Educación XX1
ISSN: 1139-613X · e-ISSN: 2174-5374

Analysis of academic performance and mental health of secondary school students by access to technological resources

Análisis del rendimiento académico y la salud mental de los alumnos de educación secundaria según el acceso a los recursos tecnológicos

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Cómo referenciar este artículo/ How to reference this article:

García-Gil, M.Á., Fajardo-Bullón, F., & Felipe-Castaño, E. (2022). Analysis of academic performance and mental health of secundary school students by access to technological resources. *Educación XX1*, *25*(2), 243-270. https://doi.org/10.5944/educxx1.31833

Fecha de recepción: 12/10/2021
Fecha de aceptación: 14/02/2022
Publicado online: 29/06/2022

ABSTRACT

Access to digital resources and academic performance (AP) are variables of great interest in today's society. However, studies are needed to delve into the association between them and mental health. This study aims to a) find out if there are differences in AP based on access to digital resources (mobile, computer, Internet access and time spent on the

Internet). b) Establish student profiles according to their AP and access or not to said digital resources and, finally, analyze the relationship of these profiles with mental health. A sample of 1,448 Spanish Compulsory Secondary Education (ESO) and Baccalaureate students was selected, of which 708 were men (48.90 %), with a mean age of 14.5 years (*SD* = 1.57). A sociodemographic questionnaire was used, grades in the previous year were measured, and the SDQ scale was used to measure mental health. The RA is positively influenced by the time of Internet connection, access to the computer, Internet and mobile. However, the differences between students with a good AP and a low AP are not exclusively associated with access to digital resources but with the presence of mental health difficulties. Students with low AP have greater emotional difficulties, hyperactivity, behavior problems and problems with peers. Finally, it seems that emotional problems stand out exclusively in those students with low AP who have digital resources, so it could be the most relevant variable for future educational interventions.

Keywords: academic success, well-being, cluster, adolescence, ICT, Spain

RESUMEN

El acceso a los recursos digitales y el rendimiento académico (RA) son variables de gran interés en la sociedad actual. Sin embargo, hacen falta estudios que profundicen en la asociación entre ellos y la salud mental. Este estudio tiene como objetivo a) conocer si existen diferencias en el RA en función del acceso a los recursos digitales (móvil, ordenador, acceso a Internet y tiempo de conexión diario a Internet). b) Establecer perfiles de estudiantes según su RA y el acceso o no a dichos recursos digitales y, por último, analizar la relación de estos perfiles con la salud mental. Se seleccionó una muestra de 1448 alumnos españoles de Educación Secundaria Obligatoria (ESO) y de Bachillerato, de los que 708 eran hombres (48.90 %), con una edad media de 14.5 años (*DT* = 1.57). Se utilizó un cuestionario sociodemográfico, se midieron las calificaciones en el curso anterior y se utilizó la escala SDQ para la medición de la salud mental. El RA se ve influenciado positivamente por el tiempo de conexión a Internet, acceso al ordenador, Internet y móvil. Sin embargo, las diferencias entre los alumnos con buen RA y un RA bajo no vienen asociados exclusivamente al acceso a los recursos digitales sino a la presencia de dificultades en salud mental. Los alumnos con bajo RA presentan mayores dificultades emocionales, hiperactividad, problemas de conducta y problemas con compañeros. Por último, parece que los problemas emocionales destacan exclusivamente en aquellos alumnos con bajo RA que disponen de recursos digitales por lo que podría ser la variable más relevante para futuras intervenciones educativas.

Palabras clave: éxito académico, bienestar, clúster, adolescentes, TIC, España

INTRODUCTION

Academic performance (AP) is one of the most important areas of interest in education. It has been defined by Lee et al. (2015) as a measure of the responsive capabilities that express, approximately, what a person has learned after a process of instruction or training. This measure involves a complex web of cognitive and personality variables (Veas et al., 2019), influenced in turn by family, educational and individual factors which ultimately describe the nature of academic success or failure (Fajardo et al., 2017; Lee et al., 2015). Knowing that the psychosocial variables that influence adolescents' AP are varied and changeable, the question arises as to whether these factors could directly affect students' educational level, enabling or hindering their behavioural and emotional development and, in a parallel fashion, their academic development (Fajardo-Bullón et al., 2017).

AP and access to information and communication technologies (ICTs)

According to the Survey on Equipment and Use of Information and Communication Technologies in Spanish Households (National Institute of Statistics, 2019), the use of new technologies among Spanish minors is very widespread. This national survey for children aged 10-15 shows a very high use of computers (89.7 % of minors have one) and the Internet (92.9 %), and 66.0 % of the surveyed population have a smartphone.

