



Full length article

Adolescents' problematic internet and smartphone use is related to suicide ideation: Does emotional intelligence make a difference?

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ARTICLE INFO

Keywords

Adolescence
Emotional intelligence
Suicide ideation
Problematic internet use
Problematic smartphone use

ABSTRACT

Problematic Internet and smartphone usage among adolescents has become an alarming social problem. Previous research suggests a detrimental effect of Internet and smartphone problematic use on psychological adjustment. Therefore, it is important to identify protective factors that may ameliorate these deleterious mental health consequences. We examined emotional intelligence as a potential moderator in the association between problematic Internet and smartphone use and suicide ideation in a sample of 2196 (1008 male; 1188 female) Spanish adolescents. Results showed that problematic Internet and smartphone use was significantly associated with suicide ideation. Emotional intelligence scores were negatively associated with both problematic Internet and smartphone use and suicide ideation. Finally, results of moderation analyses indicated that emotional intelligence moderates the negative link between problematic Internet and smartphone use and suicide risk. Specifically, a weaker association between problematic Internet and smartphone usage and suicidal ideation was found among adolescents with higher emotional intelligence. These findings reinforce the notion that emotional intelligence might be a protective factor in adolescents, helping them to reduce the negative symptoms associated to problematic Internet and smartphone use. Implications of these findings for the prevention of psychological maladjustment associated to Internet and smartphone problematic usage in adolescents are discussed.

1. Introduction

Information and communications technology (ICT) brings opportunities to improve our well-being through changes in time use, access to information and the possibility of new activities and communication tools (Castellacci & Tveito, 2018). However, much of the research has found that the benefits of the Internet on well-being depend largely on personal characteristics and psychological functioning (e.g. Castellacci & Tveito, 2018; Herrero, Urueña, Torres, & Hidalgo, 2017). Thus, as ICT is becoming more ubiquitous, it is important to explore the potential harm associated with these individual characteristics that can result from ICT's problematic usage.

1.1. Problematic internet and smartphone use

Two of the risks that are receiving increasing attention from researchers and practitioners are Internet and smartphone problematic use. Problematic internet use (PIU) can be defined as 'Internet use that is risky, excessive or impulsive in nature leading to adverse life consequences, specifically physical, emotional, social or functional impair-

ment' (Moreno, Jelenchick, & Christakis, 2013, p. 1885). Regarding smartphones, there is a present debate about the definition of problematic smartphone use (PSU), sometimes being considered a subcategory of PIU and sometimes as a separate phenomenon (Cheever, Moreno, & Rosen, 2018). This debate mainly lays in the fact that smartphone functions are based on Internet use, so in terms of access to information or risky use, both phenomena are quite similar. However, the problematic use of computers and smartphones may have different implications. The excessive use of computers may lead to isolation and reduced interpersonal functioning, while the portability of a smartphone may not be linked to isolation but might interfere with daily tasks (Lin et al., 2016). Hence, a consensus conceptualization defines PSU as an excessive use of one's smartphone that interferes with several areas of the person's life (Billieux, Maurage, Lopez-Fernandez, Kuss, & Griffiths, 2015).

Concerning Internet usage, statistics show that 79% of European individuals declared using the Internet on a daily basis and this percentage increased to 96% among the adolescent population (Eurostats, 2020). A cross-national study involving nine European countries found that time spent online was related to PIU and the prevalence of prob-

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lematic Internet users was between 14.3% and 54.9% (Laconi et al., 2018). In a sample of 40955 Spanish adolescents, Gómez, Rial, Braña, Golpe, and Varela (2017) found that 17.9% connected to the Internet more than 3 h on weekdays and more than 5 h on weekends; they also found that 16.3% of adolescents were considered problematic Internet users. Regarding PSU, a recent literature review found prevalence rates between 0.4% and 64% (De-Sola, Rodríguez, & Rubio, 2016). A cross-national study among ten European countries found that the average time spent using a smartphone was 8.9 h on weekdays and 5.9 h (Lopez-Fernandez et al., 2017). Thus, time spent online was related to mobile phone dependence, covering between 1% and 3.9% of the population (Lopez-Fernandez et al., 2017). In a study with Spanish population, the prevalence rate of problematic smartphone users was 20.5% (De Sola, Talledo, Rodríguez & Rubio, 2017). Because people use the Internet and carry smartphones with them most of the time, it is important to understand their psychological consequences on people's lives (Cheever et al., 2018).

