



Regulatory strategies for smartphone use and problematic internet use in adolescence

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Título: Estrategias de regulación de uso del *smartphone* y uso problemático de internet en la adolescencia.

Resumen: La autorregulación constituye una habilidad básica que puede prevenir el uso problemático de internet y del *smartphone* en la etapa adolescente (LaRose et al., 2003). El presente estudio explora las estrategias de regulación del uso de este dispositivo, así como las relaciones de tales estrategias y de las variables antecedentes del modelo de Caplan (2010) para identificar a aquellos adolescentes que presentan altas o bajas consecuencias negativas del uso de internet. Con una muestra representativa de adolescentes de 1º a 4º de la ESO de la Comunidad de Madrid ($N = 524$, $M_{edad} = 13.57$, $DT = 1.24$, Rango = 12-17), nuestros resultados apuntaron a que son los padres los que regulaban el uso del *smartphone* en cerca de la mitad de los adolescentes. El déficit de autorregulación con rumiación cognitiva, la intervención de los padres para regular el uso de este dispositivo y las variables del modelo de Caplan (2010) –excepto la regulación emocional online– fueron predictores significativos para identificar a aquellos adolescentes que mostraban altas o bajas consecuencias negativas. Las implicaciones educativas y las futuras líneas de investigación son resaltadas.

Palabras clave: Autorregulación. Uso problemático de internet. Smartphone. Adolescencia.

Abstract: Self-regulation is a basic skill that can prevent problematic Internet and smartphone use in adolescence (LaRose et al., 2003). The present study explored regulation strategies in the use of this device, as well as the relationships between such strategies and the background variables of Caplan's (2010) model, to identify those adolescents who present high or low negative consequences of Internet use. With a representative sample of adolescents from 1st to 4th year of secondary education in the Community of Madrid ($N = 524$, $M_{age} = 13.57$, $SD = 1.24$, Range = 12-17), our results indicated that parents were the ones who regulated smartphone use in about half of the adolescents. Self-regulation deficit with cognitive rumination, parent intervention to regulate the use of this device and the variables of Caplan's (2010) model –except for online emotional regulation– were significant predictors to identify those adolescents who showed high or low negative consequences. Educational implications and future lines of research are also discussed.

Keywords: Self-regulation. Problematic internet use. Smartphone. Adolescence.

Introduction

Today, everything points to a greater and growing use of the Internet and social media, as well as a more intense use of these tools through adolescence (Garmendia et al., 2016; Malo-Cerrato et al., 2018; Olafsson et al., 2014; Weinstein & Lejoyeux, 2010). Through social media, adolescents can express and develop their personalities and personal characteristics. The social nature of these networks entails managing a wide variety of interactions and relationships with peers, family members and even strangers.

Smartphones are the preferred device for adolescents to access the Internet (Garmendia et al., 2016; Pastor et al., 2019). What most of them do when they first wake up is to the messages and notifications on their phones. In recent years, scholars have even reported an increase in the feeling of anxiety when an individual cannot access their smartphone (Jiang, 2018).

In most cases, adolescents possess the skills to face and recover from the negative effects of the risks of the online world (Wisniewski et al., 2016). In this context, the acquisition of self-regulation skills becomes increasingly important, which can be defined as the capacity to modulate emotions, thoughts and behaviors through monitorization, inhibition

and evaluation processes about oneself and in comparison with existing social standards (Moilanen et al., 2015).

While experts have traditionally maintained that the capacity to self-regulate is developed throughout childhood, research shows that its development continues through adolescence both in the behavioral (Steinberg, 2008; Steinberg et al., 2008; King et al., 2013) and neurological context (Griffin, 2017). Developmental scholars indicate that this capacity undergoes notable improvements throughout adolescence (Blonigen et al., 2009; Steinberg et al., 2008; Calvetti et al., 2019). The influence that gender can exert over the development of the capacity to self-regulate is not clear in scientific literature. For guidance, Blair (2013) found differences in tasks (go/no go) according to age range, showing a chronological increase in inhibitory control, in addition to finding less control in women. It is also widely known that those adolescents who manifest greater difficulty in their self-regulatory capacities are more likely to have emotional and behavioral issues (Monahan et al., 2009; King et al., 2011; Dias & Cadime, 2017).

