Article

University students' perceptions of how mobile phones influence their academic performance. A case study in Valencia, Spain

Bernat Roig-Merino[1,*], Enrique Sigalat-Signes[2], Lluís Miret-Pastor[1], Cristóbal Suárez-Guerrero[3]

[1] Department of Economics and Social Sciences, Universitat Politècnica de València, 46730 Gandia, Spain

[2] Department of Social Work and Social Services, Universitat de València, 46021 València, Spain

[3] Department of Education and School Management, Universitat de València, 46010 València, Spain

* **Corresponding author:** Bernat Roig-Merino, bernat@upv.es

Abstract: This study seeks to explore the uses, behaviors and perceptions of university students regarding mobile phones to help elucidate whether there is a relationship between the use of mobiles and the academic performance of university students. A quantitative approach based on an ad hoc questionnaire, applied before the pandemic, was used to gather evidence in this regard, which revealed the uses and educational visions of mobile phones in a convenience sample of 314 university students from nine different degree courses in two Spanish universities. Three major conclusions are formulated as part of future lines of development. First, although there is frequent use of mobile phones, the image of the mobile as a learning resource in the university classroom does not reach one-third of students. Second, although this study does not determine the causal relationship, there is a statistically significant negative relationship between average grades achieved and hours of dedication to the mobile phone. Finally, students who are unable to spend more than one hour without checking their phone obtain a significantly lower average mark than those who can stay more than one hour without checking their phone.

Keywords: mobile phones; academic achievement; university students; surveys; student behavior

1. Introduction

The impact of the mobile phone on people's lives is indisputable. Information and Communication Technologies (ICTs) have a greater impact than expected and, according to Floridi (2015), affect aspects such as self-conception, interactions, the notion of the real and action per se. It is difficult to find exceptions to this impact when talking about mobile phones regardless of location, age, social status or any other characterization we may want to use (INE, 2021). According to AIMC (2023), in 2020, 96.4% of Spanish households acknowledged having mobile telephony devices. According to De la Torre (2012), the portability and multi-functionality features of these devices determine the iconic structure of globalized society. Mobile phones and Internet have become the innovations that best reflect the permanent turmoil in this ICT context in which digitalized society is immersed (Ariño, 2008).

The mobile phone is a tool for communication and access to information with multiple applications that anyone can use in their daily and professional activities and which has been adopted on a grand scale, becoming part of the social dynamics of society. In an increasingly mobile and digital society, and in line with the approaches of the European Higher Education Area (EHEA), the new habits of students generated by the use of mobile phones pose academic challenges on how to deal with and take

advantage of the inescapable presence of ICTs for learning both inside and outside the classroom. The subject of how smartphone use affects student behavior and academic performance, especially at the university level, is an emerging field of research (Crompton and Burke, 2018).

Mobile devices, specifically smartphones, occupy a large part of the university students' life, and even burst into the classroom, posing various threats, challenges and opportunities (Fu et al., 2021). In this context, it is pertinent to analyze and quantify the use of mobile phones by university students, as well as to hypothesize a possible negative relationship between the intensity of mobile phone use and academic performance. The aim of this paper is to stimulate a debate which, although not unprecedented, is topical and in which there is still much ground to be explored. Therefore, following the line of other authors who have studied this topic (Pimmer et al., 2016), the aim of this research is to explore both college students' usage behaviors (Chen and Yan, 2016; Mangisch, and Mangisch-Spinelli, 2020; Raposo Rivas and Garcia Fuentes, 2019) and self-perceptions (Mendoza et al., 2018) regarding mobile phone usage, in order to elucidate whether there is a relationship between college students' phone usage and their academic performance.