1.2. Problematic internet/smartphone use and psychological adjustment

Several studies have researched the links between PIU/PSU and mental health problems. For instance, higher levels of PIU/PSU have been found to make people more prone to insomnia, excessive daytime sleepiness and sleep-wake behaviour problems (De-Sola et al., 2016; Park et al., 2018). PIU/PSU is related to psychological distress and increased alcohol consumption (Grant, Lust & Chamberlain, 2019; Tsumura et al., 2018) and also depression and anxiety (Elhai, Dvorak, Levine, & Hall, 2017; Kim, Jang, Lee, Lee, & Kim, 2018). Furthermore, PIU/PSU has been linked to aggression, expression of anger, attention deficit hyperactivity disorder (ADHD) and conduct disorder (Lee et al., 2018), as well as to the fear of missing out (FoMO) and the need for touch (Elhai, Levine, Dvorak, & Hall, 2016). Finally, one of the most adverse outcomes is the significant link between PIU/PSU and suicidal ideation (Lin et al., 2014) or suicide attempts (Kim et al., 2017).

Some authors have argued that PIU/PSU is more prevalent in adolescents (e.g. Haug et al., 2015). Research evidence suggests that the relations between PIU/PSU and mental health problems tend to be stronger in adolescence because of the relatively low psychological maturity displayed (Yang, Zhou, Liu, & Fan, 2019). The link between PIU/PSU and suicidal ideation in this population might be explained by several mechanisms. Firstly, there is a high comorbidity associated with PIU/PSU (Aboujaoude, 2010), leading some researchers to suggest that adolescents suffering from such use have trouble with their impulse control and may share symptoms (e.g. suicidal ideation) and aetiology with other mental health problems (Kaess et al., 2014; Lam, Peng, Mai, & Jing, 2009; Messias, Castro, Sain, Usman & Peeples, 2011; Park, Hong, Park, Ha, & Yoo, 2012). Secondly, adolescents with PIU/PSU who are vulnerable to social exclusion and victimization may overuse the Internet as a coping mechanism, making them even more vulnerable to online risks, such as sexting and cyberbullying (Durkee, Hadlaczky, Weterlund & Carli, 2011; Gansner et al., 2019). These activities may make adolescents feel more isolated, reduce their offline networks and social support and, in turn, cause them higher psychological distress (Herrero et al., 2017). Thirdly, adolescents with PIU/PSU may have increased access to information about suicide (e.g. via pro-suicide websites), allowing them to discuss and learn about mechanisms for carrying out suicide (Durkee, Hadlaczky, Weterlund & Carli, 2011; Messias, Castro, Sain, Usman & Peeples, 2011). Some authors have also suggested that the anonymity that characterizes online interactions may allow adolescents to explore suicidal ideas and information without being criticized or judged (Lin et al., 2014). Also, internet overuse and exposure to negative information and images about suicide may cause deindividuation,

reducing self-awareness and concern with social evaluation, leading to a decreased sensitivity towards self-harm (Lin et al., 2014). Fourthly, given that adolescence is a stage where identity is formed, adolescents with PIU/PSU may find online groups of individuals with similar mindsets that promote suicide, leading them to express suicidal thoughts and actions as a way to be acknowledged by the group, gain acceptance and differentiate themselves from the dominant culture (Durkee, Hadlaczky, Weterlund & Carli, 2011; Kim et al., 2006; Lin et al., 2014).

The different pathways that connect PIU/PSU to suicidal ideation in adolescents support the relevance of examining possible protective factors as a way to reduce the distress experienced by this population.