All this led us to think about the relevance of doing research on how self-regulatory capacities could influence use and abuse of the Internet, social media and smartphones in adolescence. For example, Lee et al. (2017) showed that deficient self-regulation is associated with greater use of social media in adolescents. Self-regulation has also been shown to be negatively associated with addiction to smartphones (Gökçearsan et al., 2016; Mahapatra 2019; Van Deursen et al., 2015). A qualitative study carried out with adolescent discussion groups showed that many exhibit difficulties when it

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comes to self-regulating the amount of time dedicated to the Internet and social media, and on many occasions, parents are the ones that need to set a time limit, especially in order to not interfere with studying (Pastor et al., 2019). This way, parents act as external agents who try to regulate Internet use with external restrictions and reminders. These actions can be considered hetero-regulation or external regulation of smartphone use.

Regarding possible gender differences in the use of the Internet and mobile phones, a study by Chóliz et al. (2009) observed that girls show a more favorable attitude towards smartphones. They also use them more frequently and for a wider range of activities. In general, they use them as an instrument of interpersonal communication, as well as a psychological tool that allows them to cope with unpleasant moods. In the case of boys, they would use this device more in terms of leisure or entertainment. In this sense, the fact that girls use it as a psychological tool would increase the probability of becoming one of the factors that “predispose or facilitate dependence, since all addictions are characterized by addictive behavior used to overcome unpleasant personal situations (p. 85)”.

At the same time, Moral and Suarez (2016) observed that girls and older adolescents suffered more problems related to the problematic use of smartphones, while in another study, differences by age and gender in problematic internet use could not be found (Moral-Jiménez, & Fernández-Domínguez, 2019). Other authors have observed a higher proportion of girls than boys showing problematic internet use (PIU) in Spain (Gómez et al., 2017), as well as social media addiction and problematic smartphone use (Medrano et al., 2017).

Along these lines, Van Deursen et al. (2015) detected that men experience less social stress than women and use the smartphone less frequently for social purposes. These results showed that women are more likely to develop habitual or addictive behaviors with these devices. Finally, they also observed that age was a crucial variable: showing a positive effect on self-regulation, from which can be derived that older people are less prone to develop habitual or addictive behaviors with smartphones.

However, not all studies point in this direction. For example, Jelenchick, et al. (2016) highlighted male prevalence in PIU and Villanueva-Blasco et al.'s (2019) work could not find significant differences in gender. At the same time, Gámez-Guadix et al. (2015) showed that although various components of problematic internet use were more closely associated with women in a cross-sectional design, the tested model in a longitudinal study showed to be invariable between genders.

One of the most relevant models today exploring the role of self-regulation in problematic internet use was developed by Caplan (2010). This author argues that the negative consequences of Internet use are fundamentally preceded by self-regulation deficit, which contains a behavioral dimension (compulsive use) and a cognitive dimension (cognitive

concern). This self-regulation deficit would be influenced by two antecedent variables: preference for online social interactions (POSI) and use of the Internet for mood regulation. Previous studies developed by this author showed that some individuals who feel lonely and have social anxiety or poor social skills can develop an elevated POSI. They perceive online interactions as less menacing and perceive themselves as more skilled when they interact online (Caplan, 2002). Caplan's (2010) model has found empirical support in different countries (Barke et al., 2014; Fioravanti et al., 2013; Gámez-Guadix et al., 2013; Pontes et al., 2016). It has also been applied to the problematic use of Facebook (Moretta & Buodo, 2018).

Today, this model has taken center stage and many authors have tried to apply it. For example, in a longitudinal study, Gámez-Guadix et al. (2015) warn about deficient self-regulation (T1), which consist of decreased self-control over cognitions and compulsive behaviors related to the Internet, being a predictor of increased mood regulation, preference for online interactions and negative consequences (T2). Results show that only the deficient self-regulation component predicts an increase in the other components over time. These findings are coherent with previous studies (Caplan, 2010; LaRose et al., 2003). In fact, based on Bandura's (1991) socio-cognitive theory, LaRose et al. (2003) suggest that Internet addiction “can be redefined as poor self-regulation” (p.243), understood as a deficit in self-awareness processes that allow the individual to control, judge and adjust their behavior (LaRose, 2011; LaRose et al., 2003). According to this proposal, the results of this study suggest that deficient self-regulation is the key component maintaining PIU over time. However, these results do not support some of the hypotheses in the cognitive-behavioral model proposed by Caplan (2010), which had been previously analyzed in cross-sectional studies. A possible explanation for these results is that the mechanism from which the PIU originates and consolidates might be different from the processes that explain its long-term maintenance.

