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ORIGINAL

Technology Usage and Academic Performance in the Pisa 2018 Report

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ABSTRACT

In the last two decades, the great technological advances sweeping society have made inroads into the educational sphere. The use of information and communication technology and social networks has opened up new possibilities for student learning, which require appropriate treatment by family and teachers. This quantitative study takes a new approach to investigating the relationship between Spanish teenage students' academic success and their use of technology and social networks. It analyses data published in the 2018 PISA report to assess whether the use of these resources is appropriate, and to determine their impact on students' learning and performance in reading, mathematics and science. The study takes a new approach in terms of the variables selected and the analysis of the data through two statistical measures. The results suggest that excessive use of technology and social networks, both during the week and at weekends, impairs performance. This finding is more acute in the case of male students, as the data indicates that they start at an earlier age and are more likely to use social media for the detrimental activity of online gaming.

Keywords SOCIAL NETWORK, ICT, PISA, COMPETENCES, GENDER

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1 INTRODUCTION

There are more than 3,800 million social networks users around the world (Europa Press, 2020). The focus of this study is Internet and social network usage among young people in Spain. According to the Digital 2020 Report produced by We Are Social (2020) the total number of mobile connections in Spain is 54.11 million, in a population of 46.75 million people. At the same time, 42.40 million people are connected to the Internet and 29 million use social networks, 31% of whom are 16 to 30-year-olds. Social network usage is slightly higher among boys aged 13 to 17 (1.4%) than it is among girls of the same age (1.1%) (Europa Press, 2020).

The aim of this study was to analyse attitudes to social network usage among Spanish teenagers aged 15 to 16, in their final year of compulsory education. The paper takes a novel approach to analysing the associations of the results of the study with those obtained in the PISA assessments of Spanish students from a validated test (OECD, 2019).

PISA (Programme for International Student Assessment) is a comparative report ranking student performance by country, with the aim of providing evidence that countries can use to fine-tune their educational policies. In this international study, results from this standardized test were statistically analysed. The relevance of this report lies in the great information it provides on the eighty-two educational systems analysed, so that the findings of PISA offer a reliable general perspective for governments (at both regional and state level) to assess the success of the educational policies that have been carried out, and to establish new proposals that favour the equality of all students.

For Lamas (2015), the purpose of school or academic performance is to achieve an educational goal, that is, learning. According to the Spanish secondary curriculum set out in the Organic Law (LOE, 2006; LOMCE, 2013), the core subjects are Mathematics and (Spanish) Language, which includes reading ability. A. García, Criado, and Cañal (2015) underline the need for the Sciences to have a more important place on the curriculum.

Teasing out the influence on performance of the use of technology inside and outside the school context is a difficult task (Vázquez-Cano, Gómez-Galán, Infante-Moro, & López-Meneses, 2020) as results are often contradictory (Corder et al., 2015; OECD, 2015). Daily habits regarding the use of technologies and social networks are heavily influenced by the volume of information that users receive (Junco & Cotten, 2012).

Nudelman (2006), exploring differences in academic performance between the sexes among pupils in Valencian Community secondary schools, found that girls were better at language and boys were better at science. A previous quantitative study by Martínez-Garrido (2018) examines how the use of technology in and out of school impacts academic performance, based on the PISA results in mathematics and reading ability (OECD, 2018) in Spanish secondary schools. Another empirical study by (S. García, 2019) into the influence of new technologies on the performance of students in the Spanish Baccalaureate shows that engagement with technological tools by the students has a positive influence on their performance in the sciences and language, but a negative influence on mathematics.

The current study aims to investigate the relationship between technology and social network usage among young students and their academic performance and acquisition of the main competencies. This relationship can have a significant impact on learning in different areas, especially in science (Harlen & Qualter, 2009), and may influence their all-round development as people in the future. Several variables were used in order to characterise social network usage among the students. These included genders and the age at which participants first started using the Internet and social networks, whether these technologies were accessed. An important distinction was made between weekday and weekend usage, whether for communicating or online gaming, in order to gain some reflection of young people's management of the time spent on their obligations and leisure activities. It is also focused the students' perception of their own competence or autonomy, along with the utility, of ICT. Finally, the students' performance in the three competencies under analysis –Reading, Mathematics and Science– was assessed through the scores recorded in the PISA report.