1.3. Emotional intelligence as a moderator

Although buffering factors of mental health problems have been studied for years (e.g. Chang et al., 2017; Mackin, Perkins, & Furrer, 2012; Meadows, Kaslow, Thompson, & Jurkovic, 2005), research on individual protective factors in people with PIU/PSU is still scarce. However, a few exceptions can be found. For instance, Liu, Zhou, Niu, and Fan (2017) found that mindfulness moderated the relationship between PSU and sleep quality. In other research, Yang et al. (2019) studied the association between PSU, depression and anxiety, and found that trait mindfulness was also a moderator. Examining other personal resources that, like mindfulness, are modifiable and can be trained is a promising path towards the design of mental health and educational interventions for adolescents with PIU/PSU.

Given that PIU/PSU and suicidal ideation are related to mood dysregulation (e.g. Aboujaoude, 2010; Marchant et al., 2017), variables associated with emotional development may play a key role in understanding the relation between both phenomena. Specifically, emotional intelligence (EI) is a psychological construct that has been strongly associated with mental health and well-being (e.g. Martins, Ramalho, & Morin, 2010; Sánchez-Álvarez, Extremera, & Fernández-Berrocal, 2016). EI can be defined as 'the ability to reason validly with emotions and with emotion-related information and to use emotions to enhance thought' (Mayer, Caruso, & Salovey, 2016, p. 295). To the best of our knowledge, EI has not been studied as a protective factor in the relationship between PIU/PSU and suicidal ideation in adolescents. However, research suggests that it might play a buffering role. For instance, prior studies have found that maladaptive use of mobile phones is related to lower EI in college students (Beranuy, Oberst, Carbonell, & Chamorro, 2009). Also, Cha and Nock (2009) reported that EI moderated the association between childhood trauma and suicidal ideation. In another study, Abdollahi, Carlbring, Khanbani, and Abdollahi (2016) found that higher EI protects adolescent inpatients with depression from suicidal ideation. Also in an adolescent sample, Extremera, Quintana-Orts, Rey and Mérida-López (2018) found that EI was a protective factor in the relation between cyberbullying victimization and psychological maladjustment (i.e. low self-esteem and suicidal ideation). Finally, a recent systematic review found consistent empirical evidence of the negative association between EI and suicidal ideation (Domínguez-García & Fernández-Berrocal, 2018). In general, according to the aforementioned findings, it is tentative to say that individuals with higher EI tend to experience less psychological distress in stressful situations and are able to mitigate the influence of negative thoughts and feelings in such situations, reducing the frequency of suicidal ideation (Domínguez-García & Fernández-Berrocal, 2018).

1.4. The present study

Considering the research aforementioned, the aim of this study was to analyse the relations between PIU/PSU, EI and suicidal ideation, and

to investigate the possible moderating effect of EI in the association between PIU/PSU and suicidal ideation in a sample of adolescents. The proposed moderation model is depicted in Fig. 1.

We anticipated that PIU/PSU would be positively associated with suicidal ideation (Hypothesis 1). Given that EI can help in understanding and regulating emotional experiences, we also expected that EI would be negatively linked to PIU, PSU and suicidal ideation (Hypothesis 2). Finally, having a higher level of EI can help adolescents to engage in more adaptive ways with the Internet and to respond better to stressful situations that may arise during the use of digital technology. Therefore, we hypothesized that EI would act as a protective factor and moderate the association between PIU/PSU and suicidal ideation (Hypothesis 3).

2. Methods

2.1. Participants

Participants in this study were 2196 (1008 male; 1188 female) students from ten public secondary schools in southern Spain. Their ages ranged from 12 to 19 years old, with a mean age of 14.60 (SD = 1.65). The students involved in the study were from the 1st year of compulsory secondary education to the 2nd year of high school (i.e. 7th to 12th grades). Students reported that they used the Internet more than 6 h (46.3%) and between 3 and 5 h (25.8%) on weekdays and on weekends the percentages were 44.8% and 31%, respectively. They also informed that they used their smartphones more than 6 h a day (45%) and between 3 and 5 h a day (23.4%) on weekdays; the percentages on weekends were 44.7% and 28.2%, respectively.