Some works have shown interest in the connection between PIU and self-regulation skills. Sebena et al. (2013) observed that self-regulation skills (negatively) and depressive symptoms (positively) significantly predicted PIU. Moretta and Buodo (2018) also found that poor self-regulation predicted negative consequences of Facebook use.

Based on all these contributions, the main goals of this work have been, on the one hand, to describe the different strategies that adolescents use to regulate the use of smartphones and the Internet (from hetero-regulation imposed by parents to authentic personal regulation: self-regulation) and, on the other, to try to predict the impact of these strategies and the antecedent variables of Caplan's (2010) model on the negative consequences of Internet use.

The main hypotheses that guided our work were:

H1. We do not expect gender differences in the use of different strategies to regulate smartphone and Internet use.

- H2. Given that self-regulation skills improve with age, an increase in strategies that involve self-regulation is expected versus a decrease in strategies that involve external regulation with age.
- H3. Despite the contradictions in scientific literature, based on the previous studies carried out in our country (Chóliz et al., 2009; Gámez-Guadix et al., 2015; Gómez et al., 2017), some differences in gender are expected, albeit small, in problematic internet use that harm women.
- H4. Given the improvement in self-regulation associated with age, we might expect problematic internet use to decrease with age.
- H5. Those adolescents with lower use of self-regulation strategies and greater use of hetero-regulation strategies will experience negative consequences more frequently, and vice versa (see figure 1).
- H6. Those adolescents who develop greater problematic internet use (preference for online social interaction, online regulation of mood, cognitive concern and compulsive use) will experience negative consequences more frequently, and vice versa (see figure 2).

Method

Participants

This study was carried out with a statistically representative sample of students enrolled in compulsory secondary education (ESO, 1st to 4th year) in the Community of Madrid during the 2019 - 2020 academic year. The sample consisted of 524 adolescents ($M_{age} = 13.57$, $SD = 1.24$; Range = 12-17); 48.9% of the sample were girls. The distribution by grade was 26.7% from the 1st year, 26.6% from the 2nd, 24.8% from the 3rd and 21.9% from the 4th.

The sample design followed a multistage stratified cluster sampling. The stratification was carried out according to the type of center (public, private or subsidized) and differentiated between the capital (Madrid) and the rest of the municipalities in the Community of Madrid. The clusters corresponded to the secondary education centers in the first level. In total, 16 educational centers were selected. Once the centers accepted their participation in the survey, the classrooms were selected as units of analysis for the second stage. The error analysis was set at $\pm 4.37\%$ for the global data under the assumption of $p = q = 0.5$ with a confidence level of 95% and under the assumption of simple random sampling.

Variable and instruments

The variables evaluated were the sociodemographic characteristics (grade and sex), the strategies for regulating the use of smartphones and the Internet, and problematic internet use.

Items elaborated by the authors were used to evaluate smartphone and Internet use regulation strategies. To do this, the starting point was the results of a previous qualitative study with discussion groups of adolescents (Montes-Vozmediano et al., 2020; Pastor et al., 2019). This study concluded that many adolescents had difficulties regulating the use of social networks and smartphones while studying. Adolescents reported using various strategies to regulate its use. While some removed this device and social networks from their rooms themselves (self-regulation), most had restrictions imposed by parents (they took away their smartphones, had to be reminded to turn it off or even said that they were not able to concentrate if they did not have it with them because they were thinking about what they could be missing). Others studied while having their smartphones with them, checking WhatsApp or social media while trying to study. Based on these contributions, we included the following items in the survey: 1) At home, my parents take my phone away when I have other things to do (hetero-regulation, implies external control), 2) at home, my parents have to remind me to turn off my phone when I have other things to do (self-regulation induced by third parties), 3) When I have other things to do, I myself turn off the phone, move it away or I disconnect from social media without anyone having to tell me (authentic self-regulation), 4) I check my phone or the Internet when I have other things to do (poor self-regulation), and 5) When I am doing things and my phone is off, I cannot stop thinking about what I may be missing out on (self-regulation deficit with cognitive concern, or it may be considered a FOMO indicator or Fear Of Missing Out). The response scale for these items ranged from 1 to 4 (1 = never, 2 = sometimes, 3 = frequently, 4 = always).