In conjunction with the results obtained, an up-to-the-moment review of a range of empirical studies carried out in recent years is included, drawing on indexing databases, such as ISI and Scopus among others, and incorporating doctoral theses, reports and authorities in both English and Spanish.

A brief literature review follows, focusing on social networks and Internet usage by students in their final year of compulsory education. This is followed by a description of the methodology used in the study, and the results obtained from analysis of the 2018 PISA report. Finally, there is a discussion of the results and the main conclusions of the study.

2 GENERAL FRAMEWORK

2.1 Age at First Internet Use, Gender and Navigability of Digital Devices and the Internet

A large number of studies have focused on the negative psychological health effects of technology (Chen et al., 2017). At the same time, other studies include the positive impact of smartphones on education through microlearning (Crespo & Sánchez-Saus, 2020; Jahnke, Lee, Pham, He, & Austin, 2020; Kapp & Defelice, 2019; Sammour, Al-Zoubi, & Schreurs, 2020). So, in order to gain a more balanced perspective of the general education system, potential negative effects should not be ignored. For example, in a quantitative study, (Barrientos-Gutiérrez et al., 2019) developed a scale of technophilia (that is, positive orientation towards new technology) among students from the three largest cities in Mexico (n = 8123), via a questionnaire measuring access, use and pleasure from different electronic media. The results indicated that high levels of technophilia were associated with the trial of e-cigarettes among young people. Busch and McCarthy (2021) provide a systematic review of 293 research papers into the emerging area of problematic smartphone use (PSU). Their findings suggest that young, highly educated women are most prone to PSU, and that the most frequently occurring consequences are connected with emotional health problems.

The previous study closest in scope to this investigation is an empirical study from a sample of 152 students at the University of Sinaloa in Mexico by Rodelo and Lizárraga (2018), which examined the correlation between the students' academic performance and the use of social networks as a support for their studies. The results indicated a strong correlation between the two, growing stronger in proportion to the time spent on social networks (for educational purposes). A similar study by González, Lleixa, and Espuny (2016) surveyed recent entrants to university (n = 141) about their use of social networks for personal and academic purposes. The results indicated that the academic use of social networks was minimal, chiefly due to a perceived lack of initiative by teachers, but that students had few reservations for their potential incorporation. Gagne et al. (2019) conducted a systematic literature review of microlearning in health profession education, finding it to have a positive impact as a learning strategy in terms of knowledge and confidence. The use of social networks, which was included among the microlearning strategies, has also been studied in the educational context by Tur and Marín (2015), exploring the use of Twitter, and Aldose-

mani (2019), examining students' perceptions of Telegram as a tool for microlearning.

2.2 Young People's Internet Consumption Outside School

Yeongmin (2020) studied the use of the Internet for communication among young people, and their adaptation to school using four-year longitudinal panel data (2010 Korean Children and Youth Panel Survey). Early familiarity with the Internet was found to improve a young person's initial adaptation to school, while negatively affecting the rate of adaptation.

Kim and Moon (2018) focus their research on the use of the computer on weekdays using time as a dependent variable in an investigation into Internet addiction among Korean adolescents. They consider several variables, including weekend usage time. Computer use during the weekdays was found to decline from junior high school to senior high school. They also found that emotional problems, self-awareness, and time spent playing with friends correlated negatively with time spent using the computer.

According to Chaparro-Hurtado and Guzman-Ariza (2013), in a study of emerging subjectivities of youngsters and their digital consumption practices among a sample of 80 Colombian students in the city of Villavicencio (Colombia), 37.5% affirmed that technologies did not disturb their work or academic performance, while 32.9% said that social networks, of which 92.5% of the sample were users, enabled them above all to know what their friends were doing. Regarding usage preferences, 39.2% of the young people stated that they participated in multi-player games at home.

Yeoju and Lee (2017) present an Internet use need scale questionnaire constructed from ten factors: online relationships, new personal experiences, belonging and acceptance, stress reduction, good personal identification, expression of emotions, fun, expression of thoughts, achievements in the game and information gathering. In a study into the factors that account for the incidental consumption of news via social networks, based on a household survey in Buenos Aires, Argentina, Mitchelstein and Boczkowski (2018) conclude that young people's incidental access to information is related to the constant connection to the internet, made possible by smartphones.

