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Internalizing problems as a mediator in the relationship between low effortful control and Internet abuse in adolescence: A three-wave longitudinal study

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Internalizing problems as a mediator in the relationship between **low effortful control and Internet abuse in adolescence: A three-wave longitudinal study**

Abstract

The aim of the study is to examine the relationships between early adolescents' **low effortful** control, middle adolescents' internalizing problems and late adolescents' Internet abuse, focusing on the mediating role that middle adolescents' internalizing problems may play in the relationship between early adolescents' **low effortful** control and late adolescents' Internet abuse. The study followed a sample of 482 adolescents (245 boys and 237 girls) from early adolescence (wave 1; mean age = 14.76, $SD = .63$), through middle adolescence (wave 2; mean age = 15.77, $SD = .61$), to late adolescence (wave 3; mean age = 17.88, $SD = .57$). The participants completed self-report questionnaires on temperament in wave 1 and on internalizing problems and Internet abuse in all three waves. Data from the mediation model showed that internalizing problems in middle adolescence mediated the relationship between **low effortful** control in early adolescence and Internet abuse in late adolescence.

Keywords: Internet abuse, **low effortful** control, internalizing problems, longitudinal prospective

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Introduction

Internet use is prevalent across the world, especially in adolescence (Moreno et al., 2011; Stavropoulos, Griffiths, Burleigh, Kuss, Doh, & Gomez, 2018; Yellowlees & Marks, 2007). Indeed, Internet use today is not just indispensable but also inviting for children and adolescents. Various features make the Internet engaging, including its easy accessibility, suitability, and anonymity; these help to make Internet use one of the most popular leisure activities among adolescents in Western societies (Ellison, Steinfield, & Lampe, 2007; Ruggieri & Boca, 2013; Van Rooij & Van den Eijnden, 2007). According to UNICEF (2017), more than 175,000 children and adolescents connect to the Internet for the first time every day. Globally, 1/3 of Internet users are children, and adolescents represent the most connected age group, with 71% of them being online, compared to 48% of the total population. Adolescents today use many devices to access the Internet (computers, iPads, cell phones), and very often they simultaneously use more than one device, bringing daily total media exposure time to 11.5 hours, with over 90% now using social media, day and night (Woods & Scott, 2016). As highlighted by Giedd (2012), the amount of time this new technology has taken to be used by millions of people is unprecedented: 38 years for radio, 20 years for the telephone, 13 years for television (TV), 4 years for the World Wide Web, 3.6 years for Facebook, 3 years for Twitter, 2 years for iPads, and only 88 days for Google.

While facilitating human interactions and peer communications, Internet use can become problematic and excessive, often resulting in over-use and sometimes in addiction (Yellowlees & Marks, 2007). Durkee and colleagues (2012) showed that in some European countries,

pathological Internet use occurs among 4.4% of adolescents. Nasiri, Balouchi, and Shahdadi (2016) revealed that most adolescents have reported an intense reliance on the Internet, and many (51.1%) had a strong dependence on it. Literature also suggests that male adolescents were more likely to be addicted to the Internet than females (Li, Dang, Zhang, Zhang, & Guo, 2014). As recent research has highlighted, many problems are related not only to the use of computers but also to the use of the smartphones (Elhai, Levine, Dvork, & Hall, 2017; Finkel & Kruger, 2012). The omnipresent nature of smartphones makes their use so frequent and widespread that authors have created the new term *phubbing* (a portmanteau of the words “phone” and “snubbing”), which can be described as an individual looking at his or her mobile phone during a conversation with other individuals. *To be phubbed* is “to be snubbed by someone using their cellphone when in your company” (Roberts & David 2016, p. 134). **Several studies, indeed, suggested how the *phubbing* may play a role on the negative outcome related to Internet abuse (e.g., isolation, decrease of social bones and relationship with peers)** (Chotpitayasunondh & Douglas, 2018; David & Roberts, 2017; Karadag et al., 2015; Roberts & David, 2016).

Although the 5th edition of the *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association, 2013) does not provide a diagnostic label for Internet dependency or a similar condition, researchers have suggested that Internet addiction can be considered similar to substance dependence (Grant, Townend, Mulhern, & Short, 2010), especially regarding its psychological consequences. Indeed, Internet use can be considered pathological if the time and energy spent online have relevant effects on a person’s well-being (Campanella, Mucci, Baroni, Nardi, & Marazziti, 2015; Caplan, 2002; Schimmenti et al., 2017). Moreover, among adolescents, excessive Internet use is often connected to psychological problems such as social isolation (Young, 2009). Children and adolescents often become so

attached to the Internet that they are no longer capable of controlling their online actions. Indeed, because intense use of social networking sites can be related to addictive symptoms and is often accompanied by psychosocial distress, it can be considered a form of addictive online behavior (Müller, Dreier, Beutel, Duven, Giralt, & Wölfling, 2016).