The Spanish adaptation (Gámez-Guadix et al., 2013) of the Generalized Problematic Internet Use Scale 2 (GPIUS-2, Caplan, 2010) was used to assess problematic internet use. This 15-item questionnaire contains the following subscales: preference for online social interaction, mood regulation, negative consequences, compulsive use, and cognitive concern. These last two subscales are part of a latent variable named self-regulation deficit by its author. However, this study will work with the subscales. The reliability (Cronbach's alpha) of these subscales ranged between .82 and .86. The answers range from 1 (totally agree) to 6 (totally disagree).

Procedure

The questionnaires were administered at secondary education centers in the Community of Madrid. Professional interviewers carried out the assessment using the CAPI (Computer Assisted Personal Interview) interview system. Previously, a favorable evaluation of the data collection procedure for this research had been obtained from the Ethics Committee (Rey Juan Carlos University). Data collection consisted of obtaining: 1) The authorization of the educational cen-

ters after properly informing them of the research characteristics, 2) Parents' informed consent for those adolescents 14 years of age and under, and 3) A personal informed consent for those over 14 years of age. Fieldwork was carried out from October 24 to December 19, 2019.

Data analysis

The use of different strategies to regulate smartphone and Internet use was described using percentages. The statistical test used to study the differences by gender and grade in the different variables was the MANOVA, which allows for the assessment of these differences when the dependent variables are related to each other. The MANOVA has proven to be a robust test against parametric assumption non-compliance (Bisquerra, 1989). Two different MANOVAs were carried out: one with strategies to regulate smartphone use and the other with GPIUS-2 variables.

The next step was the assessment of two predictive models on the negative consequences of Internet use using a binary logistic regression. First, to do this, the negative consequences variable was dichotomized. Those subjects with scores equal to or lower than the mean belonged to the group of low consequences ($n = 304$, 58%), while those with scores higher than the mean belonged to the group of medium-high negative consequences ($n = 220$, 42%). The first model tried to predict the negative consequences of internet use based on different strategies for regulating smartphone use (see figure 1), and the second model aimed to assess the weight of the different GPIUS-2 factors on negative consequences (see figure 2). The forward stepwise iterative method was used in both cases, using the Wald statistic to choose the covariates to be included or excluded in the model. Analyses were carried out with the statistical package SPSS v26.

Figure 1

Model A for predicting the negative consequences of Internet use based on hetero vs. self-regulation of Smartphone use (H5).

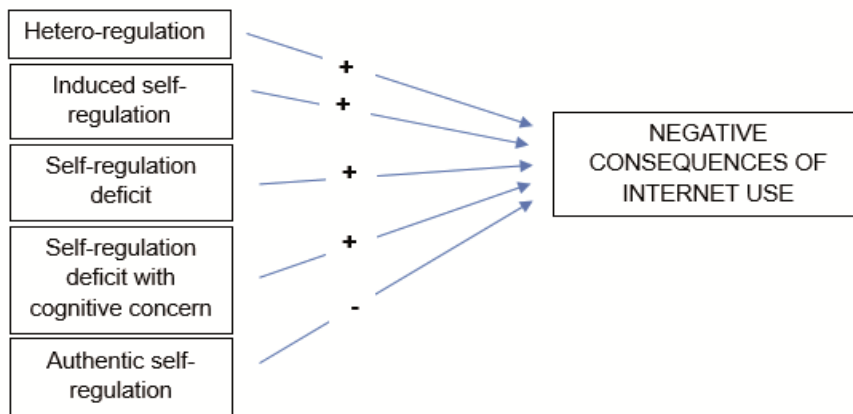
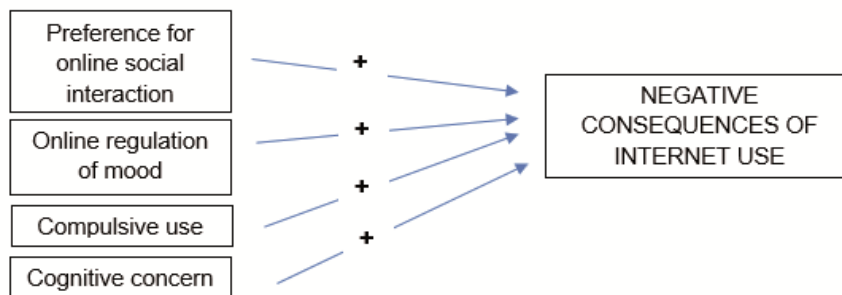