State of the art

We are living in a historical time where ICTs are assuming a fundamental role in the development of productive, social, cultural and even health processes with COVID-19, especially in the educational field (Paudel, 2021). According to Katz and Aakos (2002), mobile phones directly or indirectly affect all aspects of our personal and professional lives. Mobile technology has changed the lives of many people, except for the youngest; specifically, the population dubbed "Gen Z" (those born after 1996) and among which the vast majority of the university population is found. For the youngest, it has not been a change of life. To them, the mobile phone is an integral part of their lifestyle because they only know this highly digitalized society. Smartphones are part of young people's way of living and socializing. For them, it is a personal symbol to carry a mobile phone with them at all times (Ramos and Jiménez, 2007). However, the use of or exposure to smartphones is not always a good use, as demonstrated by the fact that the concept of "digital natives" has been questioned by several authors (Gallardo-Echenique et al., 2015; Kennedy et al., 2008). There is no doubt that the mobile phone characterizes a large part of today's youth culture, so much so that some authors have defined it as "mobile youth culture" (Campbell and Park, 2008; Vanden Abeele, 2016). In fact, it is clear that the relationship between young people and their mobiles shows striking similarities that can overcome geographical and cultural barriers (Castells et al., 2007).

Certainly, the relationship of young people with mobile devices is a complex subject that has opened up different lines of research in various disciplines. One of them is the impact of mobile phones on education and learning processes in young university students from different countries (Nikolopoulou et al., 2020). On one hand, there is an acknowledged need for education, at all levels, to adapt to new times and technologies. If the mobile phone has changed the way we relate to each other, work or access information, it is logical to think that it can also change the way we teach

and learn (Battro and Fisher, 2012; Cardenas and Caceres, 2019). On this subject, there is a certain conviction that technologies favor the emergence of new methodologies, tools, curricular formats and learning styles (Pascuas-Rengifo et al., 2020; Raposo and Garcia, 2019).

But alongside this new and exciting context where education and technology feed back into each other, or even alongside another debate where neuroscience and pedagogy discuss the benefits or detriments that the use of new technologies has on the development of teenagers (Cavanaugh et al., 2016; Tossell et al., 2015), a seemingly much more prosaic, but undoubtedly real and truly important debate is taking place in every school and every classroom: the relevance of promoting or banning mobile devices.

Thus, the use of mobile technology (such as phones, tablets or laptops) in the learning process gives rise to two opposing viewpoints, with some in favor and some against it. There are studies in the scientific literature on the subject that point to the positive impact of these devices on learning (Crompton and Traxler, 2019; Roblyer and Hughes, 2023; Traxler, 2018;). In parallel, other authors highlight the dilemmas and negative effects that these devices can have in the classroom, such as distraction, the emergence of new forms of copying, cyberbullying or dependency, among others (Carrillo et al., 2017; Gómez-Fernández and Monge-López, 2013; Pedrero-Sánchez et al., 2020; Picado-Juárez et al., 2017; Spitzer, 2014). However, the use of technology in the classroom is an undeniable issue and its use as a didactic learning strategy transforms the way of educating (Cacheiro, 2018; Fojtik, 2014; Mangisch and Mangisch-Spinelli, 2020), regardless of whether this strategy is correct or not, a debate that we will not go into here.

Much of this debate has traditionally focused on secondary education, since it is in adolescence that these pedagogical problems are most virulent and because the debate quickly leads to a media discussion on the prohibition or promotion of mobile phones in the classroom. However, this does not mean that the debate is not present in university education, although it is true that it occurs in other terms, as the students are older and are expected to be more responsible and autonomous. In any case, the influence of mobile phones on the academic performance of college students is a topic that deserves attention and has been understudied (Crompton and Burke, 2018; Gallardo Echenique et al., 2015; Kates et al., 2018; Pimmer et al., 2016).

Caution still prevails in university institutions regarding the use of these technologies in the classroom, as the majority perception is that it is still a territory to be explored (Mateus et al., 2019). However, no one doubts that the integration of these devices in the essential practices of young university students has brought about significant changes in the way they interact, access information and organize their academic development. In the university classroom, distraction with mobile phones is a common issue among university students, interacting with these devices while they are in class or studying (Chen and Yan, 2016). Along this line, although it is common for students to believe that they are able to combine tasks simultaneously, there are studies that point out that this way of proceeding distracts learning and is related to poor academic performance (Chen and Yan, 2016; Mendoza et al., 2018).

