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12-year-old students of Spain and their digital ecosystem: the cyberculture of the Frontier Collective

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Abstract

In the context of primary education, students aged 11–12 years old begin to integrate digital devices and online behaviours that are more common and widespread at the secondary level. The objective of this study is to understand the factors that determine the initial digital ecosystem of students, and to evaluate the risks that these students face at a certain threshold age. The 356 participants in the sample completed a questionnaire designed ad hoc based on the findings of other studies with the same aim. The identified correlations and the regression equations obtained indicate, fundamentally, that two out of every three students who own a smartphone use it to communicate with family and friends. Furthermore, the use of mobile phones encourages young people to join and participate in social networks at an early age. The study also reveals that at this age, students use social networks mainly for the consumption of audiovisual content and not so much to share personal information of a critical nature. Finally, students in this particular age group are considered at a threshold age because they begin using smartphones regularly, making autonomous decisions without sufficient supervision regarding digital risks, thus becoming part of the Frontier Collective.

Keywords: Primary education, Digital ecosystem, Digital competence, Social networks, Mobile devices

1 Introduction

The contemporary digital culture, or cyberculture, refers to the set of practices, behaviours, values, and forms of interaction that emerge in the context of digital technology and online communication. It encompasses a plethora of activities, including Internet access, social networking, and gaming. The smartphone has become as a pivotal tool for accessing these activities (Tavakoli & Wijesinghe, 2019). It is therefore crucial to consider the age or developmental stage at which a young person first encounters technology and the digital environment it provides (Vaterlaus & Tarabochia, 2021). As might be expected, the acquisition of a mobile device marks the beginning of a transition towards greater digital autonomy. This is reflected in the integration of video platforms, social networks,

video games, and other digital technologies into people's daily lives, thus implying the configuration of their own digital ecosystem.

In this paper, we define the threshold age of 11–12 years old as the Frontier Collective age. At this age, students have access to mobile devices and are capable of making autonomous decisions regarding the design of their own digital ecosystem.

1.1 Literature review

In a social context mediated by technology, the smartphone is the most prevalent device as a communicative resource across all social strata and age groups (Pérez-Escoda & Contreras-Pulido, 2018). For the youngest age group, the smartphone has become a highly desired item (Gheno, 2020), and its incorporation and use resembles a rite of passage into adulthood. The influence of the mobile is such that in Spain, two out of every three twelve-year-old students and almost all thirteen-year-old students own and habitually use one. Among students aged ten to fifteen, 89.7% have a computer or tablet, and its use decreases in favor of the mobile phone as they get older (Instituto Nacional de Estadística [INE], 2020; Observatorio Nacional de Tecnología y Sociedad [ONTSI], 2019).

Despite an awareness of the potential issues associated with problematic smartphone use (Sohn et al., 2019), families continue to provide their children with these devices. This is due to the perceived benefits of greater control and peace of mind (Ling & Bertel, 2013) and the ability to adhere to social norms and avoid parental conflicts (Perowne and Morrison, 2023).

A number of studies have been conducted in Spain which indicate that the smartphone is the most commonly used device for accessing the Internet. These studies also show that young people primarily use their smartphones for socialising, academic performance and recreational purposes (Díaz-Vicario et al., 2019; Ditrendia, 2020; Garmendia et al., 2019; ONTSI, 2022; Vara-Miguel et al., 2022; CNMC, 2017). In particular, the focus of attention on mobile device screens is on web services and platforms that facilitate the consumption of multimedia content and interaction between users (Campi-Maldonado et al., 2021).

In the view of Berger (2020), those who are new to the use of digital technologies are not fully aware of the risks they may face. Consequently, experts suggest that the ability to identify potential threats on the network should be addressed from the earliest stages of online engagement (Álvarez-de-Sotomayor & Carril, 2021; Ángel-Prats et al., 2018). However, the findings of the EU Kids Online survey of minors aged 9 to 17 years in Spain (Garmendia et al., 2019) indicate that only one in four minors have received information or recommendations on cybersecurity in their educational institution, with approximately one third having received such information from their family.