Recent studies have highlighted how Internet abuse affects stress, coping strategies, and adolescents' mental health (Harwood, Dooley, Scott, & Joiner, 2014; Nassehi, Arbabisarjou, Jafari, & Najafi, 2016; Wei et al., 2017). In other words, among adolescents, Internet abuse is a relevant risk factor that can have nefarious effects on development. Internet use becomes increasingly problematic when related to a vulnerable temperament. **Low effortful control** has been found to be one of the most relevant temperamental factors related to Internet addiction behaviors among adolescents (Cerutti et al., 2017; Koo & Kwon, 2014; Li, Zhou, Li, & Zhou, 2016; Pace, Schimmenti, Zappulla, & Di Maggio, 2013). Also, Internet overuse has been considered a possible attempt to cope with social anxiety and other painful feelings by escaping into an online life, thus resulting in behavioral difficulties (Lam & Peng, 2010). In this sense, adolescents with a vulnerable temperament would indirectly be at increased risk of Internet abuse because of their increased risk of internalizing difficulties. **Internalizing problems are defined as a specific type of emotional and behavioral difficulties, as well as problems that are based on overcontrolled symptoms. Furthermore, the term "internalizing" is related to the fact that these evolutionary problems lead the individual to withdraw into oneself, without directing and exhibiting symptoms to others.** These adolescents' internalizing behavioral problems, in turn, may evolve into Internet abuse (Martel et al., 2009), thus mediating a developmental progression from a vulnerable temperament in early adolescence toward Internet abuse in late adolescence. Our overall propose was to examine the relationships between early adolescents'

low effortful control, middle adolescents' internalizing problems, and late adolescents' Internet abuse, focusing on the mediating role that middle adolescents' internalizing problems may play in the relationship between early adolescents' **low effortful** control and late adolescents' Internet abuse. More specifically, as shown in the conceptual model (Figure 1), the present study, using a three-wave longitudinal design (early, middle, and late adolescence), investigated: (1) the contribution of early adolescents' **low effortful** control in predicting later internet abuse (path *c*); (2) the contribution of early adolescents' **low effortful** control in predicting later internalizing problems (path *a*); (3) the contribution of internalizing problems in predicting later Internet abuse (path *b*); and, finally, (4) the mediating role that middle adolescents' internalizing problems may play in the relationship between early adolescents' **low effortful** control and late adolescents' Internet abuse (path *c'*).

INSERT FIGURE 1

Internet abuse and **low effortful control**

Among adolescents, an uncontrollable need to use the Internet is often associated with loss of control, preoccupation with Internet use, and persistent use despite negative consequences (Beranuy, Oberst, Carbonell, & Chamarro, 2009; Lepp, Barkley, & Karpinski, 2014). In other words, adolescents can be susceptible to Internet addiction, as characterized by compulsive behaviors linked to a temperamental difficulty with controlling themselves regarding Internet use (Young, 2004, 2009). Temperament, defined as "biologically rooted individual differences in behavior tendencies that are present early in life and are relatively stable across various kinds of situations and over the course of time" (Bates, 1987, p. 1101), often has been linked to Internet addiction (Ko, Wang, Liu, Yen, Chen, & Yen, 2015; Pace et al., 2014; Şenormancı, Şenormancı, Güçlü, & Konkan, 2014; Wartberg et al., 2016; Yan, Li, & Sui, 2014). Specifically, some

authors (Koo & Kwon, 2014; Li et al., 2016; Pace et al., 2014) have indicated **low effortful control** as the most relevant temperamental factor related to Internet addiction behaviors among adolescents. Effortful control is the self-regulatory aspect within a psychobiological model; it modulates reactivity by means of the ability to focus attention, and it can also activate or inhibit behavior when necessary (Di Maggio, Zappulla, & Pace, 2016; Eisenberg, Smith, Sadovsky, & Spinrad, 2011; Evans & Rothbart, 2007; Olson & Sameroff, 2009; Rothbart, Ellis, & Posner, 2011; Zhou, Chen, & Main, 2012). Because effortful control has been widely considered to be a valid predictor of adolescents' adjustment and emotional regulation (Eisenberg et al., 2004, 2011; Eisenberg, Hofer, & Vaughan, 2007; White & Turner, 2014), adolescents who display low levels of effortful control are seen as being at particular risk of developing psychological disorders (Yap, Allen, & Sheeber, 2007; Pace, D'Urso, & Zappulla, 2018; Zappulla, Pace, Lo Cascio, Guzzo, & Huebner, 2014) as well as of increasing Internet addiction (Li et al., 2014; Pace et al., 2014; Wang, Tao, Fan, Gao, & Wei, 2017). Accordingly, this study proposes the following hypothesis:

H1. Early adolescents' **low effortful control** is related to later Internet abuse.