The five most visited websites in Spain, ranked according to average monthly traffic by web analytics company Similarweb and reported in Xiz (2020), are Google.com, Youtube.com, Facebook.com, Google.es, and Amazon.es.

A study by Lu, Hao, and Jing (2016) investigated the use of social networks inside and outside of school by high school students at two educational institutions in Hong Kong. This research concluded that students tend to consume and share more social media content outside of school, showing less self-regulation, but create more social media content when in school. One of the perceived motivations was the desire to share content with colleagues.

Likewise, there are studies exploring the correlations between social networks consumption and well-being among young people visiting the most popular sites. One such study is the *Status of Mind* report by the Royal Society for Public Health (2017). The report presented the results of a survey of nearly 1,500 young people aged 14 to 24 across the UK, who were asked to quantify their perceptions of the impact of the five most popular social networks platforms on their health and well-being in terms of 14 factors, on a scale of -2

(very negative), though 0 (no effect) to +2 (very positive). Of the five platforms only one, YouTube, achieved a net positive score, while the others, Twitter, Facebook, Snapchat and Instagram, in rank order, achieved net negative score.

2.3 Perception of Digital Competence and Autonomy

Digital competence refers to the knowledge, skills and attitudes required for safe and critical use of technology in diverse situations (Restrepo-Palacio & Segovia, 2020). The term 'digital competence' is used more frequently in educational research (Gallardo-Echenique, Oliveira, Marques-Molias, & Esteve-Mon, 2015; Obërlander, Beinicke, & Bick, 2020; Van Laar, Van Deursen, Van Dijk, & Haan, 2017) than the alternatives 'digital literacy' (Maderick, Zhang, Hartley, & Marchand, 2016) and 'digital skills' Torres-Coronas and Vidal-Blasco (2011).

Autonomy is the ability developed by students to self-organize the learning process. Seguel (2016) investigated teachers in a Chilean educational institution in which student autonomy was not encouraged, concluding that in general the training was insufficient to develop student autonomy. Uribarri-Lapicotequi (2016) presents an instrument for the evaluation of autonomy competence. M. García, Ortiz, and Chávez (2017) provide a range of strategies to promote autonomy. Other researchers (Carmona, 2017; Contreras, 2014) study performance focusing on the correlations with school success and failure.

3 METHODS

Given the significant impact on society of technologies in general and social networks in particular, this study aimed to analyse what influence, if any, the use of these technologies and social networks have on school performance and the acquisition of the chief competencies in education.It was carried out with male and female students in the final year of compulsory education, with the following research objectives:

- To determine the relationship between internet and social networks usage and academic performance.
- To assess students' perception of autonomy and competence with digital technologies.
- To differentiate the use of social networks and internet in terms of gender.
- To establish the relationship between age at first use of technology, frequency of use and academic performance.

The study was carried out using data downloaded from the 2018 PISA report (OECD, 2018), which included among other variables internet and social network usage by students. This data was also compared with the statistical results of the scores obtained in the competencies evaluated by the test: mathematics, reading and science. Part of the PISA report includes data collected by a student questionnaire, which is made available by the test administrators, but is not subjected to any kind of previous analysis by them. This study carried out an empirical analysis of the 2018 PISA data using a quantitative methodology, focusing on the variables described below.

The total test sample was very large and included the results of schoolchildren from up to eighty-two countries. However, only the Spanish data, comprising a variable number of male and female students, was taken into account, since in some cases not all the necessary information was available to perform statistical calculations. The total number of participants was 35,945, although the valid values ranged between that figure and 25,248. The large sample size means that the data can be considered significant and general conclusions can be drawn. The age of the participants was 15 to 16 years old, all enrolled in the final year of Compulsory Secondary Education (ESO: Educación Secundaria Obligatoria).

The variables taken into consideration during the process of collating the data were as follows. Digital usage was measured in terms of the age at which participants first used a digital device (IC002Q01HA) or started using the Internet (IC004Q01HA), and the time spent on networks outside school on weekdays (IC006Q01TA) and during the weekend (IC007Q01TA). Students' academic performance consisted of their proficiency in Mathematics (PV1MATH to PV10MATH), Reading (PV1READ to PV10READ) and Science (PV1SCIE to PV10SCIE). The students' self-evaluations were used to measure their perceived competence in ICT (COMPICT) and autonomy (AUTICT). Finally, three variables relating to social networks were analysed: the use of digital devices outside the school for managing social networks (IC008Q05TA) and playing online games (such as The Sims Social of Farmville) via social networks (IC008Q07NA); and the participants' perception of utility provided by the use of social networks (IC013Q05NA).