2.2. Measures

2.2.1. Problematic internet use (PIU)

The levels of PIU were assessed using the Spanish version of the Internet Addiction Test (IAT: Fernández-Villa et al., 2015; Young, 1998). The scale, consisting of 20 items scored on a five-point Likert scale (1 = rarely, 5 = always), evaluates the frequency at which the person has suffered from certain problematic situations due to their Internet usage (e.g. *How often do you find that you stay on-line longer than you intended? How often do you find yourself anticipating when you will go on-line again?*). A higher score is indicative of worse PIU. The internal consistency, or reliability, of the present sample was good (Cronbach's alpha = .86; McDonald's omega = 0.85). Fernández-Villa et al. (2015) found that IAT scores correlated significantly with time spent online ($r = 0.32$), providing evidence for the convergent validity of the IAT.

2.2.2. Problematic smartphone use (PSU)

The level of PSU was assessed using the Spanish version of the Smartphone Addiction Scale-Short Version (SAS-SV: Lopez-Fernandez, 2017), which is developed from the original Smartphone Addiction Scale (SAS: Kwon, Kim, Cho, & Yang, 2013). This scale contains 10 items that can be answered on a six-point Likert scale, where 1 indicates a strong disagreement with the statement and 6 indicates a strong agreement. Examples of items are: *Missing planned work due to smartphone use; Won't be able to stand not having a smartphone*. Higher scores show higher PSU. In our study, Cronbach's alpha and McDonald's omega were both 0.86. Kwon et al. (2013) tested the convergent va-

lidity of the original scale using the Smartphone Addiction Proneness Scale (NISA, 2011; $r = 0.762$) and the Korean Self-reporting of Internet Addiction Scale- Short Form (Kim, Chung, Lee, Kim, & Cho, 2008; $r = 0.421$).

2.2.3. Emotional intelligence (EI)

We used the Spanish version of the Wong and Law Emotional Intelligence Scale (WLEIS: Wong & Law, 2002; Extremera, Rey, & Sánchez-Álvarez, 2019) to measure self-report EI ability. The scale has 16 items scored on a seven-point Likert scale, ranging from 1 ('totally disagree') to 7 ('totally agree'). These items evaluate four dimensions of EI: self-emotion appraisal (e.g. *I have a good sense of why I feel certain feelings most of the time*), use of emotions (e.g. *I always set goals for myself and then try my best to achieve them*), regulation of emotions (e.g. *I am able to control my temper and handle difficulties rationally*) and other-emotion appraisal (e.g. *I always know my friends' emotions from their behaviour*). A composite total EI score can be calculated based on these four subscales. Wong and Law (2002) provide evidence for the original scale's convergent (EQ-i; BarOn, 1997; $r = 0.63$; Life satisfaction items; Campbell, Converse, & Rodgers, 1976; $r = 0.39$) and discriminant (NEO Personality inventory; Costa & McCrae, 1985; neuroticism: $r = -0.40$ to -0.24 , conscientiousness: $r = 0.50$ to 0.51) validity. In our sample, Cronbach's alpha and McDonald's omega were 0.88.

2.2.4. Suicidal ideation

This variable was assessed using the Spanish version (Sánchez-Álvarez, Extremera, Rey, Chang, & Chang, submitted) of the Frequency of Suicidal Ideation Inventory (FSII: Chang & Chang, 2016). There are five items on this inventory (e.g. *Over the past year, how often have you thought about hurting yourself? Over the past year how often have you thought about committing suicide?*) and they are answered on a five-point Likert scale from 1 ('never') to 5 ('almost every day'). Hence, higher scores on the FSII are indicative of higher suicidal ideation. The internal consistency of this sample was very good (Cronbach's alpha = .91, McDonald's omega = 0.92). Construct validity of this scale was assessed in its original version. Chang and Chang (2016) provided evidence for convergent validity using the Adult Suicidal Ideation Questionnaire (Reynolds, 1991; $r = 0.88$), the Suicidal Behaviors Questionnaire- Revised (Osman et al., 2001; $r = 0.85$) and Beck's Depression Inventory (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961; $r = 0.54$). In their study, discriminant validity was assessed with the Positivity Scale (Caprara et al., 2012; $r = -0.47$), the Flourishing Scale (Diener et al., 2010; $r = -0.45$) and the Positive Affectivity Scale (Watson, Clark, & Tellegen, 1988; $r = -0.32$).