Low effortful control and internalizing problems

Many studies have shown associations between **low levels of effortful control** and internalizing problems (Eisenberg, Cumberland, Spinrad, Fabes, Shepard, & Reiser, 2001; Eisenberg et al., 2005, 2009; Muris, de Jong, & Engelen, 2004; Muris, Meesters, & Blijlevens, 2007; Muris, Meesters, & Rompelberg, 2007; Muris & Ollendick, 2005; Pace, Zappulla & Di Maggio, 2016).

Internalizing problems refer to a specific type of emotional and behavioral problems consisting of difficulties that are based on overcontrolled symptoms (Cicchetti & Toth, 1991; Merrell, 2007). The term “overcontrolled” is used to denote that these problems in part are manifest when individuals attempt to maintain inappropriate or maladaptive control or regulation of their internal emotional and cognitive state. The word “internalizing” also indicates that these problems are developed and maintained to a great extent within the individual. For this reason, internalizing disorders have been referred to as secret illnesses (Reynolds, 1992), meaning that they are difficult to detect through external observation.

Internalizing behavioral problems may include a wide range of symptoms linked to depression (for example, loss of interest in activities, sleeping problems, psychomotor retardation or slowing of physical movement, fatigue or lack of energy, feelings of worthlessness or excessive guilt, difficulty in thinking, concentrating, or making decisions), to anxiety (for example, negative and unrealistic thoughts, misinterpretation of events, panic attacks, obsessions or compulsive behavior, physiological arousal, oversensitivity to physical cues, fears regarding specific situations or events, excessive worry in general), to social withdrawal (for example, actively avoidance of the companionship of others, lack responsiveness to the social initiations, excessive shyness, social immaturity, unrealistically negative view or anxiousness regarding one’s social ability), and to somatic problems (Bordin, Rocha, Paula, Teixeira, Achenbach, Rescorla, & Silveiras, 2013; Garber, 2004; Garnefski, Kraaij, & van Etten, 2005; Merrell, 2008). Internalizing problems peak in adolescence (Petersen et al., 2018), especially among adolescents who are low in effortful control (Eisenberg et al., 2007, 2009; Lengua, 2006; Muris, 2006; Muris et al., 2004; Oldehinkel et al., 2007). The difficulty in modulating emotionality and in coping with daily and major stressful events during periods of overpressure may be considered one of

the most important causes of internalizing problems during adolescence. Internalizing problems not only involves prolonged, intense expressions of anxiety, social withdrawal, and depression but also efforts to control or suppress negative emotions (Zhan Waxler, Klimes-Dougan, & Slattery, 2000). It has been found that adolescents with low levels of effortful control often act on the basis of a reactive temperament, as they cannot regulate these emotions; hence, they are vulnerable to developing psychological issues such as internalizing problems (Dodd, Hudson, & Rapee, 2017; Wang, Eisenberg, Valiente, & Spinrad, 2016). Accordingly, the study proposes the following hypothesis:

H2: Early adolescents' **low effortful** control is **associated with** later internalizing problems.

Internalizing problems and Internet abuse

Inappropriate Internet use and Internet addiction during adolescence have both been found to be closely related to internalizing problems such as somatization, anxiety, depression, stress, loneliness, and withdrawal (Baek, Shin, & Shin, 2014; Deters & Mehl, 2012; Ko, Yen, Yen, Chen, & Chen, 2012; Lam & Peng, 2010; Moreno et al., 2011; Nassehi et al., 2016; Pace et al., 2014; Passanisi & Pace, 2017; Shensa, Escobar-Viera, Sidani, Bowman, Marshal, & Primack, 2017; Twenge, Joiner, Rogers, & Martin, 2017; Wartberg et al., 2016; Wei et al., 2017; Woods & Scott, 2016). However, the relationship between internalizing problems and Internet overuse is controversial (Ginsberg & Burke, 2017). On the one hand, researchers have affirmed that Internet addiction causes some adolescents to show a series of internalizing problems, including indifference to social relationships, narrow social interactions, poor social adaption, and disorganized time management; this can lead to academic and personal developmental hardship. From this perspective, pathological Internet use generates many social and mental problems that

can lead to mental disorders, such as social anxiety, depression, and suicide (Ko, Yen, Chen, Yeh, & Yen, 2009; Wei et al., 2017).