The following working hypotheses were established, and their acceptance or rejection was tested against the variables above:

1. **H_1:** There are differences in the use of ICT in terms of gender.
2. **H_2:** There is a relationship between age at first use of the internet or digital devices and the results in the PISA tests.
3. **H_3:** There is a relationship between the frequency of Internet usage and the results in the PISA tests.
4. **H_4:** There is a relationship between the usage of social networks and the results in the PISA tests.
5. **H_5:** There are differences in social network usage for games in terms of gender.
6. **H_6:** There is a relationship between social network usage and perception of competence and autonomy with ICT.

The relevant data from the 2018 PISA report was exported to SPSS 24.0 for data processing. This made available an alternative methodological approach for analysing the Spanish PISA results from a different perspective. To do so, two statistical tests were used as the most appropriate for identifying the correlation between the variables selected, and for determining whether there was any significant difference between the samples, thus providing the necessary rigor for this investigation. The Spearman correlation measures the statistical dependence between the different variables. The frequency distributions for the participants' results were also compared using the Chi-square test, and the p-value was used to

assess the degree of significance in the differences between the variables compared in each case.

4 RESULTS

The results obtained after analysing the data are presented below.

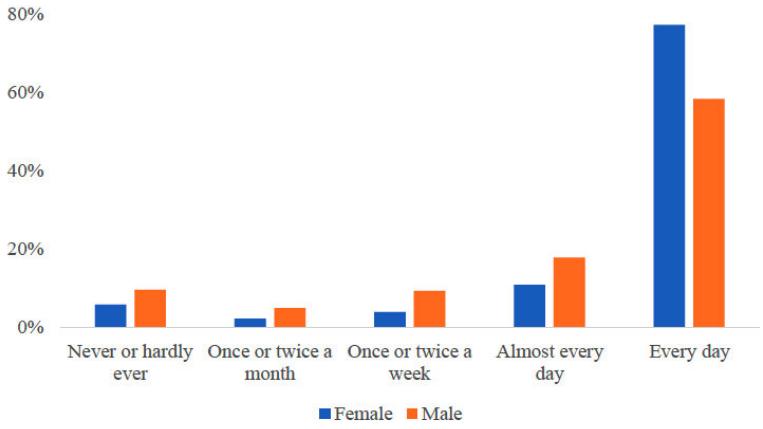


Figure 1 Social networks usage according to gender

Figure 1 gives a clear picture of the social networking habits of the male and female Spanish students. Both display a marked tendency to connect to networks via digital devices on a daily basis, although this figure is higher among the female students, at close to 80%, than it is for the male students, where the figure is slightly less than 60%. The Chi-square value of 1290.764 ($p < 0.001$) clearly indicate that the difference is significant, and consequently we can affirm that a general trend can be observed in which social networks are used on a more or less daily basis, with higher usage among female students.

Table 1 shows the relationship between the Spanish students' results in the three core competencies (Mathematics, Reading and Science) of the PISA test and use of the internet and digital devices outside school. The age at which these technologies were first used and the days of the week they were most frequently accessed were considered.

With respect to age at first use of these technologies, there is a very high correlation between this first access to digital devices and first access to the Internet (0.624, $p < 0.001$), a result which could largely be expected. Likewise, it was predictable that there would be a clear relationship between accessing the Internet during the week and accessing it at the weekend (0.707, $p < 0.001$). However, first use of both digital devices and the internet correlated negatively with the frequency of use (-0.094 and -0.101 respectively, in both cases $p < 0.001$). In other words, early uptake of these technologies corresponds to reduced usage, both during the week and at weekends, later in the students' school life.