Figure 2

Model B for predicting the negative consequences of Internet use from the variables of Caplan's model (2002, 2010) (H6)



Results

Regarding the use of different self-regulation strategies, we found that parents never took the smartphones away from 50% of subjects when they had other things to do. About 25% reported that their parents sometimes took them away,

and the remaining 25% said this frequently or always happened. When they had other things to do, 47% were never reminded at home to turn off their smartphones, compared to 30.5% who indicated that this sometimes happened, and 22.5% who were frequently or always reminded. These data matched results referring to self-regulation achieved by ado-

lescents. In this sense, 26.9% stated that they always disconnected or moved to another place their smartphones when they had other things to do and 31.1% reported doing it frequently. Lastly, 27.9% and 14.1% claimed to do it sometimes or never, respectively. Regarding paying attention to their smartphone when they had other things to do, 25.1% reported that they "never" did it, 42.1% "sometimes", 19.4% "frequently" and 13.3% "always". Regarding cognitive rumination, 57% stated that they never thought about what they could be missing when their smartphone was turned off, compared to 25.3% who said this sometimes happened, 10.3% who said frequently, and 7.4% always.

Regarding differences by gender and grade in the use of these strategies to regulate the use of mobile phones, the MANOVA reported the absence of significant differences by gender, $F(5, 529) = 0.852, p = .513$; Wilks $\Lambda = 0.992$, $\eta^2_{\text{partial}} = .008$; but there were significant differences by grade, $F(15, 1470) = 3.700, p = .000$; Wilks $\Lambda = 0.902$, $\eta^2_{\text{partial}} = .034$. Univariate tests show that grade has a significant effect on hetero-regulation $F(3, 533) = 3.424, p < .05$, $\eta^2_{\text{partial}} = .019$, induced self-regulation $F(3, 533) = 2.822, p < .05$, $\eta^2_{\text{partial}} = .016$, authentic self-regulation $F(3, 533) = 3.918, p < .01$, $\eta^2_{\text{partial}} = .022$ and deficient self-regulation ($F(3, 533) = 3.005, p < .05$, $\eta^2_{\text{partial}} = .017$).

Bonferroni's posthoc tests revealed the existence of significant differences in the use of hetero-regulation between 1st ($p < .01$), 2nd and 3rd ($p < .05$) and 4th-year ESO students, the latter being the ones who scored lower in this variable. Regarding induced self-regulation, 1st-year students obtained the lowest scores and differed significantly from 2nd and 4th-year students ($p < .05$). Interestingly, 1st-year students were the ones who showed higher scores in authentic self-regulation, differing significantly from 3rd and 4th-year students ($p < .01$). Likewise, 1st-year students also

showed lower self-regulation deficit, differing significantly from 2nd ($p < .01$) and 4th-year students ($p < .05$).

Regarding the variables of problematic internet use (GPIUS-2), the MANOVA showed significant differences by grade, $F(15, 1460) = 1.730, p < .05$; Wilks $\Lambda = 0.953$, $\eta^2_{\text{partial}} = .016$; and gender, $F(5, 529) = 2.252, p < .05$; Wilks $\Lambda = 0.979$, $\eta^2_{\text{partial}} = .021$. Univariate tests showed that grade had a significant effect on the negative consequences experienced by Internet use ($F(3, 533) = 2.697, p < .05$, $\eta^2_{\text{partial}} = .015$); in such a way that 1st-year ESO students experienced fewer negative consequences than 3rd ($p < .05$) and 4th-year students ($p < .05$). Gender showed significant effect on the preference for online social interaction ($F(1, 533) = 4.630, p < .05$, $\eta^2_{\text{partial}} = .009$), showing that boys manifested greater preference.

The next step was to predict whether individuals manifest negative consequences from Internet use based on the different types of self versus hetero-regulation strategies for smartphone use using a logistic regression model. The percentage of correct classifications of the model amounted to 69.2%, with 83.4% being correct classifications for the group of absence or low negative consequences, and 49.5% for the group of medium-high negative consequences. As can be seen in Table 1, among the type of smartphone and Internet regulation strategies that significantly predict having or not having negative consequences derived from the use of the Internet we can find: self-regulation induced by third parties (My parents have to remind me to turn off my smartphone when I have other things to do), poor self-regulation (I check my smartphone when I have other things to do) and poor self-regulation with cognitive concern (When my smartphone is turned off I cannot stop thinking about what I am missing). These strategies are positively and significantly related to the negative consequences of Internet use (see Table 1).