However, while the use of these devices has been on the rise over the last decade, AP has not improved (Madigan et al., 2019). The impact of new technologies on the lives of adolescents has been addressed in previous studies (Hancox et al., 2005), yet we still do not know whether Spanish students present different profiles depending on their access to digital resources (computers, smartphones and the Internet) and their AP, or whether these profiles are linked to differences in mental health. We do know that the availability of electronic devices can lead to digital multitasking in minors, where, for example, students simultaneously read and answer messages, negatively impacting AP in Spanish teenagers (Martín-Perpiñá et al., 2019). How video games affect AP has also been studied (Gómez-Gonzalvo et al., 2020), and how the use of screens (types of content and hours of use) can negatively impact adolescents' AP (Gómez-Gonzalvo et al., 2020; Yan et al., 2017). The Promotion of Social Studies and Applied Sociology (FOESSA) report (2022) indicates that access to digital resources may be a factor that affects social exclusion. However, we still do not know whether having a computer, Internet access, a smartphone or the amount of time spent connected to the Internet can cause differences in AP among Spanish compulsory secondary education (ESO in its Spanish initials) and Spanish Baccalaureate (*Bachillerato*) students. Some previous studies with ESO

students have shown that the use of email, Internet connection and computer use generate improvements in the academic development of students (Martínez-Garrido, 2018). However, as these studies are based on a 2015 sample, we do not know if these results still apply. Similarly, we do not know if the results are still valid when Baccalaureate students have been added to the sample and daily Internet connection time or other digital resource variables such as smartphones are included. The current debate on distance learning in ESO and Baccalaureate calls for studies that specifically analyse these variables and Spanish student profiles based on access to or lack of these resources, Internet connection time and AP. Digital resources can have a positive effect on teaching by generating content that is engaging and easier for students to work with (Halpern et al., 2021; Palacios, 2005), but how do all these resources affect the AP of ESO and Baccalaureate students? Can student profiles be built based on access to digital resources and AP? And if so, would the AP results of these groups be similar?

Some studies show how new technologies in the academic environment can lead to poorer performance among students who do not have access to ICTs at home (García & Cantón, 2019), and that students with continuous access to ICTs achieve higher performance than those without (Alderete & Formichela, 2016). Other international studies have shown how Internet-enabled computer use can have a negative impact on AP in mathematics and reading, particularly if used inappropriately or without clear instruction (Botello & López, 2014). However, other studies on a sample of Spanish adolescents show how the use of the Internet for academic tasks is positive and prioritised over communication and entertainment functions (Giménez-Gualdo et al., 2014).

These varied and sometimes conflicting results call for further studies to provide greater insight into the relationship between AP, digital resources and time spent online (García & Cantón, 2019). Regarding this, we ask ourselves whether or not students who have access to a computer, Internet or a smartphone and spend greater time connected to the Internet correlate with higher AP profiles, compared to students who do not have access to or do not use these resources, or whether, alternatively, no such differentiated profiles exist based on these variables. As Martínez-Garrido (2018) points out, studies that address the use of technological resources outside the school are still needed to reshape the design of education towards actions that benefit students (FOESSA, 2022).

Mental health and academic performance

According to the World Health Organization (WHO) website (2022), mental health is a state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to make

a contribution to his or her community. Currently, there is widespread concern about people's mental health, particularly that of minors. This is reflected in the WHO's special initiative for mental health *Universal Health Coverage for Mental Health* (2019-2023) and in Spain's recently approved *National Health System Mental Health Strategy* (2021-2026) which outlines a mental health strategy for childhood and adolescence. This paper addresses mental health using the dimensions that have been internationally accepted as indices for measuring mental health in minors (Goodman & Goodman, 2009): emotional difficulties, problems with peers, conduct problems and hyperactivity.

To begin with, mental health issues can be related to the use of digital resources. Excessive use of smartphones and/or computers can lead to a range of mental health outcomes and diminished well-being, as well as to underachievement in secondary school pupils if not supervised by the family (Dienlin & Johannes, 2020; Fajardo-Bullón et al., 2019; Halpern et al., 2021). Therefore, mental health issues may also be related to AP. Similarly, low AP has been linked to problems to do with autonomy, relationships with friends, emotions within the family and perceptions about school (Vitale et al., 2015), externalizing symptoms and attention problems (Cid-Sillero et al., 2020), conduct and peer relationship problems (Strom et al., 2013), and hyperactivity (Ludyga et al., 2017). Thus, the characteristic emotional needs of adolescence cause teenagers to keep checking their digital devices which has a negative effect on their AP (Rosen et al., 2013), highlighting the impact of both access to technological resources and the emotional state and behaviour of minors on AP. Finally, Atoum et al., (2018) found that AP decreased when mental health issues measured on the SDQ were found in Jordanian adolescents.

Elsewhere, lack of success in education, negative expectations of academic success and interpersonal problems with peers have been associated with low AP (Vitale et al., 2015). Also, improvements in AP have been linked to the degree of psychological satisfaction and well-being of the students (Lee et al., 2015). Furthermore, spending a significant amount of time on social media appears to be related to poorer mental health among adolescents (Coyne et al., 2020). However, we do not know if differences in mental health exist as a function of student profiles. Can having good AP, a computer, Internet access, daily Internet connection time and a smartphone benefit students' mental health?

Aims and hypotheses

This research attempts to address the issues raised in the previous sections. To this end, we will provide the scientific community with information regarding whether differences in AP exist among students with access to digital resources. This question is vital in order to analyse the differences between students who

have adequate access to ICT tools and those who do not (Ramírez-Castañeda & Sepulveda-López, 2018). More specifically, in 2002, the Organization for Economic Cooperation and Development (OECD) established the importance of these variables, considering that access to ICTs – computers and the Internet in particular – generated a digital divide between those who enjoy the benefits of ICTs and those who cannot (OECD, 2002). In 2022, the study "Evolution of social cohesion and consequences of COVID-19 in Spain" considers digital disconnection the new illiteracy of the 21st century, warning of the social exclusion of families that do not have access to an Internet connection and at least one computer (FOESSA, 2022). In our study, we have included the variables recommended by the OECD (2002) and FOESSA (2022): having a computer, having access to the Internet and daily Internet connection time. Given the advances in smartphones and their widespread use by Spanish adolescents, we have also added having a smartphone to the variables. Now that the importance of these variables has been established, it seems essential to provide scientific knowledge on how the variables AP and access to digital resources are related. We will also show whether different student profiles exist using a combined analysis of AP, access to smartphones, computers, the Internet, and daily Internet connection time.