Among the Internet services that young people show greater interest in, as an important link in the field of cyberculture, are social networks (Matosas-López et al., 2021). The presence or absence of an individual in a social network has been identified as a distinctive and determining factor in the opportunities for socialization (Crescenzi et al., 2013). These platforms facilitate the satisfaction of psychosocial needs, the construction of personal identity, and the pursuit of acceptance and recognition from others (González-Ramírez and López-Gracia, 2018; Tortajada-Giménez, et al., 2013). It can be

argued that when a student shares private information, it fosters a sense of connection with the subjects with whom they wish to be associated (Davis, 2013). Consequently, young people divulge personal information and repeatedly expose themselves, which carries inherent dangers and risks (Chacón-López et al., 2015; Montes-Vozmediano et al., 2020). The most frequently visited platforms by students are those that permit the viewing, sharing and rating of videos and photos (Ballesta-Pagán et al., 2015). These include YouTube, Instagram and TikTok (AIMC, 2018; Elogia, 2020).

Another of the cybercultural elements influencing the way people interact with technology and with each other, through the smartphone, is digital entertainment and streaming platforms. Although initially, streamers were dedicated to playing video games and interacting with their audience through real-time chat, thus generating a more participatory and social experience, they have now broadened their focus and created content of a diverse nature. The most prominent and successful streaming platform is Twitch, according to Gutiérrez-Lozano and Cuartero-Naranjo (2020), which, together with YouTube, attracts content creators and gamers that capture the interest of young people. This phenomenon has resulted in the downloading of games such as Clash Royale and Minecraft on smartphones by young people, as evidenced by Gewerc et al. (2017) and Fahy et al. (2018). In the case of Spain, Fortnite has also become popular (Chacón, 2020).

In the view of Bernal-Ruiz and Rosa-Alcázar (2022), Estévez et al. (2017) and Machimbarrena et al. (2018), electronic devices, social networks, video games and other technological and digital elements have become powerful resources that present various challenges, especially for families and educators of younger students, in terms of child and youth safety and psychosocial well-being. This is because the indiscriminate and thoughtless use of these technologies can have a negative impact on the maturation process and academic performance of children and adolescents (Carbonell & Oberts, 2015; Ventura et al., 2012).

1.2 Objectives and research questions

The principal objective of this study is to gain insight into the cyberculture of 11- and 12-year-old students. This will be achieved by identifying the elements that make up their digital ecosystem, and assessing the risks to which they are exposed, responding to the following research questions. To this end, the following research questions have been formulated:

1. At what age did students aged 11 and 12 obtain their first mobile phone, and what are the principal activities they engage in with it?
2. What devices do they use to connect to the Internet, and who provides them with guidance on how to proceed?
3. What is the social digital performance of students between the ages of 11 and 12?

2 Method

This research is consistent with other studies and research examining the use of digital technology by minors (Keller et al., 2020; Romero-Tena et al., 2022; Hernández, 2021; Marín-Suelves et al., 2022). Moreover, this research addresses the necessity for further

investigation into the digital domain of students in primary education, particularly those aged 11–12 years (Contrera-Cázarez, 2020; Lozano-Sánchez et al., 2019; Peñalva & Napal, 2019).

In order to address the objective of this work and answer the research questions, a quantitative research study of an associative-predictive nature was designed. This approach allowed the comprehension of the interactions between the variables under investigation and the formulation of a forecast of the prospective behaviour of the students who participated in the study to be made.

2.1 Sample

The sample was selected on the basis of including primary education centres situated in a variety of geographical areas within the Autonomous Community of the Basque Country. The data for this study were gathered using a straightforward purposive sampling method, which involved the inclusion of centres that had consented to participate (Scheaffer et al., 2007). The inclusion criterion was that the students were in the first year of the sixth grade of primary education. The sample for this research consisted of a total of 356 students from six public elementary schools. With regard to the sociodemographic characteristics of the sample, the participants were aged between 11 and 12 years. Of the participants, 56.6% were female ($n=198$), while 44.38% were male ($n=158$).

2.2 Instrument used to obtain information

In order to achieve the research objectives, an ad hoc instrument was designed taking into account other works that pursue the same purpose (Ditrendia, 2020; Elogia, 2020). The reliability and internal consistency of the instrument were evaluated using the Cronbach's Alpha coefficient, $\alpha=0.78$, which is a relevant indicator for this type of study (Hogan, 2015; O'Dwyer and Bernauer, 2013).