However, the clearest correlation that can be seen in the table are those between these four variables (age at first use of digital devices, age at first use of the internet, time spend online during the week and time spent online at weekends) and the three competencies

Table 1 Use of the internet and digital devices in relation to the results of the PISA tests

SPEARMAN'S RHO		1 time digital device	1 time the Internet	Internet weekday	Internet weekend	Maths	Reading	Science
1 time digital device	Corr.	1	**.624****	**-.094****	**-.101****	**-.200****	**-.152****	**-.178****
	Sig.		0	0	0	0	0	0
	N		32343	32172	32068	32671	32671	32671
1 time the Internet	Corr.		1	**-.095****	**-.099****	**-.120****	**-.069****	**-.092****
	Sig.			0	0	0	0	0
	N			32150	32041	32466	32466	32466
Internet weekday	Corr.			1	**.707****	**-.087****	**-.042****	**-.084****
	Sig.				0	0	0	0
	N				32130	32364	32364	32364
Internet weekend	Corr.				1	-0.007	**-.033****	-0.005
	Sig.					0.186	0	0.361
	N					32275	32275	32275
Reading	Corr.					1	**.838****	**.897****
	Sig.						0	0
	N						35943	35943
Reading	Corr.						1	**.882****
	Sig.							0
	N							35943
Science	Corr.							1
	Sig.							
	N							

Note: * p<.05; ** p<.01)

evaluated in the PISA tests. This correlation is negative in all cases except that of the reading test with internet usage during weekends, where a positive correlation was found (0.33, $p < 0.001$). In short, there is a clear trend of negative correlation between access to digital devices and the internet by young people and, in almost all cases, the three competencies measured by the PISA report. That is, in general, the students, who use these technologies more assiduously and those whose uptake was earlier, obtain lower scores in the tests, with the exception of the reading competence.

After analysing the trends in Internet usage outside school and the age at which they were adopted, the study focused on the students' perception of social networks (Table 2), a topic of considerable debate. Whichever use students made of the networks, these clearly correlated with a perception of their usefulness on the part of the users. Hence, the use of social networks, whether to simply communicate or to play online games, was perceived by young people as useful, with a positive correlation of 0.315 ($p <0.001$) and 0.051 ($p <0.001$) respectively.

Another perhaps predictable result was the correlation between using social networks to communicate and using them to play online games (0.099, $p <0.001$). However, the relationship of academic performance in the PISA tests with the type of online activity does reveal a difference. In the case of accessing social networks there is a positive correlation between the scores in mathematics, reading and science (0.96, 0.137 and 0.86 respectively,

Table 2 Social network usage in relation to results in the PISA tests

SPEARMAN'S RHO		Part. Social Networks	Playing games Soc. Networks	Usefulnes Soc. Networks	Maths	Reading	Science
Part. Social Networks	Corr.	**1**	**.099****	**.315****	**.096****	**.137****	**.086****
	Sig.		0	0	0	0	0
	N		30067	26184	30386	30386	30386
Playing games Soc. Networks	Corr.		1	**.051****	**-.130****	**-.200****	**-.152****
	Sig.			0	0	0	0
	N			26326	30513	30513	30513
Usefulnes Soc. Networks	Corr.			1	**.098****	**.138****	**.098****
	Sig.				0	0	0
	N				26823	26823	26823
Reading	Corr.				1	**.838****	**.897****
	Sig.					0	0
	N					35943	35943
Reading	Corr.					1	**.882****
	Sig.						0
	N						35943
Science	Corr.						1
	Sig.						
	N						

Note: * p<.05; ** p<.01)

p <0.001), but in the case of games played on social networks the correlation is negative (-0.130, -0.2 y -0.152, respectively, p < 0.001). Thus, the pattern seems to be that social media consumption for informative or communicative purposes can have a positive impact on academic performance, while using social networks for gaming purposes does not.

Gaming, through a variety of internet-enabled devices, is a facet of the students' online life which shows differences according to gender. Although the majority of students did not use social networks for the purposes of playing online games, the differences in usage between the male and female students who did can be seen in Figure 2. These differences in the numbers of students stating playing frequencies of 'once or twice a week', 'almost every day' and 'every day', whereby the proportion of males increases with frequency of play. Further, the differences can be considered significant, given the Chi-square value of 1187.139 (p < 0.001). In summary, the general tendency is for most of the students not to participate in games via social networks, but that among those who do, male students predominate.