Finally, regarding mental health in Spain, in recent decades there has been a growing number of children and adolescents being diagnosed with emotional and conduct disorders in children and adolescents (Ortuño-Sierra et al., 2014). In 2017, one in seven children under the age of 20 experienced a mental health issue, with numbers growing substantially since 2020, coinciding with the COVID-19 pandemic (Save the Children, 2021). As the report "The Impact of the COVID-19 Pandemic on Children's Mental Health" indicates, approximately 70% of minors reported some degree of psychological distress over the past year (Osgood, Sheldon-Dean, & Kimball, 2021). Given the preponderance of mental health issues among Spanish ESO and Baccalaureate students, the present study analysed mental health using the international SDQ Strengths and Difficulties screening questionnaire (Goodman, 1997). It is important to shed light on how the profiles based on the variables AP and access to technological resources may have different mental health issues. This information has never been reported before. Therefore, the importance of AP, access to digital resources and the mental health of adolescents led us to develop the following research aims and hypotheses (H):

A.1.—Determine whether or not differences in AP exist depending on whether or not students have a smartphone, a computer, Internet access at home, or on the number of hours they spend daily on the Internet. -H1. Students who have smartphones get higher AP scores than those without. -H2. Students who have a computer get higher AP scores than those without. -H3. Students who have Internet access at home get higher AP scores than those who do not. -H4. Students

who spend several hours a day connected to the Internet get higher AP scores than those who spend a limited time online every day.

A.2.—Use a two-stage cluster to discover whether ESO and Baccalaureate student profiles exist based on their AP and whether or not they have access to a computer/laptop, a smartphone, an Internet connection at home and the number of hours spent daily on the Internet, taken collectively. -H1: Different student profiles exist based on the following variables: AP and access/ no access to a computer/ laptop, a smartphone, Internet at home and hours spent daily online.

A.3.—Analyse the relationship between the profiles obtained in Aim 2 and mental health issues, measured through emotional difficulties, conduct problems, hyperactivity, relationship problems with peers and prosocial behaviour. -H1: Students with digital resources, low AP and a high number of hours spent online obtain worse scores in the mental health factors: emotional difficulties, conduct problems, hyperactivity and relationship problems with peers than the other profiles.

METHOD

Participants

A sample of 1448 ESO and Baccalaureate students was selected, 708 males (48.90 %), with a mean age of 14.5 years (SD = 1.57). Firstly, the local delegation of the Extremadura board of education for Cáceres and Badajoz was asked for a list with the number of schools and students enrolled in ESO and in the two provinces. Based on this, 8 schools were selected at random. Once the school was selected and permission to visit and include it were granted, questionnaires were sent to all the classes in all the schools. In schools where there was more than one group per year (e.g., a, b and c), one was selected at random. The final sample consisted of a total of 51.8% of students from rural areas and 48.2% from urban schools. Regarding distribution per year, 22% were in the 1st year of ESO, 21.8% were in the 2nd year of ESO, 20% in the 3rd year of ESO, 21.9% in the 4th year of ESO and 14% in Baccalaureate. A total of 53.7% attended state-run schools and 46.3% attended semi-private schools. All the students surveyed answered all the questions in the study.

Instruments

Data on ICT access. A questionnaire was developed specifically for the study which collected data on whether the students had a smartphone, a computer or

laptop at home, and whether or not they had access to the Internet at home. They were also asked how many hours a day they spent online.

Academic Performance (AP). To measure AP, we used the average grades in the compulsory subjects of Spanish Language and Mathematics – in this case for the year prior to the 2017-2018 survey – as recommended by several recent leading scientific studies (Fajardo et al., 2017; García & Cantón, 2019; Navas et al., 2003). This criterion has already been used in earlier studies as a valid and representative measure of AP (Arora et al., 2018; Fajardo et al., 2017; García & Cantón, 2019; Martínez-Garrido, 2018).

Similarly, the PISA Report is based on the assessment of 3 ESO subjects: Mathematics, Spanish Language and Science. Taking this report as a reference, Language and Mathematics were selected as we needed to find compulsory curricular subjects that were being studied in all the ESO and Baccalaureate classes involved in this study and avoid any extraneous variables, such as the relative weight of the subject in the Baccalaureate University Admission Exam (EVAU) or in students' individual subject choices. Furthermore, Article 28: *Assessment and Promotion* (Royal Decree 1105/2014, December 26) of the *Organic Law 8/2013 for the Improvement of Education* (which establishes the basic curriculum for Compulsory Secondary Education and Baccalaureate in Spain) designates Spanish Language & Literature and Mathematics as the only two subjects whose joint failure may warrant repeating a year, thus effectively conferring them a differentiating weight compared to the other examinable subjects. Similarly, the same law, which was in force at the time of the data collection for this study, establishes that competencies in Spanish Language and Mathematics are transversal and considered basic prerequisites for learning and developing competencies in all other ESO and Baccalaureate subjects. For these reasons, the authors decided to calculate the AP of the students based on their exam results in Spanish and Mathematics, emulating other recent studies on AP and the use of technology (García & Cantón, 2019; Martínez-Garrido, 2018).