2.3. Procedure

Participants for this study were a subsample from a larger research project (PPIT.UMA.B1.2017/23). Ethical approval for the study protocol was obtained from the Research Ethics Committee of the University of Malaga (Spain). Schools were invited to participate in the research and those that agreed were selected according to convenience criteria using cluster sampling (i.e. whole classrooms). Firstly, the head of each school was contacted, who approved the research. Secondly, because the sample was largely underage, parental consent was given. Thirdly, students were assured of anonymity, confidentiality and the voluntary nature of the data they provided. We only considered two exclusion criteria: if the student did not have parental consent or did not have a fluid comprehension of the Spanish language they could not participate. All students that met these criteria agreed to participate and the paper-based instruments were administered collectively in each classroom, supervised by a researcher and a teacher. On average, students took 50 min to complete the questionnaires. Data was collected from

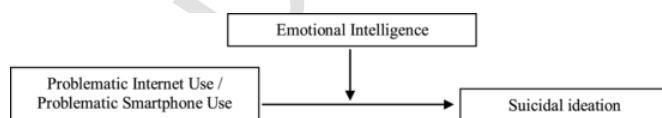


Fig. 1. Proposed model of the moderation of the emotional intelligence in the link between problematic Internet and smartphone usage and suicidal ideation.

March 2018 to May 2019. Data collection procedures were in accordance with the Code of Ethics of the Declaration of Helsinki (2013).

2.4. Data analysis

SPSS version 22 (SPSS Inc., Chicago, IL, USA) was used to conduct the descriptive and reliability statistics, as well as the correlation analysis. To examine the moderating role of EI in the association between PIU, PSU and suicidal ideation, the SPSS macro PROCESS was used (Hayes, 2017). This macro was designed to conduct path analysis-based moderation and mediation analysis, as well as conditional process models based on integration of these analyses (Hayes, 2017). In this study, we used the simple moderation analysis model proposed by the author (Model 1). In step 1 we entered gender and grade level as covariates, in step 2 we entered the main effects and in step 3 we entered the interaction term and calculated the increment of R². The covariates, predictor and moderator variables were mean centred prior to computing their interaction product. Furthermore, we determined whether the interaction products accounted for small ($f^2 = 0.005$), medium ($f^2 = 0.01$), or large effects ($f^2 = 0.025$), according to the criteria of Aguinis, Beaty, Boik, and Charles (2005).

3. Results

3.1. Descriptive results and correlations

Table 1 shows means and standard deviations of PIU, PSU, EI and suicidal ideation. Also, zero-order Pearson correlations are shown. As predicted by Hypothesis 1 (H1), PIU and PSU were positively and significantly correlated with suicidal ideation (PIU: $r = 0.26, p < 0.01$; PSU: $r = 0.20, p < 0.01$). In accordance with H2, EI was negatively associated with PIU ($r = -0.18, p < 0.01$), PSU ($r = -0.14, p < 0.01$) and suicidal ideation ($r = -0.26, p < 0.01$).

3.2. Composite reliability, average variance extracted, maximum shared variance, and McDonald construct reliability

In addition, reliability and validity of the measurement items in relation to their constructs was assessed by calculating the composite reliability (CR) and of each construct and average variance extracted (AVE) (See Table 2). Besides, MaxR (H) which refers to McDonald Construct Reliability was also estimated. Table 2 shows that the CR and McDonald Construct Reliability of all of the four constructs was greater than 0.70, showing a very good construct reliability. However, the AVE for the constructs was less than the recommended 0.50, suggesting that the convergent validity of measures was not satisfying. The lower value indicates more errors in the items rather than the variance of the items explained by the construct, suggesting need future refinements.