Finally, the students' perception of their autonomy and competence in using ICT was analysed according to the purpose of using social networks, whether for communicating with friends or for playing online games (Table 3). Some results were predictable, such as the high degree of positive correlation between the perception of autonomy and competence in using ICT (0.633, p < 0.001). Likewise, the relationship between the use of social networks for communication and for playing games was notable (0.322, p < 0.001). The cor-

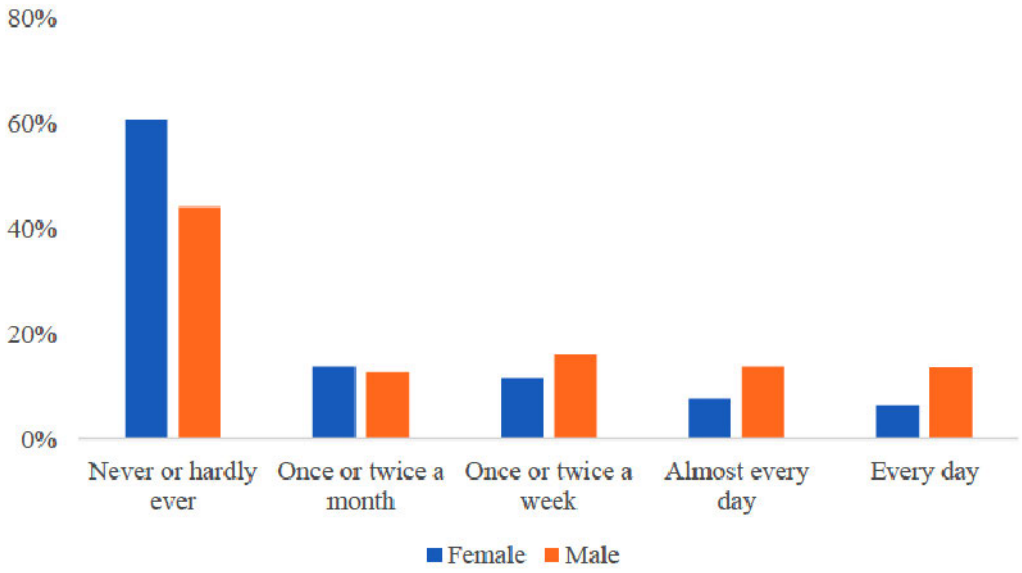


Figure 2 Online games via social networks according to gender

Table 3 Student perception of competence and autonomy in using ICT in relation to social networks

SPEARMAN'S RHO		Part. Social Networks	Playing games Soc. Networks	Perceived ICT competence	Perceived ICT autonomy
Part. Social Networks	Corr.	1	**.099****	**.151****	**.122****
	Sig.		0	0	0
	N		30067	25564	25248
Playing games Soc. Networks	Corr.		1	**.122****	**.123****
	Sig.			0	0
	N			25707	25398
Perceived ICT competence	Corr.			1	**.633****
	Sig.				0
	N				25494
Perceived ICT autonomy	Corr.				1
	Sig.				
	N				

Note: * p<.05; ** p<.01)

relation between all the variables is also positive, with a very high significance level, always below 0.01. In short, the greater the use of social networks, the higher the perception of competence, and of autonomy, in handling ICT.

In the next section, these results will be discussed, and the main conclusions of the research will be set out.

5 DISCUSSION

Once the results presented in the previous section are analysed in detail, various behaviour patterns and attitudes among young Spanish students can be deduced with respect to the use of social networks and the impact these may have on educational performance, providing original insights in certain aspects. In a review of various research papers Saa, Emram, and Shaalam (2019) raise four issues around performance: previous performance, e-learning activity, demographics, and social information about students.

First, the question of gender differences in the use of ICT was investigated. The majority of students in both genders used ICT frequently, that is, on a daily basis, with a slightly higher occurrence among females than males, although the difference is not large. This could possibly be due to earlier maturity and development of social relationships on the part of females (Wang & Gimenez-Nadal, 2018), or it might be a reflection of searches relating to the subculture of physical attractiveness (Gutiérrez, 2017). It would be interesting in future studies to investigate what other variables play a part in this asymmetrical use of ICT and social networks. Likewise, it would be useful to learn more about the effects of online phenomena such as digital narcissism and trolling on female teenagers' school performance. The results in this study confirm hypothesis $\mathbf{H}_1$, which stated that there are differences in the use of ICT according to gender.