Strengths and Difficulties Questionnaire (SDQ, Goodman, 1997). This questionnaire, designed by Goodman at the Institute of Psychiatry in London (Goodman, 1997), has been translated into more than 66 languages and used in Spain and internationally in several research studies (Fajardo-Bullón et al., 2019), as well as in national health surveys (Spanish Ministry of Health, 2017), and is a globally recognised mental health screening tool which has improved on classic tools such as the Child Behavior Checklist (Goodman & Scott, 1999). Previous research (Fajardo et al. 2019, Ortuño, et al., 2016; Savkina et al. 2010) has obtained validity evidence that supports the usefulness of this measuring tool in school and clinical contexts. So, the SDQ is a quick, easy-to-administer mental health screening tool which is useful for assessing these types of problems in childhood and adolescence. Tereshchenko et al. (2021) and Tripodaki et al. (2008) have also used it, confirming

that the SDQ scale is suitable for determining conduct problems, and attention and emotional symptoms related to pathological Internet use.

The SDQ is made up of 25 items for assessing emotional and behavioural difficulties, as well as prosocial behaviour in children and adolescents, using a multi-informant approach. It consists of five scales: emotional symptoms, conduct problems, hyperactivity, peer relationship problems and prosocial behaviour. For this study, the Total Difficulties score was used, evaluated using the self-report version for children aged 11-17 (https://www.sdqinfo.org). Following the questionnaire guidelines, the mental health difficulties total was obtained by adding the scores for the first four scales: emotional difficulties, conduct problems, hyperactivity and peer relationship problems (Ortuño-Sierra, et al., 2018), without including the prosocial scale (Goodman et al., 2000). A Cronbach's α of .729 was obtained, which is satisfactory, although somewhat lower than in other studies (Rothenberg et al., 2008).

Procedure

Once the green light was given by the school heads and guidance counselling teams, questionnaires were handed out to all the classes in the survey. Parents and pupils had been asked previously for their consent and informed of the purpose of the research. Participants were informed as to the confidentiality of the data and assured they would be used for research purposes only. The questionnaire was administered collectively in groups, according to the time available in the school, and lasted approximately 10-15 minutes. At least one researcher and one in-house teacher were present to answer questions during the administration of the questionnaires. The data were collected in 2018. The guidelines were followed using the criteria of voluntary participation and confidentiality, adhering strictly the American Psychological Association's code of ethics (APA, 2017).

Data analysis

In this work, the authors performed parametric tests based on the central limit theorem (CLT), which recommends running parametric tests when the sample is large, e.g., the 1,448 students in this study (Ernst & Albers, 2017; Pek et al., 2018) and when the study variables are quantitative, continuous, and meet the assumptions of normality (Kolmogorov-Smirnov >.05) and of homogeneity of variance (Levene >.05). When heterogeneous variances were encountered, a robust one-factor ANOVA was performed using Welch's procedure (see the Results section). To study the first three hypotheses in Aim 1, parametric tests (Student's

t test) were performed for independent samples. A parametric one-factor ANOVA test was performed to test the 4th hypothesis of Aim 1.

A *two-stage clustering* was used to obtain the profiles of ESO and Baccalaureate students to test the hypothesis in Aim 2. This analysis provides an automatic procedure for the optimal number of clusters, allowing clusters with categorical and continuous variables (Rubio-Hurtado & Vilà-baños, 2017). The categorical variables included in the cluster were "has/does not have a smartphone", "has/does not have Internet at home", "has/does not have a computer or laptop at home" and "daily Internet connection time" from 1 to over 5 hours. As a continuous quantitative variable, the variable AP was added with a scale from 0 to 10, calculated as the average of the grades in Spanish and Mathematics for the previous year. The variables in the model meet the assumptions of independence, the continuous variables had a normal distribution and the categorical qualitative variables had a multinomial distribution. Even when the assumptions of independence are not met, "The internal empirical checks indicate that this procedure is quite robust, even when these conditions are not met" (Rubio-Hurtado & Vilá-Baños, 2017, p.120).

The log-likelihood probability measure was used to analyse the distance between clusters. The Bayesian/Schwartz information criterion (BIC/SIC) was used to determine the number of clusters. To minimize order effects, the cases were randomly ordered. The results provided a satisfactory model consisting of four clusters.

To analyse the hypothesis in Aim 3, once the four student profiles were obtained, a one-factor ANOVA with post-hoc tests was performed for each of the four scales of the SDQ questionnaire, using emotional difficulties, conduct problems, hyperactivity and peer relationship problems as dependent variables. The independent variable was the typology of the ESO or Baccalaureate students, which were classified into 4 clusters obtained using the two-stage cluster.

RESULTS

Table 1 (below) presents the main characteristics of the study sample and the results regarding the proposed hypotheses.

Following the first hypothesis in the study, the AP results related to whether or not the students have a smartphone are shown here. Using a Student's t-test for independent samples, differences in AP (t_{1446} = 2.48, p = .013) were found for students who had a smartphone (*M* = 6.77, *SD* = 1.86) versus those who did not (*M* = 5.97, *SD* = 1.99).