However, there is no unanimous opinion among scholars as to whether the use of mobile phones can contribute to improved academic performance. Some studies and

experiences show that its use in the classroom can have positive effects, such as those carried out by Tejedor and García-Valcárcel (2007), where they show that students with greater academic success acknowledge that the use of ICTs has favored and has been a great support in their learning process. Other studies conducted with university students show the benefits of using mobile devices in the classroom (Guerrero et al., 2016; Villegas, 2016; Zarzycka, 2016), highlighting the following: they emphasize digital competence, allow the use of technological educational tools, increase motivation and participation through active and collaborative learning experiences, improve the classroom atmosphere, access to information and the performance of practices, among others. What is central here is that this educational use—good or bad—of mobile phones is not only a technical issue, but also a matter of focus, hence the importance of exploring the perception and expectations of young university students. This work is along these lines.

The question of whether to prohibit the use of mobile devices in university classrooms or to allow their use, considering the impact they may have on academic performance, has sparked and continues to fuel a heated debate in the educational field in general, and in higher education, in particular. Drawing on previous studies conducted on this topic over the past decades, it can be observed that there is still no fully satisfactory answer to this question.

The potential of ICT in education has already been recognized and emphasized by the Education 2030 Incheon Declaration (UNESCO, 2015), the 2017 Qingdao Declaration (UNESCO, 2017), and the 2019 UNESCO Mobile Learning Week (UNESCO, 2019). Teachers are the cornerstone of the education system, and their involvement is crucial for the viability of ICT in pedagogical endeavors. One of the key aspects to consider in the use of mobile technologies is to provide education and critical literacy regarding the media, uses, and abuses of these tools, both in higher education specifically and in education in general, where it is essential to educate on the responsible and safe use of technology and mobile devices from an early age to counteract their negative effects. This is a challenge that universities face and to which a current response must be provided.

In view of the above, there does seem to be agreement that the presence of these devices in the classroom, without an apparent academic use and without programming by teachers, usually has adverse effects and has a negative impact on the academic performance of young university students, as some studies (Chen and Yan, 2016; Mendoza et al., 2018) point out. However, the introduction of mobile devices in the teaching-learning process opens up a wide range of educational potentialities, some of which have yet to be explored and discovered (Navaridas et al., 2013), that commend and praise the discussion of its applicability in the classroom as a tool to be taken into account. (Bennett et al., 2008; Cardenas and Caceres, 2019; Crompton and Traxler, 2019; Villegas, 2016). For these educational potentialities to make sense, and be pedagogically meaningful (Gros and Suárez, 2016), both for educational policies based on digital technology, as well as for whoever teaches and learns in traditional and hybrid pre- and post-pandemic contexts, it is important to know how students use and perceive mobile devices in their academic development. This study is part of that broad line of research pre-COVID and, especially, for post-COVID education (Jandrić, 2020) that attempts to provide evidence and lay down lines of development to enrich

the educational view of technology.

2. Aim and methodology

Taking into account the state of the art on the relationship between university students and mobile devices, and assuming that the perception that users have of technology is as important as the technological system itself, the main objective of this paper is to learn the perception that young Spanish university students have of their use of mobile phones and how it affects their academic performance.

