez et al., 2020).

2.3. Procedures

Since 2013, the questionnaire has been applied to new university students in the academic unit where the study was conducted. This takes place during the month of February each year. For the purpose of this research, data from the years 2019 to 2022 were selected. Regarding ethical safeguards, students were provided with an informed consent form in which written and verbal instructions informed the students that participation in this research was voluntary, their responses would remain anonymous, the purpose was strictly for research, and the data would not be shared with third parties, except when legally required.

In relation with data analysis procedure, descriptive data analysis techniques were applied, such as frequency analysis, percentage, means, and standard deviations were employed. To estimate the relationships between the frequency of internet use and the years in which the instruments were applied to students, the chi-square statistic was utilized. Student's t-statistic was used to compare the ICT competences of students who entered their studies in different years, in which the effect size was also assessed using Cohen's D indicator. An exploratory factor analysis was conducted using a principal components method and varimax rotation of internet uses. Subsequently, a simple average of the grouped actions was computed, and these factors were used as predictor variables of ICT competences oriented towards social communication and collaborative learning, and ICT competences oriented towards information search and processing. This was done using a multivariate general linear model (MANCOVA).

3. Results

In the evaluated students, no statistically significant differences were observed in relation to the type of activities in which they used the Internet before and around the pandemic. This, except for talking with friends on social networks (Chi-square = 6.457; p = 0.04) and working in groups with classmates to do homework (Chi-square = 14.466; p = 0.001). In both activities there was an increase in the pandemic season (See Table 1).

In relation to the competences in knowledge and use of ICT in social communication and collaborative learning, students show an increase in the competences to communicate through e-mail (t = −2.604; gl = 392.212; p = 0.010), use instant messaging as a communication tool (t = −2.534; gl = 370.937; p = 0.012), participate in social networks (t = −2.103; gl = 386.054; p = 0.036), navigate professional networks (t = −1.980; gl = 387; p = 0.048), use forums (t = −6.208; gl = 384.940; p = 0.000), participate in blogs (t = −3.999; gl = 401; p = 0.000), use wikis (t = −2.059; gl = 406; p = 0.040), design, modify or create a wiki (t = −3.390; gl = 370.060; p = 0.001), use syndication system (t = −4.276; gl = 232.656; p = 0.000), use social bookmarking and tagging (t = −3.332; gl = 287.831; p = 0.001), and use educational platforms (t = −3.504; gl = 383; p = 0.001) (See Table 2).

The data shows an increase in competences related to information technology for searching and processing information in the context of pandemics. Specifically, there has been an improvement in competences related to searching and planning information (e.g., using search engines), organizing and creating digital content (e.g., working with networked documents or organizing and synthesizing information using computer tools), and creating and disseminating digital content (e.g., using programs to share networked presentations, working with images using computer tools and applications, or using QR codes to disseminate information) (See Table 3).

TABLE 1 Percentages and chi-square for "technology consumption."

		Nothing	Little	Much	Pearson's chi-square	gl	p
Watch TV programs	2019–2020	23.8%	54.5%	21.8%	1.573	2	0.455
	2021–2022	18.8%	57.3%	23.9%			
Listening to music	2019–2020	0.5%	9.9%	89.6%	0.473	2	0.789
	2021–2022	0.5%	8.0%	91.5%			
Inform myself on topics that interest me academically and professionally	2019–2020	0.5%	44.1%	55.4%	1.96	2	0.375
	2021–2022	1.9%	40.8%	57.3%			
Play online	2019–2020	70.3%	24.8%	5.0%	2.557	2	0.278
	2021–2022	63.4%	29.1%	7.5%			
Search for information to perform university tasks	2019–2020		20.3%	79.7%	1.035	1	0.309
	2021–2022		16.4%	83.6%			
Publish photos/videos	2019–2020	7.9%	50.5%	41.6%	0.325	2	0.850
	2021–2022	6.6%	50.2%	43.2%			
Download music, movies, games, etc.	2019–2020	29.2%	43.1%	27.7%	0.454	2	0.797
	2021–2022	31.0%	44.1%	24.9%			
Talking to friends through social networks, chat	2019–2020		12.9%	87.1%	6.457	2	0.040
	2021–2022	0.5%	6.1%	93.4%			
Search for new friends through the use of social networks (Facebook, Tuenti, Twitter, MySpace, Orkut, Hi5, Google plus, etc.)	2019–2020	41.1%	39.1%	19.8%	0.643	2	0.725
	2021–2022	39.9%	37.1%	23.0%			
Working in groups with classmates to perform academic tasks	2019–2020	0.5%	38.1%	61.4%	14.466	2	0.001
	2021–2022	0.5%	21.1%	78.4%			