Similarly, statistically significant differences (t_{1446} = 5.45, $p < .001$) were found between those who had a computer at home (*M* = 6.82; *SD* = 1.84) and those who did not (*M* = 5.69, *SD* = 1.96).

Table 1
Student sample by access to technological resources and time spent daily online

		n	*%*
Has smartphone?	Yes	1414	97.7 %
	No	34	2.3 %
Has computer at home?	Yes	1362	94.1 %
	No	86	5.9 %
Has Internet access at home?	Yes	1408	97.2 %
	No	40	2.8 %
Time spent online (daily)	Under 1 hour	166	11.5 %
	From 1 to 3 hours	552	38.3 %
	From 3 to 5 hours	393	27.3 %
	Over 5 hours	331	23 %

Finally, regarding the impact on AP of having internet at home, significant differences in AP ($t_{1446} = 4.24$, $p < .001$) were observed for students who had Internet access at home ($M = 6.78$, $SD = 1.86$) compared to those who did not ($M = 5.52$, $SD = 1.86$).

The results of the study regarding daily time spent on the Internet and its impact on AP showed that students with high daily online usage had higher AP scores than those with low daily connection usage. A one-factor ANOVA also found statistically significant differences in AP as a function of Internet connection time ($F_{3, 1438} = 11.32$, $p < .001$). Post-hoc multiple comparisons were performed using the Bonferroni procedure (see Table 2).

Table 2
Means and comparison of AP means by Internet connection time

	M	*SD*	*Comparison*	*MD*	*p*	*IC 95%*
G1	6.94	1.91	*G1-G2*	-0.04	1	[-0.48, 0.39]
G2	6.98	1.83	*G1-G3*	0.14	1	[-0.31, 0.59]
G3	6.80	1.81	*G1-G4*	0.68	.001	[0.21, 1.15]
G4	6.26	1.91	*G2-G3*	0.19	.772	[-0.14, 0.51]
			G2-G4	0.72	<.001	[0.38, 1.06]
			G3-G4	0.54	.001	[0.17, 0.9]

Note. G1=Under 1 hour, G2=From 1 to 3 hours, G3=From 3 to 5 hours, G4=Over 5 hours, M=Mean, SD=Standard deviation, MD=Mean difference, p=p-value adjustment with Bonferroni.

After analysing these differences, a two-stage cluster analysis was conducted. The characteristics of each of the four resulting clusters are as follows:

- Cluster 1: This cluster consists of 516 students (35.8 %). All the students in this cluster have a smartphone, computer, Internet access at home and use the Internet from 1 to 3 hours per day. The average academic performance of the students in this cluster is 7.05. We will call this cluster "Students with resources with low connection" (SRL).
- Cluster 2: This cluster consists of 261 students (18.1 %). 89.3 % of the students have a smartphone, 69 % have a computer, 87 % have Internet access at home and 63.6 % use the Internet less than 1 hour per day. The average academic performance of this cluster is 6.51. We will call this cluster "Students without resources with minimum connection" (SWM).
- Cluster 3: This cluster consists of 365 students (25.3 %). All the students in this cluster have a smartphone, computer, Internet access at home and use the Internet from 3 to 5 hours per day. The average academic performance of this cluster is 6.89. We will call this cluster "Students with resources with high connection" (SRH).
- Cluster 4: This cluster consists of 300 students (20.8 %). All the students in this cluster have a smartphone, computer, Internet access at home and use the Internet more than 5 hours per day. The average academic performance of this cluster is 6.31. We will call this cluster "Students with resources with maximum connection" (SRM).

The four-cluster model is "satisfactory/good" with a cluster goodness-of-fit value of .5 out of 1. For validation, the analysis was repeated after changing the order in which the subjects appeared in the matrix, yielding the same satisfactory result (Rubio-Hurtado & Vilá-Baños, 2017). Within this model, the importance of the different variables is diverse: based on the data obtained in the two-step cluster, the variable Internet connection time carries the greatest weight in the creation of the 1-over-1 clusters ($\chi^2_9 = 3509.34$, $p < .001$), followed by having a computer at home ($\chi^2_3 = 388.33$, $p < .001$), with a predictor importance of .27 over 1, having Internet access ($\chi^2_3 = 157.56$, $p < .001$) with a predictor importance of .11 over 1, having a smartphone ($\chi^2_3 = 129.21$, $p < .001$) with a predictor importance of.09 over 1, and lastly, AP, with a predictor importance of .02 over 1.

Regarding Aim 3, whose objective was to determine the effect of the number of hours spent online on the mental health of adolescents, measured in terms of emotional difficulties, conduct problems, hyperactivity and peer relationship problems, the results found statistically significant differences in "*Emotional difficulties*" as a function of the cluster type ($F_{3, 1437} = 5.9$, $p = .001$). Post-hoc multiple comparisons were performed using the Bonferroni procedure (see Table 3).