The use of these technologies can impact students' academic performance, leading to generally lower grades (Cao, Masood, Luqman, & Ali, 2018; Flanigan & Babchuk, 2015) or even addiction (Díaz, Vergara, & Simancas, 2019). Nuñez, Segundo, Jérez, Rivera, and Espinosa (2018) suggest that academic performance depends on the students themselves and the socio-affective factors surrounding them. Taking an original approach, this study suggests that early uptake and frequent usage of digital devices and the internet are detrimental, as they are associated with lower academic results. Consequently, it can be affirmed that there is a relationship, albeit negative, between early uptake of the Internet and digital devices and the results in the PISA tests, and therefore hypotheses $\mathbf{H}_2$ and $\mathbf{H}_3$ must be accepted.

However, the impact of technology on educational performance is not always negative. If social networks are used properly, good academic performance can result and have a positive influence on students' development (Karpinski, Kirschner, Ozer, Mellott, & Ochwo, 2013). The young students themselves consider that these networks can be useful, and there is some support for this view in the results. However, there is a clear difference between social networks when they are used to communicate among their peers and when they are used to play online. This latter is clearly an emergent result linked to lower academic performance and worse results in the three competencies assessed by the PISA tests. Hence, hypothesis $\mathbf{H}_4$, postulating a relationship between the use of social networks and academic results, is confirmed. In addition, a singular detail can be noted in which males were more likely to use social networks to play online games in all cases where the frequency of play was at least once or twice a week. Hypothesis $\mathbf{H}_5$, which states that there are gender differences in social networks usage for games, can thus also be accepted. This is consistent with the finding elsewhere that, among male university students, time spent on passive enter-

tainments is detrimental to performance (Brint & Cantwell, 2006) .

Finally, the use of digital devices by young people can provide them with the necessary tools for functioning in their daily lives and help them develop autonomy and competence in the use of ICT (Juhanak, Zounek, Zaleska, Barta, & Vlckova, 2019). The data obtained in this study confirms that young people's social network usage (whether for communicating or playing online) is closely associated with their perception of autonomy and competence in using technologies. Hypothesis $\mathbf{H}_6$, suggesting a relationship between the use of social networks and the perception of competence and autonomy with ICT, can be accepted.

6 CONCLUSIONS

There can be no doubt that information and communication technology now form part of the fabric of today's society, and one way or another exerts considerable influence on the day to day lives of young people. Teenagers are at a difficult age regarding relationships with their peers and their experiences on social networks can have a significant influence on their development. This study adds to those which find that female students make greater use of social networks to maintain relationships with their peers.

The results obtained in this study indicate several emerging problems in the use of technologies and social networks among young Spanish students which can have negative consequences on performance. These emerging factors could form the focus of further research in order to test the results of this study and to delve further into the variables.

It would also be interesting to discover whether these findings are applicable to other educational contexts or to different settings such as the family environment. This would contribute to the development of appropriate guidelines for teenage use of the Internet and for improving academic performance. One essential finding is that it is important for parents to supervise their children's first use of the internet, as this can influence their relationships as well as their academic performance. At the same time, it is also important for young people to develop autonomy and competence in using ICT, given their embedded role in society, something which can be achieved though using social networks, whether for communicating with their peers or playing games, although it is evidently preferable to promote the first option. Educating children on the most effective use of digital devices and the internet is clearly essential, and great consideration must be given to how to approach this question. Restrictions and punitive actions can have an opposite effect to the desired ones and end up sparking interest in inappropriate topics. It must be assumed that sooner or later young people are going to come into contact with social networks and the important thing is to educate them in their proper use.

The risks associated with social networks should be recognised early in the children's related experience, and they should be guided in how to avoid them. It should be borne in mind that, according to the data in this study, males first access the internet earlier than females and use social networks more that the latter for online gaming. The amount of time young people spend online should be limited, both during the week and at weekends, as in most cases excessive use leads to poor academic performance. Males should be given

special attention in this regard as they have a greater tendency to use social networks inappropriately, that is, online gaming.

The risks associated with interacting with strangers, who may have ulterior or illicit motives, must also be highlighted. Young people should receive guidance in recognising and dealing with this kind of situation so that should they find themselves in one, they have the appropriate strategies to make decisions and act with the necessary autonomy.

Future research can compare these results with those obtained in the next round of PISA tests, pandemic allowing, or indeed with any other studies that might be carried out within this timespan. It would be interesting to review developments in young Spanish students' use of ICT in general and social media in particular. Also, of interest would be comparisons with the performance of students from other countries in terms of social networks and ICT usage, and their impact on academic performance in different contexts.

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