This research has a marked exploratory nature, aiming to contribute by providing new evidence that can inform a more educated decision regarding the debate on whether to permit or prohibit the use of mobile devices in university classrooms, considering their impacts on students' academic performance

2.1. Design and sample

To gather the information, quantitative research was carried out by means of an individual and anonymous questionnaire administered by the researchers in the classroom, thus ensuring the maximum quantity and quality of the answers obtained. A total of 322 questionnaires were collected, of which 314 were validated by checking for consistency and minimum response level. Thus, a convenience sample of 314 university students from nine degrees courses (Polytechnic University of Valencia (UPV): Tourism Degree (GT), Degree in Business Administration and Management (GADE), Double Degree Tourism-ADE (TADE), Master's Degree in Agri-Food Engineering (MUIA), Degree in Management and Public Administration (GAP) and Degree in Food Science and Technology (GCTA). University of Valencia (UV): Bachelor's Degree in Social Work (GTS), Bachelor's Degree in Social Education (GES) and Bachelor's Degree in Sociology (GS)) at the two public universities in the province of Valencia was obtained, guaranteeing the confidentiality and anonymity of the answers at all times. In this non-probability sampling technique known as convenience sampling, participants are selected according to ease of access and availability and because they belong to the population of interest, not because they have been selected using statistical criteria (Ochoa, 2017). Fieldwork was conducted between June 2019 and February 2020, prior to the lockdown period.

As this is a non-probabilistic and convenience sample of an exploratory nature, rather than seeking the random representativeness of the sample and the external validity of the population, the focus here is on the external validity of the situation, as the most available subjects may be the most typical of the population in terms of the variables of interest; that is, those who complete the questionnaire are still volunteers. After all, in this type of non-probability sampling, it is the participants themselves who decide to participate in the work. The students who completed the questionnaire are in some way interested in the subject matter of the research and this is the main motivation for filling it in. This factor is more important when the exploration is about interests and expectations of use.

2.2. Measuring instrument

An ad hoc semi-structured questionnaire composed of 22 questions was

developed and divided into two parts and blocks:

- Part I: Identification-classification data (gender, course, degree, if Erasmus student, country of residence and age).
- Part II: Content of the questionnaire made up of different blocks. The first, of a more general nature, included five questions on how much time they spend on their smartphone, whether it is used in the classroom, the purpose of its use and whether they use it to connect to social networks (Following Flores-Vivar (2009, p. 74), here we understand the concept of social network as "a meeting point, a rendezvous for friends or people who share common interests" whose common context is the Internet. Examples of social networks are Twitter, Facebook, Instagram, TikTok, WhatsApp and YouTube, among many others). A second block, with seven questions on whether the mobile phone is a distracting element, how it influences their behavior, whether they consider it is used appropriately and whether they think it affects their academic performance. A third block with four questions on the situations and time spent with the smartphone and its main use in the classroom. Finally, there is a fourth block with six questions on the perception of their use of this device, their dependence on it, whether they use it as a didactic resource in some subjects and the average mark of their academic record.

A review of previous studies and questionnaires was carried out (Chóliz et al., 2016; Ruiz de Miguel et al., 2021) to validate the questions measuring students' dependence and overuse behavior towards mobile phones. And before the survey, a pilot test of the initial questionnaire was conducted with students from different degrees and courses. The necessary adjustments were made to ensure that the questions were understood and answered according to the response format. The data processing and analysis of the outcomes were performed using the statistical program "Dyane v4" (Santesmases-Mestre, 2009), carrying out simple tabulations, cross tabulations with Chi-square test and analysis of variance and covariance.

3. Results analysis and discussion

This section provides a quantitative description of the use of mobile phones by university students, focusing on their use in the classroom. Then, the students' own perception of this use is included and, finally, the influence of the mobile phone on academic performance is statistically analyzed.

3.1. Univariate analysis

We begin by analyzing the use of mobile phones by university students. The first thing that can be observed is the continuous use of mobile phones; only 3% of students use the device less than one hour a day and more than 80% of students say they use their phones more than three hours a day. This use seems to be parallel to the use of social networks, with responses showing that more than 70% of students spend between 1 and 4 h a day on social networks. If we analyze the mobile phone use by taking the extreme data of the population, we see that 15% of the population spends less than one hour on it and 12% spends more than 4 h a day.