At the level of interpersonal competences in using ICT in the university, there was an increase in seeking consultations with professors through network communication channels ($t = -3.122$; $df = 413$; $p = 0.002$), searching for tutorials on the internet ($t = -2.357$; $df = 413$; $p = 0.019$), and talking with classmates to solve problems ($t = -3.122$; $df = 413$; $p = 0.002$). On the other hand, there was a decrease in requests for face-to-face tutorials ($t = 2.132$; $df = 413$; $p = 0.034$) (See Table 4).

To define the grouping of student internet use behaviors, an exploratory factor analysis was conducted. This procedure established three factors that account for 47.66% of the variance. The behaviors associated with each factor were determined through a principal component analysis with varimax rotation and are presented in Table 5. Factor 1 reflects academic use of the internet, factor 2 relates to social use, and factor 3 corresponds to recreational use (See Table 5).

We examined the impact of different types of internet use on digital competences related to social communication and collaborative learning, as well as information search and processing. Our findings show that playful internet use predicts higher digital competences for social communication and collaborative learning ($F = 5.041$; $p = 0.025$) and information search and processing ($F = 5.556$; $p = 0.019$). Academic use of the Internet is also associated with increased digital competences for social communication and collaborative learning ($F = 5.659$; $p = 0.018$) and information search and processing ($F = 15.026$; $p = 0.000$). The social use of the Internet would not predict these competences (See Table 6).

4. Discussion

Except for social networking with friends and group work to complete homework assignments, students did not significantly differ in the time they spent on internet activities before and during the pandemic. During the pandemic, there was an increase in both activities.

An interesting observation is the increase in collaborative work with classmates for homework during the pandemic. This could be attributed to the students' attempts to mitigate the lack of in-person social interaction by working in teams online. Moreover, online collaborative work may offer greater flexibility and convenience to students, as they do not have to coordinate schedules and locations for in-person meetings.

In terms of metacognition, online collaborative work can have a positive impact on students, as it provides opportunities for reflection on their learning process and promotes greater awareness of their thinking strategies and competences. For example, by working in teams online, students can discuss and compare the different strategies they are using to address a problem or task, which can help them reflect on their own approaches and consider alternatives. Moreover, receiving feedback from their peers can assist students in evaluating their work critically and developing their capacity to self-regulate their own learning.

In light of the pandemic, collaborative online work (Pérez, 2019) combined with metacognitive reflection can serve as a valuable tool for students, since this approach not only enables students to maintain

TABLE 2 Descriptive statistics and student's *t*-test: competences in knowledge and use of ICT in social communication and collaborative learning.