On the other hand, some researchers consider Internet abuse to itself be an internalizing disorder (Tonioni et al., 2012, 2014). In this sense, Internet overuse can be considered an attempt to cope with social anxiety and other painful feelings by escaping into an online life, thus resulting in behavioral difficulties (Lam & Peng, 2010). Adolescents who are already feeling socially anxious and isolated often avoid social interaction when associated with stress and may choose online social interaction because of its high accessibility and the possibility of socialization in a controlled setting that produces less anxiety (Elhai et al. 2017; Liu et al., 2016; Primack et al., 2017a, 2017b). Research has found that adolescents experiencing depressive symptoms are prone to use the Internet very frequently, probably in an effort to improve their mood, with the goal of gaining social support and releasing their emotions (Radovic, Gmelin, Stein, & Miller, 2017). Over time, those individuals can become dependent on the Internet, which can make them unable to fulfill their offline responsibilities (Andreassen et al., 2016; Shensa et al. 2017). Therefore, this study proposes the following hypothesis:

H3. Internalizing problems **are related to** later Internet abuse.

Early **low effortful control, internalizing problems, and later adolescents' Internet abuse**

According to the most relevant models, adolescents' problems do not originate from a single factor that operates in isolation (Muris & Ollendick, 2005; Nigg, 2006; Tackett, 2006), but conversely, problematic behaviors can be explained through processes with multiple factors, including temperamental, individual, and social variables (Bandura, 2012). In line with these

models, it is assumed that temperament (adolescents' personal predispositions) would be a starting point for explaining adolescent behaviors (incorrect use of the Internet), but internalizing problems, which often originate from a social-relationship malfunction, can be a factor that conveys this relationship. From this perspective, the result would be a model in which internalizing problems are an intervening factor between an earlier **low level of effortful** control and later Internet abuse, such that an adolescent with a vulnerable temperament would indirectly be at increased risk of Internet abuse because of his or her increased risk of internalizing difficulties (Choi et al., 2014; Ding, Li, Zhou, Dong, & Luo, 2017). These adolescents' internalizing problems, in turn, may evolve into Internet abuse (Martel et al., 2009), thus mediating a developmental progression from a vulnerable temperament in early adolescence toward Internet abuse in late adolescence. Accordingly, this study proposes the following hypothesis:

H4. Internalizing problems mediates the relationship between early **low effortful** control and later Internet abuse.

Methods

Participants

Participants in this study are drawn from a larger longitudinal study on the role played by individual and relational characteristics during early adolescence as precursors of some developmental outcomes in middle and late adolescence. In particular, this study followed a sample of 482 adolescents (245 boys and 237 girls), from early adolescence to late adolescence. At wave 1, participants were 507 early adolescents (249 boys and 258 girls) aged 14-15 years ($M = 14.76$; $SD = .63$), attending the second classes of two public high schools located in Italy. One year later (wave 2), 499 adolescents (247 boys and 252 girls) participated again in the study

when they attended the third classes of the same high schools ($M = 15.77$; $SD = .61$). Two years later (wave 3), 482 adolescents (245 boys and 237 girls) participated again in the study when they attended the fifth classes of the same high schools ($M = 17.88$, $SD = .57$). Of the entire initial group, 25 adolescents did not participate in the longitudinal study because had dropped out the school or they had moved to a new residence. All the participants were Caucasian and, based on demographic information, were mostly of middle class backgrounds. The majority (92%) of the participants' parents had completed high school or had a college degree. Most of the participants (85%) came from intact two-parent families. In all three waves, a written informed consent was obtained for all by sending letters to parents in order to inform them of the study. No parents objected to their child's involvement in the study. We also obtained assent from all the adolescents involved in the study.

Procedure

This study is part of a larger longitudinal study on the role played by individual and relational characteristics during early adolescence as precursors of some developmental outcomes in middle and late adolescence. Data collection for the current study took place in the second (wave 1), third (wave 2), and fifth year (wave 3) of high school of the ongoing study. Two researchers collected data during school visits conducted in February-April 2012 (wave 1), in February-April 2013 (wave 2), and in February-April 2015 (wave 3). The participants completed self-report questionnaires on temperament in wave 1, on internalizing problems in all three waves, and on Internet abuse in all three waves. No questionnaire was rejected due to missing data.

Measures

Low effortful control. We administered the Early Adolescent Temperament Questionnaire-Revised Short Form (EATQ-R Short Form; Capaldi & Rothbart, 1992; Ellis, & Rothbart, 2001). that consists of 65 items evaluating four temperamental traits (Effortful Control, Negative Affectivity, Surgency, and Affiliativeness) and two additional scales (Aggression and Depressive mood). For the present study, we only considered the Effortful Control (16 items, e.g. “It is easy for me to really concentrate on homework problems”; “I pay close attention when someone tells me how to do something”; $\alpha = .77$), but we decided to use the construct in its negative value in order to better focus on temperamental difficulties related to Internet abuse. We called it **Low Effortful Control** (Pace et al., 2014). Participants were asked to answer on a 5-point Likert scale ranging from 1 (*almost always untrue of you*) to 5 (*almost always true of you*). The questionnaire was translated into Italian and then back translated by a native speaker to ensure its comparability to the English version.