Mobile use is not limited to time outside the classroom. In fact, students show

their dependence on mobile phones even in the classroom. The responses to the question "How often do you check your mobile (even when in class)?" reveal that only 6% of the total spend longer than one hour without checking their phones. In fact, about three out of four check it at intervals of 30 min or less. Linked to this question, 70% of the students acknowledge that the main use they give to their mobile phones (in the classroom) is personal, while only 30% state that they use it for educational-academic purposes. Along the same lines, only 7% of students say they do not connect to social networks during classes, compared to 38% who connect sometimes and 55% who openly admit to connecting to social networks during classes.

When asked about applications or activities, students primarily use mobile phones to access social networks and to search for information and read digital newspapers. Consistent with other studies in the scientific literature on the subject (Fondevila-Gascón et al., 2019; Mese and Aydin, 2019), this research reveals that WhatsApp has the highest level of usage among Spanish university students.

Once the students' use of mobile phones was determined, the students' own perception of the influence that this use has on their academic performance was analyzed. The students acknowledged that smartphones and social networks influence their academic performance, as 65.5% of students believe that their academic performance would improve if they spent less time on their smartphones and social networks. In fact, more than 50% admit to a certain dependence on their mobile phones.

3.2. Bivariate analysis

Once the variables were analyzed individually, a cross analysis was carried out to study their influence on each other, through the analysis of the significance level of the Chi-square and Snedecor's F statistical tests. **Table 1** shows how the number of hours students spend on their smartphones clearly decreases with age. Even more interesting is the relationship found between hours spent on the mobile phone and the average mark. As can be seen in this table, the group of students who spend more than 4 hours a day on their mobiles has a lower average mark than the rest, with a significance level of $p = 0.0059$, less than 0.01 (less than 1% if we speak in percentages).

Table 1. Age and average mark according to hours spent on the smartphone.

Variable	Sample total	Average hours a day using smartphone			Snedecor's F
		Less than 3 h	**3–4 h**	**>4 h**	
Age	21.6393	23.2105	21.5197	21.0248	$F(2302) = 11.5440$
	$n = 305$	$n = 57$	$n = 127$	$n = 121$	$p = 0.0000$
Average mark	7.0641	7.134	7.2296	6.8628	$F(2278) = 5.2347$
	$n = 281$	$n = 53$	$n = 115$	$n = 113$	$p = 0.0059$

To verify that the relationship between the average score and the hours spent on the mobile phone is not due to a third variable (age), which has a negative correlation with the hours spent on the phone (linear correlation coefficient $R = -0.24$ and clearly significant, with $p = 0.0000$), an analysis of covariance was performed, as shown in **Table 2**. This analysis showed that the statistically significant relationship (at the 1%

level) between the average mark and the number of hours spent on mobile phones is maintained when we isolate the effect that age has on both variables.

Table 2. Analysis of covariance (one-way): average mark. mobile hours and age.

Dependent variable (Y)		Average mark				
Treatment variable		**Average hours a day using smartphone**				
Covariable		**Age (Years):**				
			Dependent variable		**Covariable**	
	Groups	$N°$ **of cases**	**Arithmetic**	**Standard**	**Arithmetic**	**Standard**
			Mean	**Deviation**	**Mean**	**Deviation**
	Sample total	277	7.0686	0.8776	21.7329	3.0235
	Treatment variable categories					
	Less than 3 h	52	7.1365	0.8589	23.3462	4.376
	3–4 h	114	7.236	0.8578	21.5877	2.8464
	>4 h	111	6.8649	0.8651	21.1261	1.9779

Ancova Table							
					Residuals		
Variation source	**Degrees of freedom**	**Sum X^2**	**Sum XY**	**Sum Y^2**	**Degrees of freedom**	**Sum Y'^2**	**Average**
Intergroup	2	178.6048	16.6513	8.0407	2	7.3221	3.661
Within groups	274	2353.63	52.6246	205.3161	273	204.1395	0.7478
Total	276	2532.23	69.2758	213.3568	275	211.4615	
Snedecor's F with 2 and 273 degrees of freedom = 4.8960 ($p = 0.0081$))							

Table 3 below shows in more detail the relationship between the time spent on the mobile phone and the average mark for each age group. It can be seen that students aged 18 to 21 who spend more than 4 h/day on their mobile phones have an average score roughly 0.5 points lower than their peers of the same age who spend less than 4 h/day on their phones. In contrast, for students over 21 years of age, there is no longer any relevant relationship between the number of hours they say they spend on their mobile phones and their average mark.