		N	Media	Standard Deviation	t	gl	p	D for Cohen
I can communicate with other people via email	2019–2020	201	3.65	0.632	−2.604	392.212	0.010	−0.258
	2021–2022	212	3.80	0.534				
I use the chat to interact with other people	2019–2020	199	3.70	0.672	−1.048	377.581	0.295	−0.104
	2021–2022	210	3.77	0.534				
I use instant messaging as a tool to communicate with other people	2019–2020	197	3.35	0.992	−2.534	370.937	0.012	−0.254
	2021–2022	203	3.58	0.776				
I can communicate with other people by participating in social networks (Ning, Facebook, Twitter, Hi5, Myspace, Tuenti, etc)	2019–2020	195	3.61	0.676	−2.103	386.054	0.036	−0.210
	2021–2022	210	3.74	0.589				
I am able to manage professional networks (LinkedIn, Xing)	2019–2020	184	2.19	0.936	−1.980	387.000	0.048	−0.201
	2021–2022	205	2.38	0.956				
I am able to participate appropriately in forums	2019–2020	194	2.30	1.026	−6.208	384.940	0.000	−0.627
	2021–2022	200	2.92	0.923				
I consider myself competent to participate in blogs	2019–2020	196	2.27	0.956	−3.999	401.000	0.000	−0.399
	2021–2022	207	2.64	0.913				
I know how to design, create and modify blogs (for example: Blogger, WordPress, etc.)	2019–2020	194	1.80	0.919	−1.128	400.000	0.260	−0.113
	2021–2022	208	1.90	0.859				
I know how to use Wikis (Wikipedia, Aulawiki21, etc.)	2019–2020	200	2.78	0.936	−2.059	406.000	0.040	−0.204
	2021–2022	208	2.97	0.892				
I consider myself competent to design, create or modify a wiki (Wikispace, Nirewiki, PBworks, etc.)	2019–2020	185	1.48	0.700	−3.390	370.060	0.001	−0.344
	2021–2022	198	1.75	0.892				
I use the syndication system (RSS)	2019–2020	110	1.38	0.813	−4.276	232.652	0.000	−0.537
	2021–2022	131	1.92	1.148				
I know how to use social bookmarking, tagging, social bookmarking (del.icio.us, Blinklist, etc.)	2019–2020	132	1.24	0.594	−3.332	287.831	0.001	−0.380
	2021–2022	161	1.52	0.807				
I am able to use educational platforms, (WebCT, campus on line, intranet, Moodle, Dokeos, etc.)	2019–2020	186	2.44	1.045	−3.504	383.000	0.001	−0.357
	2021–2022	199	2.81	1.017				

social interaction and support amongst their peers but also assists in developing crucial skills for learning and self-regulation.

Amidst the pandemic, students have demonstrated improved competences in their knowledge and usage of ICT for social communication and collaborative learning. In this sense, students have notably increased their competences to communicate via email, use chat to relate with other people, use instant messaging as a communication tool, participate in social networks, use forums, participate in blogs, wikis and use educational platforms Lechuga et al. (2020).

Effective use of ICTs for communication and collaborative learning can offer significant benefits for students Gámez et al. (2018) and Robins et al. (2015). For instance, email and instant messaging can facilitate real-time communication with peers and teachers, whereas social networks and blogs can serve as effective tools for sharing information and collaborating on group projects. Furthermore, educational platforms can provide access to online learning resources and activities, as well as the opportunity to interact with other students in a virtual environment (ENyD, 2023).

It is important to emphasize that, while students have shown improvement in their competences regarding the use of ICTs for communication and collaborative learning, it remains crucial for them to continue developing digital skills relevant to both, present and future demands, such as critical thinking, creativity, and online problem-solving. Moreover, students must also be aware of the potential risks and dangers that exist in the digital world and must know how to protect themselves and others in a digital environment.

Likewise, competences in the field of information technology for searching and processing information have increased, signifying a shift in the teaching paradigm (Tumino and

TABLE 3 Descriptive statistics and student's *t*-test: competences in knowledge and use of ICT in information research and processing.