The questionnaire enabled the identification of the elements that make up the students' initial digital ecosystem through the use of multiple-choice items. Additionally, it permitted the assessment of their knowledge using a Likert scale, with responses ranging from one to five (1: a little; and 5: a lot). Accordingly, the set of topics and aspects collected through the following 18 items is presented in Table 1.

2.3 Procedure

Prior to the commencement of the research, the objective of the study was presented to the management teams of each educational institution, and the approval and informed consent of the students' families and guardians were obtained. Finally, the students were informed that completion of the questionnaire was entirely voluntary. Consequently, the students who participated in the study responded to the questions via the Internet and were allotted a period of 30 min to complete the questionnaire.

2.4 Data analysis

In order to conduct this study, a series of analyses were performed using *SPSS Statistics* software (version 25). The analyses included the calculation of the frequencies and percentages of responses to the multiple-choice items of the questionnaire. Moreover,

Table 1 Questionnaire items and respondents' response options

Please indicate the length of time you have been in possession of your own cellular telephone	I don't have my own mobile phone I have my own mobile phone, for 6 months I have my own mobile phone, for one year I have my own mobile phone, for two years I have my own mobile phone, for more than two years	
Please indicate the time of year in which you obtained the mobile phone	At Christmas On my birthday In the summer At another time I have never been given a mobile phone	
Please provide a detailed account of the ways in which you utilise the mobile device in question	To play games To listen to music To access social media To communicate with friends To talk with family To take videos and photos For something else	Likert scale (1–5)
Please indicate whether you are able to utilise your mobile phone to access the internet	Yes No I don't use a mobile phone	
Please indicate which mobile game you consider to be your favourite	Open field	
Please indicate whether you have access to the Internet at your place of residence	Yes No I don't access the internet	
Please indicate whether you utilise a wireless fidelity (WiFi) connection to establish a network link	Yes No I don't access the internet	
Please indicate the age at which you commenced using the Internet	8 years old 9 years old 10 years old 11 years old 12 years old I haven't started	
Please evaluate whether you have received advice and information on how to navigate the online environment safely	Yes, I have received information from my parents Yes, I have received information from my siblings Yes, I have received information from my friends Yes, I have received information from school No, I haven't received any information	Likert scale (1–5)
Please indicate the frequency with which you access the Internet	Every day Every week Every month I don't access the internet	
This assessment determines the device from which the Internet is accessed	From a computer From a tablet From a mobile phone From a television From a gaming console From another place No, I don't connect	Likert scale (1–5)
Please indicate which questions you pose on the Internet	Open field	
Please indicate which actions you undertake on social networks	Play, entertain myself (games) Listen to music, watch movies... (YouTube, etc.) Access social media Consult news, newspapers, magazines Search for information to do school homework Other activities I don't use the internet	Never Every day Every week Every month

Table 1 (continued)

Please indicate the number of social media profiles you possess	Facebook WhatsApp TikTok Instagram Snapchat YouTube Gaming websites (Twitch, etc.)	View Share information Like or dislike Talk with friends Play I don't do anything
Please indicate which public information you display on social networks	I don't have social media My photo on the profile I am a girl or a boy Date of birth Origin Phone number Residential address Email address Name of the school I attend Interests (activities, music, books, etc.) My full name A photo on the profile that is not me False age False information about me	
Please evaluate the social network you use the most	WhatsApp TikTok Instagram Snapchat YouTube Gaming social networks (Twitch, etc.)	Likert scale (1–5)
Please indicate the amount of time you spend using social networks	Facebook WhatsApp TikTok Instagram Snapchat YouTube Gaming social networks (Twitch) Other	Never Every day Once a week Once a month
Please indicate the video game you play the most on your mobile device	Open field	

Data Collection Instrument

Source: Own elaboration

the means and standard deviations of the items rated on a *Likert scale* from one to five were also examined. Additionally, *Student's t-tests* were conducted to analyse equality of variances, and *Pearson* correlation analysis was performed to examine the relationships between the variables that make up smartphone use. *Cohen's d* was calculated to analyze effect sizes. Cohen proposed the following scale: small effects range from 0.1 to 0.29, medium effects from 0.3 to 0.49, large effects from 0.5 to 0.69, and very large effects are ≥ 0.7 (Cohen, 1992). Finally, linear regressions were performed, the *Durbin-Watson test* was applied, and *beta* coefficients (β) were calculated in order to identify the variable that determines the incorporation of social networks into the students' initial digital ecosystem.