Table 3. Average mark according to the number of hours spent on mobile phones by age group.

Age and mobile hours	Average mark	Number of cases	% of total of each row
18–19 years	**6.97**	**50**	**18%**
≤4 h	7.31	28	56%
>4 h	6.54	22	44%
20 years	**7.04**	**51**	**18%**
≤4 h	7.23	24	47%
>4 h	6.86	27	53%
21 years	**7.04**	**48**	**17%**
≤4 h	7.24	32	67%
>4 h	6.63	16	33%

Table 3. (*Continued*).

Age and mobile hours	Average mark	Number of cases	% of total of each row
22 years	**7.13**	**49**	**18%**
≤4 h	7.21	23	47%
>4 h	7.06	26	53%
23 years	**7.29**	**34**	**12%**
≤4 h	7.33	22	65%
>4 h	7.21	12	35%
Over 23 years	**7.02**	**45**	**16%**
≤4 h	7	37	82%
>4 h	7.09	8	18%
Overall total	**7.07**	**277**	**100%**

This negative trend between use (or rather abuse) of the mobile phone and the average mark or grade achieved is confirmed by another of the questions posed, regarding how long they can go without looking at their mobile phones without feeling uneasy (which is an indicator of dependence according to Chóliz et al. (2016). **Table 4** shows that the higher the dependence on the mobile phone, the lower the average mark. The students who express their inability to spend more than one hour without checking their phone have a significantly lower average mark than those who do express their ability to go for more than an hour without checking their mobile ($p = 0.0151 < 0.05$). As in **Table 1**, the most mobile-dependent are younger than those less dependent.

Table 4. Age and average mark according to the time they could be without the smartphone.

Variable	Sample total	How long could you be without the smartphone (or without checking it) without feeling bad?		Snedecor's *F*
		Could not or Maximum 1 h	More than 1 h	
		(Major dependency)	(Minor dependency)	
Age	21.6393	20.7955	2.7816	$F(1303) = 4.2449$
	$n = 305$	$n = 44$	$n = 261$	$p = 0.0406$
Average mark	7.0641	6.7395	7.1148	$F(1279) = 5.9971$
	$n = 281$	$n = 38$	$n = 243$	$p = 0.0151$

As for awareness of the issue, students say they are aware of the negative impacts of mobile phones on their academic performance and behavior. This is not only an impression, but is justified by the data. In fact, students who believe that "academic performance would improve if you spent less time on your smartphone and social media" score lower than those who do not (**Table 5**). Again, those who believe that their marks would improve are significantly younger than those who do not (significance level of 0.26%, less than 1%).

In any case, we attempted to go beyond the mere statistical description of facts that were already intuited, even as we have described, by the students themselves. Next, the statistical validation of the hypothesis that there is a negative relationship between the hours spent on the smartphone and the academic performance of university

students was proposed. For this purpose, the average mark of the student's academic record was included in the questionnaire.

Table 5. Age and average mark according to the perceived impact of smartphone use on academic performance.

| Variable | Sample total | Do you think your academic performance would improve if you spent less time on the smartphone and social networks? | | Snedecor's F |
		Yes	No	
Age	21.648	21.194	22.534	$F(1302) = 14.6474$
	$n = 304$	$n = 201$	$n = 103$	$p = 0.0002$
Average mark	7.0679	6.9731	7.2553	$F(1278) = 6.4631$
	$n = 280$	$n = 186$	$n = 94$	$p = 0.0116$

As we detected in **Table 1**, there is a key variable in this analysis, namely age. A negative and highly significant relationship was found between age and the number of hours spent on smartphones. The higher the age, the fewer the hours of mobile use. Likewise, we detected a significant and negative relationship between the number of mobile phone hours and academic performance, thus validating our initial hypothesis.