Internalizing problems. We administered the Italian version (Frigerio, Giannotti, Cortesi, & Milone, 2001) of the Youth Self Report (YSR; Achenbach, 1991; Achenbach & Edelbrock, 1987). YSR consists of 112 items measuring adolescents’ internalizing and externalizing behavioral problems. According to Achenbach (1991), the internalizing grouping consists of the sum of the scores of the Withdrawn (e.g. “**Rather be alone**”; “**Won’t talk**”), Somatic Complaints (e.g. “**Dizzy**”; “**Stomachaches**”), and Anxious/Depressed (e.g. “**Fears**”; “**Cries**”) scales, and the externalizing grouping consists of the sum of the scores of the Delinquent and Aggressive Behavior scales. For the present study, we considered only the internalizing score (37 items; $\alpha = .78$). Youths were asked to rate their behavior on a three-point Likert scale ranging from 1 (*not true*) to 3 (*very true or often true*).

Internet abuse. We administered the Internet Addiction Test (Widyanto & McMurrin, 2004) to assess the degree to which the Internet use affected adolescents' daily routine, social life, productivity, sleeping pattern, and feelings. It consisted of 20 items, to which participants were asked to answer on a 5-point Likert scale ranging from 1 (*never*) to 5 (*always*), concerning six dimensions: Salience (e.g. "How often do you choose to spend more time online over going out with others?"), Excessive use (e.g. "How often do you find that you stay online longer than you intended?"), Neglect of work (e.g. "How often does your school performance or productivity suffer because of the Internet?"), Anticipation (e.g. "How often do you find yourself anticipating when you will go online again?"), Lack of self-control (e.g. "How often do you try to cut down the amount of time you spend online and fail?"), and Neglect of social life (e.g. "How often do you prefer the excitement of the Internet to intimacy with your partner?"). The total score, calculated according to Young's suggestions, was used for this study ($\alpha = .79$). The minimum score can be 20, and the maximum can be 100; the higher the score, the greater the problems Internet use causes.

Analysis plan

We conducted preliminary analyses, including descriptive statistics of the study variables, and intercorrelations between all the variables considered in the mediation model. We followed the Preacher, Hayes and colleagues (Hayes, 2013, 2015; Preacher & Hayes, 2008; Preacher, Rucker, & Hayes, 2007) guidelines to assess whether internalizing problems at wave 2 mediated the influence of the low effortful control at wave 1 on the participants' Internet abuse at wave 3. The model incorporates a bootstrapping procedure that generates a sample size of 5,000 to assess the regression models necessary for a mediation. As suggested, we first examined the total effect of low effortful control at wave 1 on Internet abuse at wave 3, then the effect of low effortful

control at wave 1 on internalizing problems at wave 2, the proposed mediator, and then we entered low effortful control at wave 1 and internalizing problems at wave 2 together as independent variables in the analysis to examine their joint effect on Internet abuse at wave 3. Finally, we tested the conditional indirect effects of the moderator, checking if the magnitude of the direct effect of low effortful control at wave 1 on Internet abuse at wave 3 has decreased (partial mediation) or became not significant (full mediation) compared with the total effect. In all cases gender was inserted as a covariate variable. Due to the fact that self-report was the only way of collecting data in this research, its results could be affected by common method biases. To minimize the effect of common method bias (CMB) in this study, we strictly controlled the process of data collection and data analyses (Chang, van Witteloostuijn, & Eden, 2010; MacKenzie & Podsakoff, 2012; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003; Podsakoff, MacKenzie, & Podsakoff, 2012). Initially, during the data collection, we collected data anonymously, separated the questionnaires with similar contents, and subtly changed the description of questionnaires among different subjects. Moreover, in order to reduce participants' evaluation apprehension and make them less likely to edit their responses to be more socially desirable, lenient, acquiescent, and consistent with how they think the researcher wants them to, we assured respondents that there were no right or wrong answers. Moreover, acquiescence was reduced by reverse scoring some of the items. The temporal separation for measuring the predictor and criterion variables also reduced biases. With regards to data analysis, first we adjusted estimated predictor-criterion correlations for Common Method Variance by eliminating artifactual negative correlations by reversing any variables with a preponderance of negative correlations with other variables. We further checked for CMB in our data performing the common latent factor (CLF) test (Podsakoff & Organ, 1986; Podsakoff et al., 2003). In

particular, we compared the standardized regression weights from the CFL model to the standardized regression weights of our model without the CLF. The CLF test did not identify differences that exceed the threshold of .20, suggesting that the CMB was unlikely to be a serious concern for this study.

Results

Preliminary analyses: Descriptive statistics and correlations.