Table 1

Logistical regression analysis of different smartphone regulation strategies on the negative consequences of Internet use.

Step	Variables	B	SE	Wald	df	<i>p</i>	Exp (B)
1	I can't stop thinking about what I may be missing	.816	.110	54.804	1	.000	2.262
	Constant	-1.698	.205	68.492	1	.000	.183
2	I check my phone when I have other things to do	.498	.109	19.932	1	.000	1.628
	I can't stop thinking about what I may be missing	.639	.117	29.597	1	.000	1.894
	Constant	-2.487	.283	76.994	1	.000	.083
3	My parents have to remind me to turn off the phone	.442	.117	14.277	1	.000	1.555
	I check my phone when I have other things to do	.441	.111	15.863	1	.000	1.553
	I can't stop thinking about what I may be missing	.500	.123	16.445	1	.000	1.649
	Constant	-2.957	.321	84.971	1	.000	.052

Regarding the global fit of the model, the model showed a good fit according to chi-square ($\chi^2 = 99.876$; $df = 3, p < .000$). This would indicate that the model is more effective at predicting the consequences variable than the null hypothesis. However, the Hosmer and Lemeshow test did not show a good fit ($\chi^2 = 21.295$; $df = 7, p = .003$). It should be noted that this indicator is not reliable when there are not enough

cases in all the boxes to cross scores between the different variables and the dependent variable. Other supporting indices were Cox and Snell's R^2 ($R^2 = .174$) and Nagelkerke's R^2 ($R^2 = .233$). Both showed an adequate but moderate level of model prediction.

Our last step was to assess the predictive power of Caplan's (2010) model using a logistic regression model. For

this, an attempt was made to predict the negative consequences of Internet use from the rest of the variables of the GPIUS-2. The percentage of correct classifications of the model amounted to 82.6%, 86.8% corresponding to the group with low negative consequences, and 76.8% to the group with high negative consequences. Table 2 shows the

parameters obtained by the model in each step of the analysis. The final model shows that negative consequences can be predicted from greater preference for online social interaction, greater cognitive concern about not being connected, and greater compulsive use of the Internet.

Table 2
Logistical regression analysis of the GPIUS-2 variables on the negative consequences of Internet use.

Step	Variables	B	SE	Wald	df	<i>p</i>	Exp (B)
1	Online cognitive concern	1.380	.116	142.682	1	.000	3.974
	Constant	-3.855	.314	150.658	1	.000	.021
2	Preference for online social interaction	.590	.111	28.166	1	.000	1.804
	Online cognitive concern	1.064	.123	74.330	1	.000	2.898
	Constant	-4.535	.366	153.678	1	.000	.011
3	Preference for online social interaction	.549	.114	23.226	1	.000	1.731
	Online cognitive concern	.783	.139	31.899	1	.000	2.189
	Compulsive use	.468	.122	14.680	1	.000	2.189
	Constant	-5.097	.418	148.446	1	.000	.006

Regarding the global fit of the model, the model showed a good fit according to the chi-square ($\chi^2 = 308.715$; $df = 3$, $p < .000$) and according to the Hosmer and Lemeshow test ($\chi^2 = 21.295$; $df = 7$, $p = .112$). This would indicate that the model was more effective at predicting the consequences variable than the null model. Other supporting indices were Cox and Snell's R^2 ($R^2 = .445$) and Nagelkerke's R^2 ($R^2 = .599$). Both show an adequate level of prediction of the model.