Moreover, to further explore this hypothesis, in **Table 2** we conducted an analysis of covariance that introduces the effect of age on the results. Eliminating the effect of age, the relationship between average mark and hours of mobile use remains significant and negative. In addition to continuing to validate the initial hypothesis, we obtain relevant information from this cross analysis, such as the fact that this negative relationship intensifies for the youngest segment of the population and among those who spend more than four hours a day on their mobile phones.

In fact, the analysis allows us to quantify that the segment of students between 18 and 21 years of age who spend more than four hours on their mobile phones achieved an average mark half a point lower than that of their peers of the same age who use their mobile phones less. This outcome is similar to that reported by Glass and Kang (2019), in an experiment carried out with their university students, where they observed a 5% reduction (0.5 points out of 10) in the average marks of the group of students who were allowed to use their mobile phones in class, compared to the group that was not allowed to use them.

In short, beyond a negative relationship between mobile phone use and marks, the data clearly show a negative and significant relationship between mobile phone abuse and marks.

4. Discussion

The learning process has evolved in recent years, becoming more dynamic and continuous, driven primarily by the rapid evolution of technology, resulting in an inevitable transformation in teaching and learning methods, particularly in universities which must be able to build competitive advantages using digital transformation (Mohamed Hashim et al., 2022). This change entails and necessitates a comprehensive digital transformation, requiring the adaptation of current university education to meet such demands.

In this regard, it is essential to design and implement new innovative education

and training programs that better align with the requirements of the technological contexts in which society operates today (Mangisch and Mangisch-Spinelli, 2020). From a strictly technical standpoint, once addressed the issues related to the culture of connectivity (Van Dijck, 2016), there are now virtually no technological barriers preventing universities from driving a profound transformation in their approach to teaching and learning processes, leveraging the potential of mobile devices for designing a renewed educational strategy. All that is required is the willingness of relevant authorities to undertake such efforts.

As mentioned, the introduction of ICT in classrooms highlights the need for a new definition of roles, particularly for teachers and students (Garay Núñez, 2020). Teachers, to some extent, are compelled to depart from their traditional role as the sole source of knowledge. Students, on the other hand, may gain greater autonomy and responsibility in the learning process. This generates potential fears and uncertainties, a reality that calls for a creative re-adaptation, in our case, of higher education institutions.

Education, in general, faces the unavoidable need for transformation, evolving from an education system suited to an industrial society to one that prepares its students to thrive in the knowledge society, deeply interconnected and digital, where they must acquire new skills consistent with this new order.

This update implies, first, a pedagogical challenge to incorporate ICT into the classroom and educational curriculum, and second, the integration of public policies that bolster the orderly implementation of reforms impacting educational systems comprehensively, aiming to prepare university students to navigate a digitally evolving world at an unprecedented pace.

If information technologies and the new forms of interactive mediation through mobile devices produce new languages and forms of representation, and enable the generation of new learning scenarios, higher education institutions cannot remain on the sidelines. They should familiarize themselves with and utilize these new languages and forms of interaction, analyzing models for integrating ICT and mobile devices into higher education institutions to effectively address the challenge posed by mobile phone use in the classroom, creatively transforming them into powerful educational resources (Casanovas, 2021).

5. Conclusions

The first conclusion of the study is the objective confirmation and quantification of a perception shared by many university teachers: that students make a generalized and intensive use of mobile phones. However, pedagogically speaking, it seems more relevant the fact that this use continues even in the classroom and that in fewer than one third of the cases it has an educational or academic purpose. In fact, a large proportion of students (more than 65%) acknowledge that their academic performance would improve if they could reduce their smartphone dependence.