		N	Media	Standard deviation	t	gl	p	D de Cohen
I can surf the Internet with different browsers (Mozilla, Opera, Explorer, etc.)	2019–2020	201	3.64	0.610	0.385	410.000	0.701	0.038
	2021–2022	211	3.61	0.724				
I am able to use different search engines (Google, Ixquick, Mashpedia, etc.)	2019–2020	195	3.08	0.936	−3.093	400.000	−0.002	−0.309
	2021–2022	207	3.35	0.851				
I feel able to work with some digital mapping software to search for places (Google Maps, Google Earth, Vpike, Tagzania, etc.)	2019–2020	199	2.68	1.099	−2.402	391.483	0.017	−0.238
	2021–2022	209	2.93	0.951				
I know how to use programs to plan my study time (Google Calendar, etc.)	2019–2020	199	2.42	1.083	−4.743	401.978	0.000	−0.470
	2021–2022	209	2.91	1.029				
I work with documents on the network (Google Drive, SkyDrive, etc.)	2019–2020	201	3.39	0.859	−3.625	355.981	0.000	−0.359
	2021–2022	211	3.65	0.601				
I am able to organize, analyze and synthesize information through concept maps using a social software tool (Cmaptool, Mindomo, Text2mindmap, Bubbl, etc.)	2019–2020	176	1.85	0.939	−3.676	369.000	0.000	−0.382
	2021–2022	195	2.23	1.010				
I can use programs to promote interactive presentations on the web (Prezi, SlideShare, Scribd, etc.)	2019–2020	198	2.77	0.999	−2.833	400.000	0.005	−0.283
	2021–2022	204	3.05	0.956				
I feel competent to work with social software tools that help me to analyze and/or browse content included in blogs (wordle, Tagxedo, etc.)	2019–2020	155	1.63	0.798	−3.850	327.220	0.000	−0.419
	2021–2022	178	2.02	1.022				
Work with images using social software tools and/or applications (Gloster, Picmonkey, Animoto, etc.)	2019–2020	170	1.76	0.975	−2.296	347.000	0.022	−0.246
	2021–2022	179	2.01	1.028				
I feel able to use podcasts and videocasts (flicks, Odeo, YouTube, etc.)	2019–2020	193	2.53	1.041	−1.076	387.000	0.283	−.109
	2021–2022	196	2.65	1.054				
I use QR codes to disseminate information	2019–2020	179	1.40	0.706	−7.236	362.546	0.000	−0.725
	2021–2022	209	2.06	1.077				

TABLE 4 Descriptive statistics and Student's *t*-test: interpersonal competences in the use of ICT in the university context.

		N	Media	Standard deviation	t	gl	p	D de Cohen
I consult the teacher through a network communication channel	2019–2020	202	2.550	0.9774	−3.122	413	0.002	−0.307
	2021–2022	213	2.845	0.9514				
I look for tutorials on the internet and try to solve it on my own	2019–2020	202	2.827	1.0341	−2.357	413	0.019	−0.231
	2021–2022	213	3.061	0.9910				
I talk to a colleague to see if we can solve it together	2019–2020	202	2.960	1.1190	−3.382	413	0.001	−0.332
	2021–2022	213	3.315	1.0139				
I look forward to and request a face-to-face tutorial	2019–2020	202	2.470	1.0797	2.132	413	0.034	0.209
	2021–2022	213	2.244	1.0801				

Bournissen, 2022). As a result, competences such as searching and planning information (e.g., utilizing search engines), organizing and creating digital content (e.g., working with networked documents, organizing and synthesizing information via computer tools), and creating and disseminating digital content (e.g., using programs for networked presentations, working with images via computer tools and applications, or utilizing QR codes to disseminate information) would have increased (Tumino and Bournissen, 2022).

Fernandez-Marquez et al. (2020) mention that at the level of interpersonal skills in the use of ICT in the university context, there was an increase in consultations with professors through network communication channels, searching for tutorials on the internet, talking to classmates to solve problems. At the same time, requests for face-to-face tutoring decreased.

When visualizing the effect that internet use has on the development of digital competences, it is possible to appreciate that the academic and recreational use of the internet can predict greater

TABLE 5 Matrix of rotated components for internet usage.

	Component		
	1	2	3
Search for information to perform university tasks	0.828		
Working in groups with classmates to perform academic tasks	0.730		
To inform myself on topics that interest me academically and professionally	0.687		
Talking to friends through social networks, chat		0.719	
Search for new friends through the use of social networks (Facebook, Tuenti, Twitter, MySpace, Orkut, Hi5, Google plus, etc.)		0.693	
Publish photos/videos		0.664	
Watch TV programs			
Download music, movies, games, etc.			0.721
Play online			0.674
Listening to music			0.503

Extraction method: principal component analysis.
Rotation method: varimax with kaiser normalization.
The rotation has converged in 4 iterations.

TABLE 6 Effects of internet use on ICT competences: general linear model results for social communication, collaborative learning, and information search and processing.