Table 1
Correlations, means, standard deviations and reliabilities of the study variables.

	1	2	3	4
1. PIU	–			
2. PSU	.67 **	–		
3. EI	-.18 **	-.14 **	–	
4. Suicidal ideation	.26 **	.20 **	-.26 **	–
M	2.14	2.63	4.76	1.67
SD	.61	1.03	1.00	.89
Cronbach's alpha	.86	.86	.88	.91

Note. **p < 0.01.

Table 2
Composite reliability, average variance extracted, maximum shared variance, and McDonald Construct Reliability.

Construct	CR	AVE	MaxR(H)
<i>Problematic Internet Use</i>	.856	.238	.866
Time Control	.570	.306	.570
Consequences of use	.724	.302	.807
Cognitive-emotional dimension	.775	.266	.797
<i>Problematic Smartphone Use</i>	.841	.354	.861
<i>Emotional Intelligence</i>	.881	.327	.898
Self-emotion appraisal	.870	.633	.935
Other-emotion appraisal	.684	.362	.713
Use of emotions	.764	.448	.770
Regulation of emotions	.761	.453	.791
<i>Suicidal Ideation</i>	.921	.699	.927

Notes: CR = Composite Reliability; AVE = Average Variance Extracted; MaxR(H) = McDonald Construct Reliability. $CR = (\sum \text{standardized loading}) \text{standardized loading} + \sum \text{IME} / (\sum \text{standardized loading})^2 + \sum \text{IME}$ where, IME (indicator measurement error) = $1 - \text{standardized loading} / (\sum \text{squared standardized loading}) / (\sum \text{squared})$.

3.3. Moderation analyses

Hypothesis 3 predicted that EI would moderate the relations between PIU/PSU and suicidal ideation. Thus, the association between PIU/PSU and suicidal ideation would be stronger for adolescents with lower EI. Therefore, we conducted two moderation analyses, testing PIU and PSU as independent variables separately. In both models, suicidal ideation was the dependent variable, EI was the moderating variable and gender and grade level were entered as covariates. Results of these analyses are presented in Tables 3 and 4.

Concerning PIU, the full prediction model for the moderating variable EI was statistically significant ($F_{(5,1944)} = 67.27, p < 0.001$) and accounted for 15% of the variance. With regard to the covariates, there was a significant effect of gender but not grade level. The ordinal interaction of PIU and EI was found to account for a small ($f^2 = 0.004$), but significant ($\Delta R^2 = 0.004, p < 0.01$), additional unique variance in suicidal ideation.

Fig. 2 illustrates the conditional effect of PIU on suicidal ideation at two levels of EI: one standard deviation above (i.e. high EI) and below (i.e. low EI) the mean. This figure shows Z scores for the predictor and moderator variables. The association between PIU and suicidal ideation was significant at low levels of EI ($b = 0.39, t_{(1944)} = 9.43, p < 0.001$). This relation decreased at high levels of EI but remained significant ($b = 0.21, t_{(1944)} = 5.12, p < 0.001$). Furthermore, results from post hoc analyses showed that the slopes of the two lines were significantly different ($t = 3.00, p < 0.01$). In accordance with H3,

Table 3
Tested moderation model 1 with suicidal ideation as outcome predicted by emotional intelligence and interaction product.

	b	SE b	R ²	Δ R ²	95% CI
Model 1. PIU			.15 ***		
Constant	1.20 ***	.07			1.07 to 1.33
Gender	.30 ***	.04			.23 to .37
Grade Levels	-.001	.001			-.02 to .02
PIU	.30 ***	.03			.24 to .36
EI	-.20 ***	.02			-.24 to -.16
PIU x EI	-.09 **	.03		.004 **	-.14 to -.03

Note. b = Unstandardized beta; SE b = Standard error of beta. **p < 0.01; ***p < 0.001.

PIU: Problematic Internet Use. EI: Emotional Intelligence.