Table 3
Means and comparison of means for "Emotional Difficulties" by cluster type

	M	*SD*	*Comparison*	*MD*	*p*	*IC 95%*
SRL	2.72	2.02	*SRL-SWM*	-0.16	1	[-0.59, 0.26]
SWM	2.88	2.19	*SRL-SRH*	-0.36	.078	[-0.74, 0.02]
SRH	3.08	2.11	*SRL-SRM*	-0.61	< .001	[-1.02, -0.21]
SRM	3.33	2.17	*SWM-SRH*	-0.20	1	[-0.65, 0.26]
			SWM-SRM	-0.45	.067	[-0.92, 0.02]
			SRH-SRM	-0.26	.707	[-0.69, 0.18]

Note: SRL=Students with resources with low connection, SWM=Students with resources with minimum connection, SRH=Students with resources with high connection, SRM=Students with resources with maximum connection, M=Mean, SD=Standard deviation, MD=Mean difference, p=p-value adjustment with Bonferroni.

A robust one-factor ANOVA was also performed using Welch's test (unequal variances), yielding statistically significant differences in "*Conduct problems*" based on cluster type ($F_{w\ 3,\ 689} = 20.46$, $p < .001$). Post-hoc multiple comparisons were performed using the Tamhane procedure (see Table 4).

Table 4
Means and comparison of means for "Conduct problems" by type of cluster

	M	*SD*	*Comparison*	*MD*	*p*	*IC 95%*
SRL	1.81	1.39	*SRL-SWM*	-0.26	.195	[-0.58, 0.07]
SWM	2.07	1.71	*SRL-SRH*	-0.33	.005	[-0.59, -0.07]
SRH	2.14	1.47	*SRL-SRM*	-0.88	< .001	[-1.17, -0.58]
SRM	2.68	1.63	*SWM-SRH*	-0.07	.995	[-0.42, 0.27]
			SWM-SRM	-0.62	< .001	[-0.99, -0.24]
			SRH-SRM	-0.55	< .001	[-0.87, -0.23]

Note: SRL=Students with resources with low connection, SWM=Students without resources with minimum connection, SRH=Students with resources with high connection, SRM=Students with resources with maximum connection, M=Mean, SD=Standard deviation, MD=Mean difference, p=p-value adjustment with Tamhane.

Similarly, a one-factor ANOVA was conducted to analyse the effect of the cluster type on hyperactivity, finding statistically significant differences ($F_{3,\ 1437} = 12.7$, $p < .001$). Post-hoc multiple comparisons were performed using the Bonferroni procedure (see Table 5).

Table 5
Means and comparison of means for "Hyperactivity" by type of cluster

	M	*SD*	*Comparison*	*MD*	*p*	*IC 95%*
SRL	3.76	2.08	*SRL-SWM*	-0.09	1	[-0.52, 0.33]
SWM	3.85	2.22	*SRL-SRH*	-0.30	.251	[-0.68, 0.09]
SRH	4.06	2.06	*SRL-SRM*	-0.92	< .001	[-1.33, -0.51]
SRM	4.68	2.20	*SWM-SRH*	-0.20	1	[-0.66, 0.25]
			SWM-SRM	-0.83	< .001	[-1.3, -0.35]
			SRH-SRM	-0.62	.001	[-1.06, -0.18]

Note: SRL=Students with resources with low connection, SWM=Students without resources with minimum connection, SRH=Students with resources with high connection, SRM=Students with resources with maximum connection, M=Mean, SD=Standard deviation, MD=Mean difference, p=p-value adjustment with Bonferroni.

Lastly, a robust one-factor ANOVA was conducted using Welch's test (unequal variances), which found statistically significant differences in "*Peer relationship problems*" as a function of the cluster type ($F_{w\ 3,\ 699}$ = 3.87, p = .009). Post-hoc multiple comparisons were performed using the Tamhane procedure (see Table 6).

Table 6
Means and comparison of means for "Peer relationship problems" by type of cluster

	M	*SD*	*Comparison*	*MD*	*p*	*IC 95%*
SRL	1.75	1.59	*SRL-SWM*	-0.30	.162	[-0.66, 0.06]
SWM	2.05	1.88	*SRL-SRH*	-0.03	1	[-0.31, 0.25]
SRH	1.78	1.51	*SRL-SRM*	-0.34	.028	[-0.65, -0.02]
SRM	2.08	1.64	*SWM-SRH*	0.27	.310	[-0.11, 0.64]
			SWM-SRM	-0.04	1	[-0.43, 0.36]
			SRH-SRM	-0.30	.084	[-0.63, 0.02]

Note: SRL=Students with resources with low connection, SWM=Students without resources with minimum connection, SRH=Students with resources with high connection, SRM=Students with resources with maximum connection, M=Mean, SD=Standard deviation, MD=Mean difference, p=p-value adjustment with Tamhane.

The results show that while students in the SRL cluster have the lowest scores on all the mental health scales: emotional difficulties, peer relationship problems, hyperactivity and conduct problems, the students in the SRM cluster have the highest scores in the same four scales. In emotional difficulties, the mean in the SRL

cluster is lower than in the SRM cluster, indicating that more emotional difficulties are present when the number of daily Internet connection hours becomes excessive. Conduct problems also appear to be clearly higher in the SRM cluster than in the other clusters. The mean in the SRH cluster is also higher than in the SRL cluster, suggesting a trend toward more conduct problems with increased daily Internet connection time. The SRM cluster shows higher levels of hyperactivity than the other clusters, reinforcing the fact that excessive connection time is associated with hyperactivity. As for peer relationship problems, the mean of the SRL cluster is lower than that of the SRM cluster, indicating that excessive time online is associated with this type of problem.