Origin	Dependent variable	Type III sum of squares	gl	Root mean square	F	Sig.	Partial Eta squared
Corrected model	Social communication and collaborative learning	2.937[a]	3	0.979	4.349	0.005	0.031
	Information search and processing	9.856[b]	3	3.285	8.961	0.000	0.061
Intersection	Social communication and collaborative learning	55.637	1	55.637	247.162	0.000	0.376
	Information search and processing	34.888	1	34.888	95.161	0.000	0.188
Recreational Use	Social communication and collaborative learning	1.135	1	1.135	5.041	0.025	0.012
	Information search and processing	2.037	1	2.037	5.556	0.019	0.013
Academic Use	Social communication and collaborative learning	1.274	1	1.274	5.659	0.018	0.014
	Information search and processing	5.509	1	5.509	15.026	0.000	0.035
Social Use	Social communication and collaborative learning	0.029	1	0.029	0.130	0.719	0.000
	Information search and processing	0.468	1	0.468	1.277	0.259	0.003
Error	Social communication and collaborative learning	92.517	411	0.225			
	Information search and processing	150.681	411	0.367			
Total	Social communication and collaborative learning	3106.513	415				
	Information search and processing	3115.768	415				
Total corrected	Social communication and collaborative learning	95.454	414				
	Information search and processing	160.537	414				

[a]R-squared = 0.031 (adjusted R-squared = 0.024).
[b]R-squared = 0.061 (adjusted R-squared = 0.055).

competences for social communication and collaborative learning, as well as for searching and processing information (Ríos-Sánchez and Torres-Hernández, 2018). However, the study did not find any significant correlation between social internet use and the development of digital competences.

It is noteworthy that the use of ICT in the university context has led to an increase in students consulting their professors through networked communication channels and searching for online tutorials. This suggests that students are using digital tools to improve their learning and academic performance (Tapia, 2019). Furthermore, the decrease in requests for face-to-face tutoring may be attributed to the increased access to online resources and learning opportunities.

Moreover, it should be emphasized that both academic and recreational use of the internet can have a positive effect on the development of digital skills, specifically in the areas of social communication, collaborative learning, and information search and

processing (Cabero-Almenara, 2019). This suggests that students who use the internet effectively for academic and recreational purposes may be developing valuable digital competences for their academic and professional future.

However, it is of concern that social use of the internet does not appear to have a significant effect on the development of digital skills (Rodríguez-García, 2019). This suggests that students who use the internet mostly for social purposes may not be taking advantage of the full potential that digital tools can offer for learning and developing digital competences. Consequently, it is important to encourage the effective use of ICTs in the educational context and to raise awareness of the opportunities and benefits they can offer for learning and developing digital competences.

5. Conclusion

The study suggests that the pandemic context has led to an increase in digital skills. This research indicates that increased academic and recreational use of the internet, such as uploading photographs, playing online games, and watching television, can lead to improved digital competences oriented towards searching for or creating digital information. However, the social use of the internet, such as the use of social networks, does not significantly increase digital competences. The study also found no significant differences in digital competency development across genders or age groups (Ibáñez, 2020).

In summary, the study suggests that the pandemic has increased the digital competences of university students, particularly in their use of information and communication technology (ICT) for social communication and collaborative learning, as well as for information search and processing. Furthermore, the study observes that academic and recreational use of the internet positively affects the development of digital competences, while the social use of the internet does not seem to have a significant impact (Contreras-Colmenares, 2019).

It is worth noting that these findings are cross-sectional, as no significant differences were found based on gender or age of the students. Therefore, these conclusions may be relevant for other university contexts and may have important implications for teaching and learning in the future, as there have been no established analyzes regarding the association between networked collaborative work and metacognition. This raises the possibility of advancing and investigating deeper into this field. Generally, the study suggests that the effective use of ICT in the educational context can positively impact the development of digital competences among university

students. Therefore, promoting and encouraging the use of ICT can enhance learning and the development of digital competences.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by COMITÉ ÉTICO DE INVESTIGACIÓN (CEI) DE LA UNIVERSIDAD PABLO DE OLAVIDE, DE SEVILLA. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

EL is the author of the applied COBADI questionnaire. RJ performed the data analysis. VA performed the content and bibliography review, created the conceptual section and the research proposal. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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