Table 4
Tested moderation model 2 with suicidal ideation as outcome predicted by emotional intelligence and interaction product.

	b	SE b	R ²	Δ R ²	95% CI
Model 2. PSU			.12 **		
Constant	1.26 ***	.07			1.12 to 1.39
Gender	.26 **	.04			.19 to .34
Grade Levels	-.001	.01			-.02 to .02
PSU	.11 ***	.02			.07 to .15
EI	-.22 ***	.02			-.26 to -.18
PSU x EI	-.04 **	.02		.003 *	-.08 to -.01

Note. b = Unstandardized beta; SE b = Standard error of beta. *p < 0.05; **p < 0.01; ***p < 0.001.

PSU: Problematic Smartphone Use. EI: Emotional Intelligence.

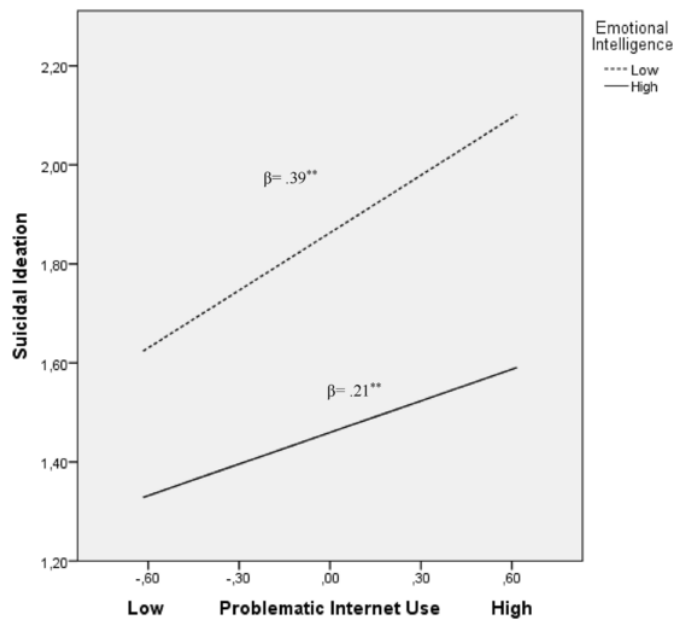


Fig. 2. Conditional effect of EI in the association between PIU and suicidal ideation.

these findings suggest that EI moderates the association between PIU and suicidal ideation.

The full prediction model concerning PSU as the independent variable and EI as the moderator variable (Table 3) was also statistically significant ($F_{(5,1944)} = 52.71, p < 0.001$) and explained 12% of the variance. The effect of gender as a covariate remained significant. The ordinal interaction term of PSU and EI was found to account for a small ($f^2 = 0.003$), but significant ($\Delta R^2 = 0.003, p < 0.05$), additional unique variance in suicidal ideation. As Fig. 3 shows, the association between PSU and suicidal ideation was significant at low levels of EI ($b = 0.16, t_{(1944)} = 6.06, p < 0.001$) and also at high levels of EI ($b = 0.07, t_{(1944)} = 2.59, p < 0.01$). Results from post hoc analyses showed significant differences between the slopes of the two lines ($t = 3.18, p < 0.01$). These results are also in line with H3.

4. Discussion

The aim of this study was to analyse the relations between PIU, PSU, EI and suicidal ideation. Correlation analyses showed that all the study variables were related in accordance with the proposed hypotheses, that is, PIU/PSU correlated positively with suicidal ideation; and EI was negatively related to PIU, PSU and suicidal ideation. Previous research has linked PIU and PSU to suicidal ideation (e.g. Durkee, Hadlaczky, Weterlund & Carli, 2011; Lin et al., 2014). Also, the bulk