It should be noted that only 30% of the surveyed population explicitly declared an academic educational use of mobile phones. In other words, slightly less than a third of students use their phones as a learning tool in the university context. This is especially relevant when, as pointed out in the univariate analysis, only 6% of the total

remain more than one hour without checking their phone. In other words, 94% of students show a dependence on their mobile phones even in class (they are unable to go for an hour without checking their phones).

Another very important fact to note is that the older student, the less dependent they are and the better their performance. Although neither this study nor other educational experiments with technology are able to clearly pinpoint the elements that explain the causal relationship between the use of mobile phones and academic performance, it is possible to establish such a relationship. That is, there is a statistically significant relationship between average mark and the time spent on mobile phones, isolating the effect that age may have as a third variable related to both.

The outcomes of this work, beyond providing information on a key aspect in our classrooms, have practical consequences for university teaching and counselling work. First, it confirms the intensive use of smartphones among university students (even in the classroom) and also validates the hypothesis of a negative relationship between academic performance and the number of hours students spend on their phones. In the debate on the presence or not of mobile phones in the classroom, this could be interpreted as a need on the part of authorities and/or teachers to limit or discourage the use of mobiles both inside and outside the classroom. However, mobile phones are a hallmark of young people's identity; they are part of their lifestyle and their daily lives. Beyond the simplistic debate between mobile yes or mobile no, this dichotomy should be overcome and a rational use of smartphones should be encouraged.

Results show that rather than use, it is mobile phone abuse that has negative consequences on academic performance. In addition, we note the natural decrease in smartphone use that students experience as they get older. Students enter university with a very high dependence on mobile phones, but this gradually decreases over the years. If there is a problem with mobile abuse, this occurs in the first years of university (students aged 18 to 21), or it is even possible that it is carried over from secondary education (but this statement would need further study and discussion). Actions to address abusive use of mobile phones should focus on these early years at university and should take into account that, as the analysis has shown, the affected students themselves are often aware of the problem. In this line, a very recent study on video games and academic performance in adolescents (Gómez-Gonzalvo et al., 2020), points out in its conclusions that those who abuse—those who play intensely—and spend more hours playing, are the ones who perform worse academically.

There is no denying the evidence and importance of these devices, which are part of the way young people live and relate to each other. In a context where education and technology feed into each other, the potential of these devices should be considered in the teaching-learning processes, especially when virtual teaching through mobile devices has become a reality in times of quarantine due to the COVID-19 pandemic.

How to rationalize mobile phone use among young people, or at least how to avoid dependence and other negative consequences of smartphone abuse, is a key issue in communication, psychology and pedagogy today. Likewise, university professors—like so many others—are wondering how to introduce the smartphone into the teaching and learning process. There are many challenges that the widespread and massive use of mobile phones by young people (or the population in general)

poses in different disciplines. Analyzing this use with different quantitative and qualitative methodologies is one of the challenges facing educational planning in the "digital" society of the 21st century.

Among the limitations of this study, it is worth noting that, in future research, it would be advisable to expand the sample to include students from other degree programs and universities across Spain, in order to work with a more representative sample of the Spanish university population. This would allow for an analysis of whether sociodemographic factors and those related to the academic field of study influence the relationship between technology use and academic performance, as well as a more precise quantification of the impacts of each variable.

In this regard, there arises the necessity to continue investigating the influence of mobile devices on learning across different countries and cultural contexts. Thus, when their usage becomes widespread, reliable and verifiable data, along with successful experiences, should be available to serve as references for those embarking on their implementation. In line with this, according to Romero-Rodríguez et al. (2021), future lines of inquiry would emphasize the ongoing study of the impact of mobile devices on academic performance and self-regulation of learning, as well as the benefits and drawbacks their implementation entails in higher education, specifically.

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