DISCUSSION AND CONCLUSIONS

The present study shows that AP improves when students have access to computers, smartphones and the Internet, while it decreases significantly when the daily online connection time exceeds 5 hours. At the same time, different ESO and Baccalaureate profiles students were obtained by combining the students' AP, availability of digital resources (computer, Internet and smartphone) and the time spent online daily, this last variable being particularly important. Finally, differences were found among these profiles in terms of emotional difficulties, peer relationship problems, hyperactivity and conduct problems.

The first result indicates that having a computer, Internet or smartphone is associated with higher AP. These results are consistent with previous Spanish studies that have associated computer use at home with high AP, showing that the more computers and the Internet are used for homework, the greater the impact of ICT access on AP (Halpern et al., 2020). Our results are consistent with those reported by Palacios (2005), Chen et al. (2021) and Guo et al. (2021) whose research confirms that the occasional use of an Internet-enabled computer for homework purposes may motivate students, reduce the number of hours spent studying and improve the AP of secondary school students in China. Other recent leading research papers on the subject claim that the use of electronic devices, such as Internet-enabled tablets or computers with Internet access, under parental supervision, enable classmates to communicate with each other instantly on online forums and virtual platforms, improving the AP of secondary school students significantly (Hurwit & Schmitt, 2020; Maqableh et al., 2021). In general, access to electronic devices improves AP, as shown in this paper. However, the papers cited here, as well as others such as the one by Putnam (2021) point to the length of screen exposure time as being the factor that determines the degree to which access to electronic devices benefits AP.

Similarly, when A1.-H4 (*Students who have a high daily Internet connection time obtain higher scores in AP than those with a low daily connection time*) was

contrasted, the influence of Internet exposure time on student performance could be seen, showing that when the daily Internet connection time exceeds 5 hours, there is a significant reduction in AP among students. Our results shed some light on the debate about AP and Internet access in adolescents, coinciding with previous studies that have shown how the use of Internet-enabled computers can have a negative impact on AP in maths and reading if used to excess (Botello & López, 2014). Our results also coincide with other similar international studies. A study by Islam et al. (2020) involving 1704 Australian students, for example, examined whether the time spent on the Internet and playing online games interfered with students' AP. They found that the time spent online has a statistically significant influence on AP, showing a pattern of influence in the number of hours of Internet use. Students who spend more than four hours a day on electronic games and social networks had lower scores in reading and arithmetic than students who spent less time on these pursuits. Other authors such as Putnam (2021) have confirmed that the days of the week the Internet is used also has a significant influence on AP. Thus, students who use the Internet between 2 and 4 hours a day at the weekend had better AP than those who did not use the Internet or those who used it on school days.

The following is an analysis of the results of Aims 2 and 3. Regarding Aim 2, the results of our study indicate the presence of four student profiles according to differential characteristics in AP, access to ICTs, and daily connection time. In the first cluster, SRL, all the students had a smartphone, computer, Internet access at home, daily Internet connection time from 1 to 3 and a AP of 7.05. Regarding Aim 3, this cluster also showed the best mental health (lower mean scores on SDQ scales). This group resembles the one in a study by Buzzai et al. (2021). Buzzai et al. confirmed that daily Internet use of under 3 hours does not affect AP and underlined the importance of parental supervision and self-control regarding the amount of time and frequency of Internet use. In the second cluster (SWM), not all students have a smartphone, computer or Internet access, are online less than 1 hour a day and have an AP of 6.51. In other words, they have fewer resources and spend less time online, which means they have a slightly lower AP than the SRL group, but as they spend less time on the Internet, they also have fewer conduct problems and less hyperactivity than the SRM cluster (Students with resource and maximum connection time).

In the third cluster, SRH, 100% of the students have a smartphone, computer and Internet access at home, are connected to the Internet between 3 and 5 hours per day and have an AP of 6.89. This cluster has more conduct problems than the SRL cluster but lower levels of hyperactivity than the SRM cluster. Lastly, in the fourth cluster, SRM, 100% of pupils have a smartphone, computer, Internet access at home and a daily Internet connection time of over 5 hours. This cluster also has the lowest mean AP score (6.31). In terms of mental health, this cluster has the highest mean scores on the four SDQ scales. SRM has a higher level of emotional difficulties than

SRL. There are more conduct problems and hyperactivity in this cluster than in the rest of the clusters. SRM also shows higher levels of peer relationship problems than the SRL cluster. The students in this cluster spend a similar amount of time with similar regularity on the Internet and other electronic devices to those in the study by Javaeed et al. (2020) and Islam et al. (2020), which confirms that being exposed to the Internet for over 5 hours a day affects adolescent well-being by increasing their levels of perceived stress, causing greater frustration in their basic psychological needs and lower academic commitment.