Given the fact that part ($N = 25$) of the initial sample was not available at the Waves 2 and 3, preliminary analyses were conducted to examine the representativeness of the longitudinal sample. Comparisons between longitudinal and non-longitudinal subjects, performed via a series of *t tests* did not show significant differences in the variables considered. To explore the role of gender on *effortful* control, internalizing problems, and Internet abuse, we conducted a series of Univariate Analysis of Variance (ANOVAs). At wave 1, data (Table 1) showed significant main effects of gender on *effortful* control ($F(1,481) = 10.10, p < .01$), internalizing problems ($F(1,481) = 3.92, p < .05$), and Internet abuse ($F(1,481) = 3.96, p < .05$), with boys reporting lower levels of *effortful* control and Internet abuse than girls, who showed higher levels of internalizing problems than boys. Also at waves 2 and 3, data (Table 1) revealed significant main effects of gender on internalizing problems and on Internet abuse, with girls reporting higher levels of internalizing problems than boys and boys reporting higher levels of Internet abuse than girls.

INSERT TABLE 1

Correlational analyses were performed to examine the associations between all the variables at waves 1, 2 and 3 (Table 2). Data showed that all the variables had significant cross-year correlations with their subsequent value, i.e., they remain stable over time. Regarding within-

time correlations, all the variables were significantly correlated to each other at all three waves. Concerning cross-year correlations between variables, **low effortful** control at wave 1 was significantly correlated to subsequent internalizing problems and to subsequent Internet abuse. Internalizing at wave 1 was significantly correlated to subsequent Internet abuse. Internet abuse at wave 1 was significantly correlated to subsequent internalizing problems.

INSERT TABLE 2

The mediating effect of internalizing problems

Regression analyses were performed to examine whether internalizing problems at wave 2 mediated the relationship between **low effortful** control at wave 1 and Internet abuse at wave 3. First, **low effortful control at wave 1 (the independent variable)** was a significant predictor of the **Internet abuse at wave 3 (the dependent variable)** ($\beta = .32, SE = .57, t = 4.85, p < .000$). Second, **low effortful control at wave 1** was a significant predictor of the **internalizing problems at wave 2 (the mediator)** ($\beta = .31, SE = .02, t = 4.76, p < .000$). Third, when the **Internet abuse at wave 3** was regressed on **low effortful control at wave 1** and **internalizing problems at wave 2**, the significance of the **low effortful control coefficient** decreased ($\beta = .17, SE = 1.58, t = 3.92, p < .01$), and the **internalizing coefficient** remained significant ($\beta = .33, SE = 1.09, t = 4.76, p < .000$), suggesting a partial mediation. The bootstrap analysis using the **INDIRECT SPSS macro** (Preacher & Hayes, 2008) confirmed a significant partial mediating pathway from **low effortful control to Internet abuse through internalizing problems** (95% confidence interval [CI] = .01 to .02). The mediating model is shown in Figure 2.

INSERT FIGURE 2

Discussion

This study aimed to verify that internalizing problems in middle adolescence play a mediating role in the relationship between **low effortful** control in early adolescence and Internet abuse in late adolescence.

In accordance with the recent international literature (Li et al., 2014; Pace et al., 2014; Wang et al., 2017), this three-wave longitudinal study showed how **low effortful** control during early adolescence may increase the risk of behavioral problems, which may in turn evolve into Internet abuse during late adolescence. In early adolescence, **low effortful** control may already represent a risk factor in the genesis of Internet abuse in late adolescence. Indeed, in line with Young (2004, 2009), **low effortful** control is often a distinctive feature of addictive behavior. Scholars have suggested (Yen, Ko, Yen, Chen, Chung, & Chen, 2008) that poorly adjusted adolescents (i.e., those who cannot modulate their behavior) often enter a vicious circle that can lead to addiction. As underlined in a previous study (Pace et al., 2014) those adolescents who have a temperamental predisposition toward **low** levels of **effortful** control are more vulnerable to developing addiction problems, including Internet addiction. Several early-life studies have illustrated temperament's powerful influence as a long-term risk factor among maladapted youth (Caspi, Henry, McGee, Moffitt, & Silva, 1995); in those studies, the temperamental factor led to **low effortful** control (as characterized by elements such as emotional lability, restlessness, lack of emotional regulation, and negativity) and was associated with addictive behaviors in late adolescence.

Regression analyzes from recent studies (Ko et al., 2012; Şenormanc et al., 2014; Wartberg et al., 2016; Wei et al., 2017) have also shown that internalizing problems in middle adolescence can predict Internet abuse in late adolescence. Addictive behaviors are usually characterized by social withdrawal; thus, adolescents' internalizing behaviors (such as anxiety and depression)

can lead to the development of Internet abuse. In this way, internalizing problems can result in dependence, as adolescents, through abuse, can find a basis for expiating any feelings that induce anxiety, social withdrawal, or other problems. The object of the abuse can therefore become the means to expiate internalizing problems. Moreover, Internet abuse can represent a way of escaping from problems or of alleviating a dysphoric mood (e.g., feelings of helplessness, anxiety, or depression).