Discussion

Smartphones have become the main way adolescents connect to the Internet and social media. There has been an increase in time spent interacting virtually with the outside world, particularly with their peer group (Garmendia et al., 2016; Mascheroni & Ófalsson, 2014). This increased connectivity implies undeniable benefits but also negative consequences on their well-being that must be taken into consideration, especially if we consider that the self-regulation capacity to face and overcome these effects has not yet reached its zenith at this stage (Blonigen et al., 2009; Calvetti et al., 2019). Based on the problematic internet use model (PIU) proposed by Caplan (2010) and using a representative sample of adolescents enrolled in compulsory secondary education (ESO) in the Community of Madrid, this article analyzes the influence of regulatory strategies on smartphone use and the influence of GPIUS-2 variables on the negative consequences of the use of the Internet. Additionally, the prevalence of the different strategies of hetero versus self-regulated smartphone use is described, and the influences of gender and school grade on these and the PIU are explored. The results obtained among adolescents in the Community of Madrid showed that, according to the interviewees themselves, about half of the parents intervened in their children's use of smartphones when they had other obligations, either by taking it from them or reminding them to turn it off. Di-

rected hetero-regulation restrictions and induced self-regulation restrictions are consistent with the data on acquired behavioral and cognitive self-regulation manifested by adolescents. In this sense, only a quarter of them declared that they always kept their smartphones away or never paid attention to it when they had other responsibilities. On the contrary, about 15% of adolescents showed significant deficiencies to self-regulate their smartphone-related behavior, carrying the device with them all the time and constantly paying attention to it while they would carry out other tasks. In addition, a similar percentage showed poor cognitive self-regulation and were always or frequently thinking about what they may be missing when it is not accessible to them. This data confirms the recent trend that shows an increase in anxiety when they have signal issues or do not have access to their smartphones (Jiang, 2018).

Although different studies indicate that gender influences smartphone use, our results did not show that it affects the way adolescents self-regulate, whether it is external, induced or internalized regulation. In this sense, our first hypothesis was validated: gender did not influence self-regulation strategies of minors using this device, but, consistently, it did not influence hetero-regulation directed or induced by parents either.

Regarding age, as can be expected, the results of our study reported that paternal hetero-regulation decreased among adolescents in the last year of ESO. However, it is surprising that it is 1st-year students who, to a greater extent, indicated that they were capable of self-regulation, putting away the smartphone or not paying attention to it when they carried out other tasks. This contradicts the data in the scientific literature which indicates an increased maturation in self-regulatory capacity during this period (King et al., 2013). Consequently, we could conclude that, although hypothesis 2 was partially fulfilled, the results contradicted the meaning of the expected relationship. One possible interpretation is that younger adolescents who have just accessed this device

(the average age of access in Spain is 12 years) (Golpe-Ferreiro et al., 2017) do not use it as much.

Regarding problematic internet use, our results showed that gender and age only had a weak effect on it. It should be noted that the differences found do not follow the direction that was hypothesized. Contrary to expectations, it was boys who showed the highest POSI (refuting hypothesis 3). In previous studies, POSI had been associated with poor self-regulation (Assunção & Matos, 2017; Gámez-Guadix et al., 2015). In fact, results found by Caplan's (2010) model confirm that POSI is one of the most relevant predictors of problematic internet use, which affects the negative consequences experienced through self-regulation. Our results did not match the results of previous studies that indicated a greater tendency in girls towards problematic internet use (Gómez et al., 2017; Gámez-Guadix et al., 2015; Van Deursen et al., 2015), and social media and smartphone use (Chóliz et al., 2009; Medrano et al., 2017). However, they did match what was found by other authors (Jelenchick et al., 2016). Additionally, it should be noted that our data did not show gender differences in mood regulation. These data contradicted previous scientific literature on gender differences that report greater social stress in smartphone use in the case of girls (Van Deursen et al., 2015), and greater use of this device by them for emotional self-regulation (Chóliz et al., 2009). These differences may be due to methodological differences with previous studies (different instruments used, evaluation of smartphone use in general and not exclusively Internet use, or differences in the age range of the sample) or could also be indicating a change in trend by the male population, which future studies should explore.

On the other hand, regarding the influence of grade on the different dimensions of problematic internet use, and in line with results previously reported in self-regulation indicators, it is the youngest who reported the least negative consequences for Internet use (thus refuting hypothesis 4). As previously indicated, it may be due to more limited Internet use in the early years of adolescence. This aspect is also consistent with longer use time and increase in the number of online activities (García-Jiménez et al., 2013) as adolescents grow older. This may help also increase online dependency.