3 Results

3.1 Smartphone ownership and use

In relation to the first research question (1. At what age did students aged 11 and 12 obtain their first mobile phone, and what are the principal activities they engage in with it?), the data obtained show that, first of all, 39% ($n = 141$) of the students

do not own a cell phone. In addition, 29.1% ($n = 103$) have owned one for less than six months, 19.1% ($n = 67$) for a period of one year and 12.1% ($n = 43$) for a period of two years or more. Regarding the time when they obtained the cell phone, 18.3% ($n = 39$) of the respondents indicated that they received it as a gift on their birthday, 11.9% ($n = 25$) during the summer vacation period, and 69.8% ($n = 148$) at a different time. In addition, 30.6% ($n = 65$) of the students demonstrated the capacity to utilise a data tariff to undertake the aforementioned activities.

In regard to the video games used on smartphones, it noteworthy that 27.8% ($n = 59$) of students engage with Brawl Stars, 9.3% ($n = 20$) play Fortnite, 5.1% ($n = 11$) play Clash Royale, 4.7% ($n = 10$) play Subway Surfers, and 3.9% ($n = 8$) play Roblox.

The study indicates that the participating students mainly use their smartphone for communication with family members, as evidenced by the highest rating of $M = 2.83$ ($SD = 1.75$) points for this particular aspect, as detailed in Table 2. The results show that there is a difference in the ratings given by boys and girls on this issue, with boys rating it at $M = 2.73$ ($SD = 1.69$) points and girls rating it at $M = 3$ ($SD = 1.83$). The difference is statistically significant, $t(349.42) = -1.44, p = 0.001, d = -0.27$, 95% CI [-0.642, 0.099], but the effect size (Cohen's d) is small (< 0.3). A similar pattern is observed for communication with friends, $t(350.45) = -1.69, p = 0.02, d = -0.30$, 95% CI [-0.662, 0.049].

However, significant differences were found in the *t-student test* for editing photos and videos, $t(347.93) = -0.74, p = < 0.01, d = -0.61$, 95% CI [-0.89, -0.33]), and the effect size (Cohen's d) is moderate ($d = -0.45$), respectively, as shown in Table 2.

A further study was conducted using a linear regression model (see Table 3) to assess the impact of the correlated variables. The results indicated that $R^2 = 0.497$, $F(1,356) = 349.306$, $p \leq 0.001$, which suggests that 49.7% of the variability in the use of cell phones to access social networks can be explained by the students' use of the *smartphone* to communicate with their friends.

The independence analysis of the residuals served to corroborate the validity of the model, with a value of 2.028 being obtained. This result indicates the absence of positive (values close to 0) and negative (values close to 4) autocorrelation according to the *Durbin-Watson* statistic.

Likewise, the regression coefficient analysis (see Table 3) demonstrates that the *beta* slope ($\beta = 0.705$, $t = 18.690$, $p < 0.01$) was statistically significant, thereby confirming the existence of a linear relationship between the two variables.

Subsequently, a second linear regression was carried out (see Table 4), which demonstrated that 56.5% of the variability in the use of the cell phone to communicate with friends can be explained by the students' use of their *smartphones* to talk to their families ($R^2 = 0.565$, $F(1,354) = 459.764$, $p < 0.001$). This finding corroborates the influence of this variable. The analysis of independence of residuals confirms the validity of the model, as it yielded a value of 1.829, indicating the absence of positive (values close to 0) and negative (values close to 4) autocorrelation according to the *Durbin-Watson* statistic. In addition, the regression coefficient analysis (see Table 4) shows that the *beta* slope ($\beta = 0.752$, $t = 21.442$, $p = < 0.01$) is statistically significant, indicating an acceptable linear relationship.