Finally, proceeding from recent findings (Choi et al., 2014; Ding et al., 2017), the mediation model suggests that middle adolescents' internalizing problems mediate the relationship between early adolescents' **low effortful** control and late adolescents' Internet abuse. The individual aspect is linked to effortful control and thus is not negligible in the relationship with Internet abuse. However, when internalizing problems arise during development, they seem to create a maladaptive relationship that can undermine the subject's ability to act regarding the addictive object. In other words, **low effortful** control is not sufficient to explain dependent behavior, but when combined with social withdrawal, anxiety, and depression, it can lead to Internet abuse.

Limitations and future directions

Although the studies cited above have provided valuable new insights about the key roles that temperamental traits and internalizing problems may play in Internet abuse during the most important phases of adolescence, a few limitations apply. First, the use of self-report questionnaires collected by the same source allows for only a partial assessment of the complexity of the study's variables and may engender common method biases. Future research could therefore benefit from using other types of measures (perhaps by using different informants, such as parents and teachers, or observations and interviews). Specifically, future

studies could investigate whether a positive climate and parental social support can act as protective factors, thus reducing Internet-addiction behaviors (Chou & Lee, 2017; Ding et al., 2017; Pace, D'Urso, & Zappulla, 2018). Future studies could use implicit instruments for data collection (e.g., the Implicit Association Test and the Implicit Relational Assessment Procedure; Barnes-Holmes, Barnes-Holmes, Stewart, & Boles, 2010). Finally, although a longitudinal design is appropriate for testing a mediation model, more comprehensive analyses of causal directions may require full-panel longitudinal data collected from more than just the three phases used here (even though those are the most important phases of development); preferably, one of the time points in such a study would occur during adulthood. This would enable verifying the mediating effects of the social variables that, according to the literature, are connected to internalizing problems and/or Internet dependence (Ding et al., 2017; Patwardhan, Mason, Savolainen, Chmelka, Miettunen, & Järvelin, 2017). Finally, one of the limitations of this research lies in its own content, the abuse of the Internet, since it is difficult to collect, process and return data keeping pace with everything concerning the Internet and its use by young people, in which things evolve so quickly. This limit may make research in this area outdated and must be taken into account.

Implications

This study's results suggest that, in monitoring adolescents' mental health, it is crucial to supervise, especially when the adolescents have problems related to control or internalizing. Furthermore, the results suggest the relevance to realize intervention and prevention strategies related to Internet abuse and addiction, as temperament and internalizing problems are both significant risk factors during adolescence. Indeed, Torres-Rodríguez, Griffiths, and Carbonell (2017) underlined the preliminary efficacy of intervention programs for adolescents; these

programs aim to reduce symptoms related to Internet addiction by acting on specific areas (both interpersonal and intrapersonal). Accordingly, it would be very important to implement programs that are aimed at teaching correct Internet use; these programs should primarily target adolescents, as well as those who are involved in the educational process (e.g., teachers and parents). They should act on critical areas among adolescents (e.g., difficulties related to temperament and psychopathology) and not focus only on social context. Finally, this study suggests that there is a need to extend the literature on how risk and protection factors are linked to Internet addiction during development.

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration (including its later amendments) or with comparable ethical standards.

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Table 1Descriptive statistics of the study variables for the longitudinal sample ($N = 482$).

	Boys	Girls	$F(1,481)$	Possible	Observed
	$n = 245$	$n = 237$		range	range
	$M (SD)$	$M (SD)$			
Variables at wave 1					
Low effortful of control	3.76 (.67)	3.56 (.73)	10.10**	1-5	1.42-4.79
Internalizing problems	1.17 (.24)	1.21 (.01)	3.92*	1-3	1.06-2.07
Internet abuse	39.99 (8.58)	38.63 (7.43)	3.96*	20-100	24.80-66.13
Variables at wave 2					
Internalizing problems	1.65 (.32)	1.81 (.40)	20.51***	1-3	1.40-2.79
Internet abuse	39.91 (11.69)	38.51 (8.58)	4.16*	20-100	24.00-96.00
Variables at wave 3					
Internalizing problems	1.66 (.30)	1.82 (.41)	20.52***	1-3	1.41-3.00
Internet abuse	46.67 (10.69)	45.06 (9.12)	3.77*	20-100	31.40-99.00

* $p < .01$; ** $p < .001$; *** $p < .000$

Table 2Correlations between model variables, at waves 1, 2, and 3 ($N = 482$)

	2	3	4	5	6	7
1. Low effortful control wave 1	.39**	.35**	.30**	.26**	.21*	.32**
2. Internalizing problems wave 1		.25**	.49***	.22**	.69***	.24**
3. Internet abuse wave 1			.27**	.48***	.26**	.66***
4. Internalizing problems wave 2				.26**	.75***	.33**
5. Internet abuse wave 2					.26**	.70***
6. Internalizing problems wave 3						.23**
7. Internet abuse wave 3						/

* $p < .01$; ** $p < .001$; *** $p < .000$

Fig 1. The proposed mediation model for **low effortful** control, internalizing problems, and Internet abuse.