Regarding hypothesis 5, our data revealed a statistically significant and positive association between parental-induced self-regulation (parents have to remind me to turn the smartphone off when I have other things to do), poor self-regulation (I check the smartphone when I have other things to do), poor self-regulation with cognitive concern (when my smartphone is off, I cannot stop thinking about what I may be missing) and negative consequences of Internet use manifested by minors. These results confirmed those found in the Gámez-Guadix et al. (2015) study, which showed that poor self-regulation, measured as cognitive preoccupation and compulsive use, was related to negative consequences of Internet use. Furthermore, they were consistent with those found by Sebená et al. (2013) and Durak (2020), who found a negative association between self-regulation skills and PIU

or problematic social media usage. However, it should be noted that the low use of these strategies allowed for the correct identification of adolescents belonging to the healthy group (low negative consequences), being less reliable when identifying adolescents at risk. This may be because there are many other variables (social anxiety, isolation, self-esteem and others) that affected negative consequences and were not considered in the hypothesized model.

The positive relationship between parental-induced self-regulation and negative consequences could be happening because parental intervention occurs reactively once their children begin to show difficulties, as indicated by previous studies in parental mediation (Duerager & Livinstone, 2012; López-de-Ayala et al., 2019). This suggests the need to develop prevention programs to promote the development of smartphone and Internet use self-regulation both at home and in the educational environment before adolescents manifest their first difficulties in this regard. It also suggests that external restraint strategies used by parents do not promote the development of self-regulation and could be counterproductive.

Finally, the second logistic regression analysis showed that POSI, cognitive preoccupation and compulsive use of the Internet (these last two variables are indicators of self-regulation deficit), predicted the negative consequences of Internet use. Therefore, hypothesis six was partially confirmed because our analysis did not show a statistically significant relationship in online mood regulation. In this case, the logistic regression model showed a high identification percentage in both adolescents at risk and those belonging to the healthy group, confirming the predictive power of Caplan's (2010) model. Therefore, preference for online social interaction and self-regulation deficit (behavioral and cognitive) were good predictors of the negative consequences of Internet use in Madrid adolescents. Echoing the words of LaRose (2011), a possible explanation for the lack of relationship in mood regulation is that the mechanism from which the PIU originates and consolidates could be different from the processes that explain its maintenance. Perhaps in the early stages of the problem, the use of the Internet for mood regulation may favor the development of poor self-regulation. However, once poor self-regulation has become a problem, it plays a more central role. The use of longitudinal designs is necessary to confirm this trend.

Among the limitations of our study, it should be noted that it was limited to a geographical area of Spain (Madrid), which limited the possibility of generalizing the results to the entire population. However, the use of a representative sample favored the generalization of these results to Madrid adolescents. Another possible limitation was the evaluation of the different strategies for regulating the use of smartphones with items elaborated by this research team, which had not been previously validated. From our point of view, its content was validated by previous studies that were carried out with adolescent discussion groups (Montes-Vozmediano et al., 2020), and it may contribute to inspire future studies

since there are no instruments that evaluate these aspects, nor previous research on this topic. Likewise, the cross-sectional nature of our work limited the possibility of establishing causal relationships, making it necessary to use longitudinal designs.

Conclusion

The results of this work consolidate the importance of self-regulation in smartphone and Internet use in the adolescent stage. While a quarter of Madrid adolescents between 12 and 16 years of age stated that they had acquired the ability to self-regulate the use of this device, around 15% stated that they had significant difficulties in this regard. The rest required of parental intervention to regulate its use (hetero-regulation or induced self-regulation). Curiously, it is the youngest (1st of ESO) who stated that they had better smartphone use self-regulation and experienced fewer negative consequences of Internet use.

The models tested in this paper support the role played by deficient self-regulatory strategies in smartphone use (hetero-regulation, induced self-regulation, deficit with and without associated cognitive concern), as well as the POSI and the self-regulatory deficit of the Caplan model (2002, 2010) as predictors of the negative consequences of Internet use. These results open both practical and theoretical discus-

sions. At a practical level, it is necessary to promote the development of authentic internal self-regulation in smartphone and Internet use from the start both at schools and inside the families. It should be emphasized that poor self-regulation of smartphone use and problematic internet use can be associated with academic difficulties in adolescents (Yang et al., 2019) and even with mental health problems (Coyne et al., 2019). At a theoretical level, researchers must continue to study the mechanisms involved in the negative consequences of Internet and smartphone use in order to design better preventive strategies and promote a healthy use of new technologies. It is also necessary to analyze and develop precise instruments that assess educational strategies inside the families and explore whether they favor or harm the development of authentic self-regulation of smartphone use in adolescence.

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