Table 2 Student's t-test for independent samples on smartphone use

Shares	Males		Women		Total		Sig	Cohen's d	t	df	MD	SE Diff	95% CI	
	M	SD	M	SD	M	SD							L	U
Playing video games	2.55	1.47	2.45	1.39	2.50	1.44	.082	.07	0.63	356	.09	0.15	-206	.402
Listening to music	2.34	1.43	2.60	1.52	2.44	1.47	.032	-.18	-1.65	350.61	-.26	0.15	-574	.049
Enter Social Networks	2.12	1.45	2.27	1.50	2.18	1.47	.181	-.1	-0.96	356	-.15	0.15	-463	.159
Communicating with friends	2.43	1.61	2.73	1.76	2.55	1.68	.02	-0.18	-1.69	350.45	-.30	0.18	-662	.049
Communicating with family	2.73	1.69	3.00	1.83	2.83	1.75	.001	-0.15	-1.44	349.42	-.27	0.18	-642	.099
Edit photos and videos	1.99	1.14	2.60	1.55	2.25	1.37	.01	-.45	-4.26	347.93	-.61	0.14	-897	-.331
Other	2.00	1.43	2.12	1.47	2.04	1.45	.552	-.08	-.74	356	-.11	0.15	-424	.190

M mean, SD standard deviation, t Student's t statistic, Cohen's d effect size, df degrees of freedom, MD mean difference, SE diff standard error difference
 95% CI = 95% Confidence Interval, Sig Significance level $p < 0.05$

Source: Own elaboration

Table 3 Regression results of the variables smartphone to communicate with friends and Social Networks

Model	R ²	R ² adjusted	Standard error of the estimate	Statistics of change					Durbin-Watson
				Change in R ²	F	df ¹	df ²	Sig	
1	0.497	0.495	1.046	0.497	349.306	1	356	<0.001	2.028

Predictors: (Constant). Value for what you use the cell phone: To communicate with friends; Dependent variable: Rate what you use your cell phone for: To enter Social Networks

Source: Own elaboration

Table 4 Regression results of the variables smartphone to communicate with family and friends

Model	R ²	R ² adjusted	Standard error of the estimate	Statistics of change					Durbin-Watson
				Change in R ²	Change in F	df ¹	df ²	Sig	
1	0.565	0.564	1.114	0.565	459.764	1	356	<0.001	1.829

Predictors: (Constant) Rate what you use your cell phone for: to talk to your family; Dependent variable: Rate what you use your cell phone for: to communicate with friends

Source: Own elaboration

3.2 Internet, digital devices and usage tips

In relation to the second research question (2. What devices do they use to connect to the Internet, and who provides them with guidance on how to proceed?), the study shows that 98.1% ($n = 349$) of the students have Internet access at home and 76.9% ($n = 273$) connect to the network via WiFi. It also shows that 63.5% ($n = 226$) had their first autonomous Internet experience at the age of 8, 20.2% ($n = 72$) at the age of 9 and 13.5% ($n = 48$) at the age of 10.

In terms of frequency of use, 68.5% ($n = 242$) stated that they connect to the Internet every day. Specifically, 25% ($n = 60$) estimated that they connect for about one hour per day and 33.3% ($n = 79$) for between one and two hours.

Regarding the digital resources they use to connect to the network, the personal computer received the highest mean rating with $M = 3.93$ ($SD = 1.27$) points, with no significant differences found, $t(356) = 2.01, p = < 0.97, d = 0.27$, 95% CI [0.007. 0.541] (see Table 5).

The *t-student* test revealed statistically significant differences between the sexes in the use of digital devices to connect to the Internet. Girls scored higher than boys on other devices, as evidenced by a statistically significant difference, $t(345.16) = -2.84, p = < 0.001, d = -0.37$, 95% CI [-0.633. 0.115]), and the effect size (Cohen’s *d*) is moderate ($d = -0.3$) (see Table 5). Conversely, boys scored higher than girls in using the tablet to connect to the Internet $t(348.22) = 0.40, p = < 0.001, d = 0.06$, 95% CI [-0.262. 0.396]), and television, $t(342.78) = 0.09, p = 0.03, d = 0.01$, 95% CI [-0.297. 0.327]), but the effect size (Cohen’s *d*) is small (< 0.3).