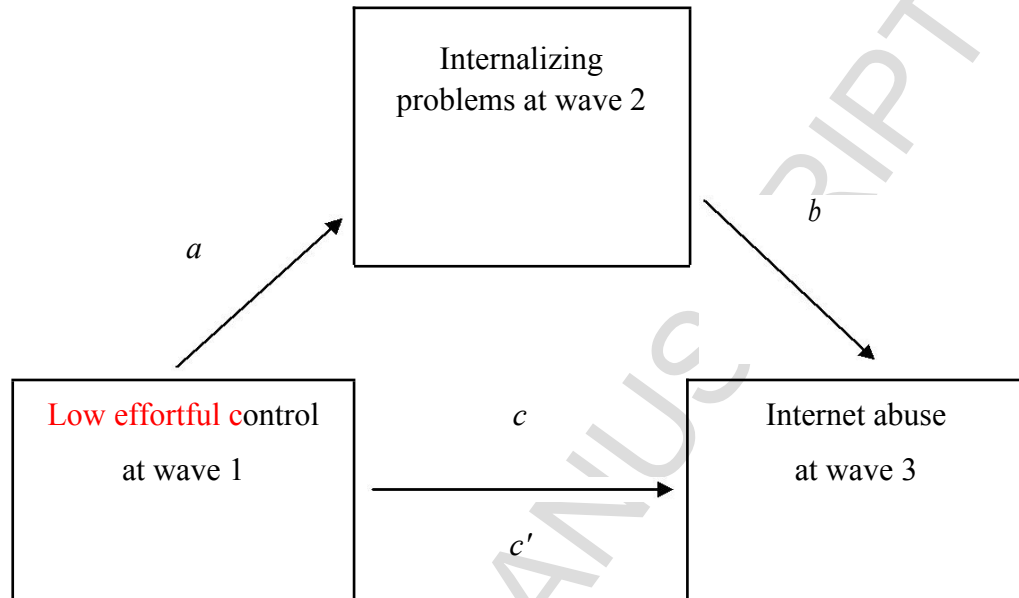
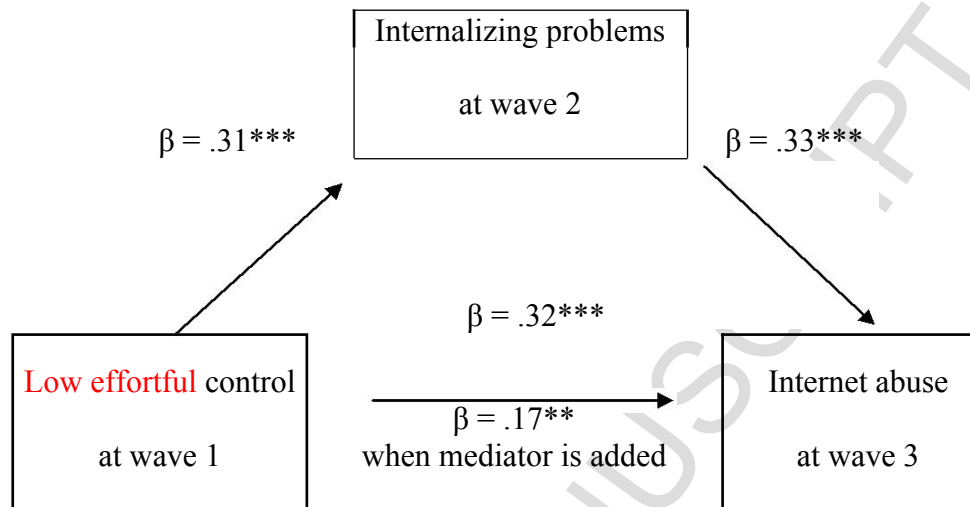


Fig 2. The observed mediation model for **low effortful** control, internalizing problems, and Internet abuse.



$**p < .01$; $***p < .000$

Internalizing problems as a mediator in the relationship between **low effortful control and Internet abuse in adolescence: A three-wave longitudinal study**

Highlights

- We found a predictive role of **low effortful** control on late adolescents' internet abuse
- We found that internalizing problems mediate the above relationship
- Predictive and mediation roles were highlighted in a three wave longitudinal design