These results highlight the complexity of the interaction among the analysed variables: AP, access to ICT, Internet connection time and mental health. However, we did find a group of students (SRM) who, despite having access to digital resources, still achieved low AP. Based on the above analysis, this would be understandable if they had had no resources, but how is it possible if they have access to digital resources? When we combine the variables computer access, Internet, smartphone and Internet connection time with AP, it appears that access to these resources alone does not determine good AP. This claim, however, is subject to considerable controversy. Some authors, including Miao et al. (2020) and Zhu et al. (2020) highlight the beneficial impact of access to digital resources on AP, pointing out that while it may stimulate the development of working memory, visuospatial skills, and mathematical reasoning, it could impact performance in literary subjects, like Spanish Language and Literature, and scientific subjects, such as Mathematics in different ways. However, most research points to the need to examine in more depth how the length of connection time and type of resources are related to understand better the impact of the Internet on AP (Buzzai et al., 2021; Javaeed et al., 2020). To do this, other variables also need to be taken into account, such as daily Internet connection time and mental health, particularly emotional and interpersonal relationships with peers. When we introduce the mental health status of the groups surveyed, we find significant differences that can explain why students with the same access to digital resources perform differently. Other variables need to be factored in to understand this association better, such as time spent online each day and mental health, especially interpersonal relationships with peers and emotional relationships. The SRM group, who had access to digital resources but spent over 5 hours a day connected to the Internet and had poor AP, had worse mental health scores on all variables compared to the rest of the groups. Their higher scores on the emotional difficulties, hyperactivity, peer relationship problems and conduct problems scales are indicative of a greater likelihood of getting low AP scores (Fajardo-Bullón et al., 2019; García & Cantón, 2019). These results are consistent with recent international studies in which difficulties in mental health, also measured using the SDQ, are associated with low AP and increased absenteeism in the classroom (Agnafors et al., 2020; Lereya., 2019). Elsewhere, research by Ozaslan et al. (2021) and Gjoneska et al. (2022) confirmed that there has been an increase in

access to digital resources as well as in the length of time adolescents spent online during the Covid 19 pandemic. These authors link this increase in Internet use with the increase in diagnoses of problematic Internet use among adolescents, which has grown compared to the years preceding the pandemic. If unsupervised by parents, the excessive use of smartphones and/or computers can lead to a series of mental health issues and poorer well-being – as well as to poor performance – in secondary school students (Dienlin & Johannes, 2020; Halpern et al., 2021). Several recent studies have also pointed to Internet abuse as a decisive factor in mental health problems (Fajardo-Bullón et al., 2019), and that students with greater access to new technologies get higher scores for conduct problems and experience fewer positive emotions and feelings than those with less access to new technologies (Coyne et al., 2020). This may be important for understanding the SRM group. One possible explanation for these results is the bidirectional associations between AP and mental health, since school failure, negative expectations for academic success and interpersonal problems with peers are also, in turn, associated with low AP (Vitale et al., 2015). However, other authors such as Ozaslan et al (2021) maintain that the problem lies not so much in the number of hours spent online but rather in the content consumed, although both factors have a significant impact on the AP of Baccalaureate students. It may also be that with good parental supervision and well-designed Internet control software, Internet use would not necessarily lead to mental health problems (Sornarajah, 2021; Fajardo-Bullón et al., 2019), so these variables need to be studied in the future. Similarly, further research should be carried out on the population of students who do not have access to digital resources, since, although a minority, they should not be neglected.

In conclusion, this study shows how AP is positively influenced by access to computers, smartphones and the Internet. However, too much time spent online every day is detrimental to AP. Our study contributes to broadening this analysis by grouping students according to these variables and by examining their mental health. The clusters are mainly determined by daily Internet connection time. Our findings show that excessive time spent online (SRM) is associated with greater mental health problems.

Finally, it seems that emotional problems stand out exclusively in low AP students with digital resources, possibly making this the variable that deserves most attention in future studies. Therefore, although digital resources have an important impact on AP, the mental health variable should also be given due consideration.

At this stage, it is important to highlight the limitations of the study and to recommend potential new avenues of research. In the first place, it is important to point out that the use of self-report data may lead to social desirability bias. However, sample size minimises this potential bias, as does the use of a validated mental health scale. Also, it would be advisable to use other versions of the SDQ in

order to collect data from other informants and compare the information from the adolescents with that of their parents or teachers. Although the average academic grade is the most widely accepted empirical criterion for measuring academic performance (Navas et al. 2003), this variable should ideally be complemented with other types of additional qualitative evaluations. Furthermore, as part of the new avenues of research, it is important to include other sociodemographic variables that may influence the availability, frequency and length of time of students' access to digital resources and the Internet, and how these factors correlate with academic performance. Examples of such variables could be parental control, the existence of learning disorders, the effectiveness of Internet use, etc.

With future research in mind, it would also be important to find out how Internet use impacts AP in specific subjects, as, according to authors Zhu et al. (2020) and Miao et al. (2020), teaching methodologies that centre on Internet use may contribute to the development and stimulation of students' visuospatial abilities, creativity, strategizing and decision-making abilities and attention, all of which are required when learning physics and technology, for example.

Finally, student profiles should also be studied in detail to avoid the effects of uncontrolled variables when mental health is included as a study variable. Finally, it is important to highlight the need for a support and information network to promote the responsible use of the Internet among adolescents. It should focus on teacher and parent training, as well as developing transversal educational curriculums that teach students to use digital resources responsibly in both the academic and socio-affective spheres. As stated by the report *Evolution of Social Cohesion and the Consequences of Covid-19 in Spain* (FOESSA, 2022), if computer equipment, access to the Internet and computer skills are already determining factors in social participation and access to social rights, in the future, public policies should guarantee the universalization of these common goods – and associated rights – for all individuals and territories (FOESSA, 2022).

FUNDING

This work has been funded by the support to Research Groups of the Junta de Extremadura (SEJO14 GR21033), Ministry of Economy Science and Digital Policy of the Junta de Extremadura and the European Social Fund (ESF).

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