The analysis revealed that the use of the video game consoles to connect to the network produced the largest difference and was statistically significant, $t(333.06) = 9.34, p = < 0.001, d = 1.51$, 95% CI [1.193. 1.829]). Boys achieved a mean score of $M = 3.25$ ($SD = 1.71$), while girls achieved a mean score of $M = 1.74$ ($SD = 1.42$) and the effect size (Cohen’s *d*) is large ($d = 1.02$) (see Table 5).

Table 5 Student's t-test for independent samples on digital resources for connecting to the Internet

Devices	Males		Women		Total		Sig	Cohen's d	t	df	MD	SEDiff	95% CI	
	M	SD	M	SD	M	SD							L	U
Personal computer	4.04	1.32	3.77	1.26	3.93	1.27	.975	.21	2.01	351	0.274	0.136	0.007	0.541
Tablet	2.97	1.49	2.90	1.66	2.92	1.56	.01	.04	0.40	348.22	0.067	0.167	-0.262	0.396
Smartphone	2.86	1.66	3.10	1.6	2.95	1.62	.344	-.15	-1.37	356	-0.238	0.174	-0.579	0.103
Television	2.55	1.43	2.53	1.54	2.53	1.47	.030	.01	0.09	342.78	0.015	0.159	-0.297	0.327
Video game console	3.25	1.71	1.74	1.22	2.58	1.68	.01	1.02	9.34	333.06	1.511	0.162	1.193	1.829
Other device	1.50	1.09	1.88	1.42	1.66	1.23	.01	-.3	-2.84	345.16	-0.374	0.132	-0.633	-0.115
Does not connect	1.19	0.77	1.49	1.11	1.31	0.97	.01	-.31	-2.89	351.23	-0.301	0.104	-0.506	-0.096

M mean, SD standard deviation, t Student's t statistic, Cohen's d effect size, df degrees of freedom, MD mean difference, SE diff standard error difference

95% CI = 95% Confidence Interval, Sig Significance level $p < 0.05$

Source: Own elaboration

The study also showed that 68.4% ($n=243$) of the respondents considered their parents as the primary source of guidance on safe online conduct. A total of 34.2% ($n=121$) of the students indicated that they had obtained information from their school teachers, 25% ($n=89$) from their friends and 20.4% ($n=72$) from their siblings. Finally, 8.4% ($n=32$) of the respondents indicated that they had not received any information from any source.

The source of information that exceeded 3 points was from the family, with a total mean score of $M=3.62$ ($SD=1.5$) (see Table 6). In terms of score, girls rated higher than boys, with a score of $M=3.86$ ($SD=1.58$) compared to $M=3.42$ ($SD=1.44$), respectively. This difference was found to be statistically significant, $t(352.33)=-2.71, p=0.01, d=-0.43$, 95% CI [-0.750, -0.120]), and the effect size (Cohen's d) is moderate ($d=0.3$).

Similarly, girls scored higher than boys in relation to the information they received from their siblings, friends, and the educational institution. These differences are statistically significant for information received from siblings, $t(347.79)=-2.06, p=0.006, d=-0.29$, 95% CI [-0.57, -0]). The results indicated that girls rated higher than boys in relation to the information they received from their friends, $t(353.13)=-2.8, p=0.001, d=0.39$, 95% CI [-0.664, 0.117]), as well as from the educational centre, $t(353.41)=-2.00, p=0.01, d=-0.32$, 95% CI [-0.639, 0.007]). These findings are presented in Table 6. In all cases, the effect size is small (<0.3).

3.3 Performance and fingerprint

The research also made it possible to identify the social digital performance of students and the footprint they leave on social networks (3. What is the social digital performance of students between the ages of 11 and 12?). The study carried out for this purpose shows that the social network that monopolizes the largest number of actions is Youtube. 56.5% ($n=201$) of students use it to watch videos and 15.7% ($n=56$) also use it to click *like/dislike*. The sum of the same actions on TikTok is 35.3% ($n=90$) and on Instagram 13.8% ($n=49$). Likewise, 31.5% ($n=112$) of students use Whatsapp to communicate or talk with friends (see Table 7).

Regarding the information that students publish in their profiles on Social Networks, 15.64% ($n=55$) publish the gender with which they identify themselves, 8.37% ($n=30$) their first and last name and 5.03% ($n=17$) disclose their telephone number. In addition, it was observed that 7.26% ($n=25$) give a false age, 5.59% ($n=19$) upload a photo that does not correspond to their real identity and 4.47% ($n=16$) use false data in general.

4 Discussion and conclusions

The work carried out has enabled the identification of the elements that constitute the initial digital ecosystem of 11- and 12-year-old students, thereby providing a more profound comprehension of a number of related issues.

This study shows that in the cohort of students in year 6 of primary education, the ownership and use of mobile devices is not universal. It also shows that participation in social networks is not universal, but rather selective, and that the use of digital games for recreational purposes is sporadic, thus justifying the identification of this stage as a threshold before the wider use of digital ecosystems.

Table 6 Student's t-test for independent samples on the source of information on how to act on the Internet

Origin	Males		Women		Total		Sig	Cohen's <i>d</i>	t	df	MD	SEDiff	95% CI	
	M	SD	M	SD	M	SD							L	U
Family	3.42	1.52	3.86	1.44	3.62	1.5	.01	-.3	-2.71	352.33	-0.43	0.16	-0.750	-0.120
Brothers and sisters	1.84	1.26	2.14	1.38	1.96	1.32	.006	-.23	-2.06	347.79	-0.29	0.14	-0.570	-0.014
Friends and friends	2.18	1.14	2.57	1.47	2.35	1.3	.01	-.28	-2.80	353.13	-0.39	0.13	-0.664	-0.117
Educational center	2.64	1.42	2.96	1.58	2.79	1.5	.01	-.22	-2.00	353.41	-0.32	0.16	-0.639	-0.007
I have not received any information	1.40	1.11	1.42	1.1	1.40	1.1	.98	-.02	-0.11	356	-0.01	0.11	-0.248	0.221

M mean, *SD* standard deviation, *t* Student's *t* statistic, Cohen's *d*, effect size, *df* degrees of freedom, *MD* mean difference, *SE diff* standard error difference
 95% CI = 95% Confidence Interval, *Sig* Significance level $p < 0.05$

Source: Own elaboration

Table 7 Frequency of actions carried out through Social Networks

	Social networks													
	Facebook		Whatsapp		TikTok		Instagram		Snapchat		Youtube		Twitch	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
I do nothing	315	88.5	145	40.7	176	49.4	265	74.4	260	73	15	4.2	144	40.4
Like /dislike	9	2.5			12	3.4	16	4.5	9	2.5	23	6.5		
Talking to friends			112	31.5	25	7	10	2.8	42	11.8	20	5.6		3.6
Play														
See	14	3.9	35	9.8	54	15.2	32	9	7	2	201	56.5		10.3
Share information	14	3.9	14	3.9	6	1.7	3	0.8	6	1.7	7	2		28
Play; watch														
Talking; looking			23	6.5	6	1.7			13	3.7	3	0.8		6.5
Watch; like/dislike					36	10.1	17	4.8	4	1.1	56	15.7		3.7
Talking to friends; watching; like/dislike									7	2	13	3.7		
Talking with friends; sharing information			23	6.5	6	1.7	9	2.5	8	2.2	11	3.1	9	2.5
Talk to friends; share information; like/dislike; share information; like/dislike	4	1.1	4	1.1	35	9.8	4	1.1			7	2	4	1.1

Source: Own elaboration

Furthermore, it can be argued that this age is crucial, as there is evidence of personal decision-making regarding the electronic resources and digital activities in which they engage and which constitute their digital ecosystem. These are the main reasons why this age threshold can be conceived as a Frontier Collective.

The research findings indicate that the students participating in the study demonstrate a high level of adoption of technological devices and Internet services which is not an occasional phenomenon but rather a phenomenon that manifests itself from a very early age. This is consistent with the observations of other researchers, including Perowne and Morrison (2023) and Rial et al. (2014).

It can be concluded that the Internet was the first digital element that students incorporated into their lives, typically around the age of eight. Furthermore, it can be stated that the Internet is a fundamental aspect of their lives, as the majority of students connect from their homes and two-thirds do so on a daily basis for more than an hour (ONTSI, 2019).

In terms of mobile phones, this study is in line with other research that indicates that approximately two-thirds of 11- and 12-year-old students own a smartphone (Escoda, 2018; Lozano-Sánchez et al., 2019). Furthermore, the study indicates that approximately one-third of students acquired their device before the start of their sixth year of primary education. It is therefore clear that access to mobile phones occurs at an early age (Chang et al., 2019) and that smartphone use begins to consolidate before pre-adolescence, becoming a fetish object that is part of their digital socio-personal kit. Nevertheless, as the phenomenon is not yet universal, the study does not allow us to conclude that it is already an integral part of the current digital ecosystem. However, it is expected that this will be the case in the near future.

This study identified several uses and habits related to smartphones, which can be considered part of the digital ecosystem at this threshold age. In particular, it was found that students primarily use their mobile devices to communicate with their family and friends (Pérez-Escoda & Contreras-Pulido, 2018). The study showed that students who received a smartphone from their families for the purpose of communicating with them also used this device in a similar way to interact with their friends through social networks. Consequently, it can be concluded that the use of smartphones is a significant factor in encouraging young people to join social networks.

It is therefore of the utmost importance that families carefully consider the context and circumstances surrounding the provision of mobile devices to their sons and daughters, as they may inadvertently contribute to their premature incorporation of social networks into their initial digital ecosystem.

It has also been observed that the use of mobile devices to watch videos and play games is a common practice among young people. In particular, it was shown that boys use mobile devices to play popular video games such as Brawl Stars, Fortnite or Clash Royale (Centurión et al., 2020; Garmendia et al., 2019), while girls use them to watch videos on YouTube. In this context, the use of other social networks such as TikTok and Instagram was limited, and their penetration on these platforms can be considered weak.

This confirms previous studies (Álvarez-de-Sotomayor et al., 2021; Ballesta-Pagán et al., 2015), which have demonstrated that 11- and 12-year-old students exhibit less interest in social networks compared to their older counterparts. It is evident that the

majority of their interactions with social networks are limited to the use of these platforms as audiovisual platforms, with a primary focus on the viewing and watching posted videos (Campi-Maldonado et al., 2021).

Similarly, a minority of students reported sharing critical or personal information on these networks. Nevertheless, those who did disclose personal information revealed details such as their gender, posted personal photos, shared their identity, or even gave their mobile number. These findings are consistent with those of previous research and confirm that there has been no change in the trend observed (Garmendia-Larragaña et al., 2016).

In light of the aforementioned findings, it cannot be concluded that the primary education students participating in this study are overexposed to social networks, contrary to what is observed in older age groups (Montes-Vozmediano et al., 2020).

In terms of online safety, the participating students received more guidance from their families than from their teachers, which is in line with previous research (Garmendia et al., 2019). This is consistent with the findings of Bartau-Rojas et al. (2020), who found that girls were the focus of greater parental concern and, as a result, received more attention and guidance.

Although the identified risk indicators identified are relatively low, it seems prudent and justified to implement strategic plans that integrate pedagogical guidelines to promote safety and responsible use of the Internet, social networks and video games among students. Furthermore, it is recommended that policies and guidelines be developed for families to help make decisions about the appropriate age for their children to receive a smartphone, with the aim of reducing the associated risks (Vaterlaus & Tarabochia, 2021).

Finally, although the results of this research cannot be extrapolated to the entire population, they do provide an understanding of the trend that 11- and 12-year-old students follow in the adoption of technology and the configuration of their digital ecosystem. For this reason, it would be beneficial to continue to analyse and study the digital inclinations and behaviours of students at this potentially vulnerable age in order to provide support.

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Authors' contributions

ET did the conceptualization of the research and the writing of the original draft. UG managed the project, the funding and administration, and supervised the paper. JP worked on the methodology, data curation and the formal analysis in the paper. AA contributed in the last review and editing, and supervised the language accuracy and quality. All authors read the last version of the manuscript and approved it.

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Availability of data and materials

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

Declarations

Ethics approval and consent to participate

All the participants were informed about the aims and objectives of the study and expressed that they agree to participate.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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