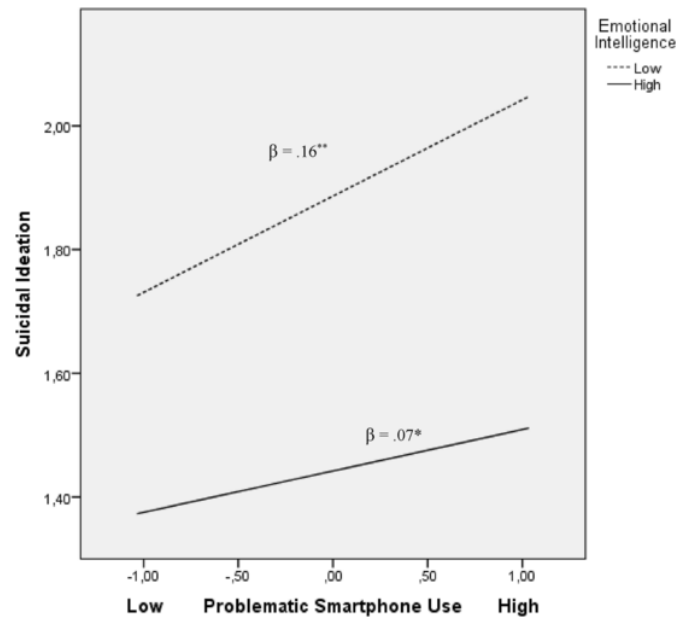


Fig. 3. Conditional effect of EI in the association between PSU and suicidal ideation.

of evidence found a negative relation between EI and psychological maladjustment (e.g. Abdollahi et al., 2016; Domínguez-García & Fernández-Berrocal, 2018). However, no prior literature has examined jointly the buffering role of EI in the link between PIU/PSU and suicidal ideation in adolescents. Thus, our study contributes to the research field that investigates how levels of problematic technology usage vary with regard to mental health problems due to the intervening role of personal factors (Fumero, Marrero, Voltes y Peñate, 2018; Lee, Sung, Song, Lee, Lee, Cho et al., 2018).

Specifically, the most important contribution of this study concerns the moderating role of EI in the association between PIU/PSU and suicidal ideation. Our results showed that this relation was stronger for adolescents with lower levels of EI. Thus, EI may act as a protective factor that helps to mitigate the negative effects of problematic digital technology usage in adolescents.

From the different pathways between PIU/PSU and suicide risk mentioned above, our results may contribute to support at least two. For instance, lower EI could point towards difficulty in managing impulses, because one of the core elements of EI is emotion regulation. Many people suffering from mental health problems also have trouble regulating their emotional states, particularly negative ones (e.g. Hertel, Schütz, & Lammers, 2009). As PIU and PSU are highly comorbid and do not seem to appear independently (Park et al., 2012), lower EI could be at the root of the association between different mental health problems and suicide risk.

On the other hand, adolescents are particularly susceptible to emotionally charged situations (Berman, 2018). Having difficulties in identifying and understanding emotions may lead them to avoid these situations and instead to over-use the internet and smartphones in order to handle stress. If this turns into a pattern, they could develop a maladaptive coping style and thus never acquire the useful skills to deal with stressful life situations (e.g. Durkee, Hadlaczky, Weterlund & Carli, 2011; Gansner et al., 2019). This cycle may lead to psychological maladjustment and possibly to increased suicide risk. As Domínguez-García and Fernández-Berrocal (2018) suggest, having higher EI could buffer against suicide risk via this mechanism by allowing adolescents to understand and regulate their emotions in order to use more adaptive coping strategies. This set of emotional abilities could also help youths to identify and prevent risky online behaviour, as well as seek help if they find themselves in an unsafe situation.

Perhaps, in a more indirect way, EI could also help to explain the other two mechanisms linking PIU/PSU to suicide ideation. For example, even if an adolescent with high EI came across online information about suicide, they could evaluate and regulate their emotions towards this information (Lin et al., 2014). In addition, it could also reduce the likelihood of deindividuation, allowing them to be more aware of themselves and their emotional states. In a similar way, because having higher EI is also linked to higher self-esteem (Domínguez-García & Fernández-Berrocal, 2018), an adolescent may use more adaptive strategies to construct their identity and avoid identification with suicidal online groups as a way to assert their distinctiveness (Durkee, Hadlaczky, Weterlund & Carli, 2011; Kim et al., 2006).

Consequently, our findings may have important implications for suicide prevention efforts in adolescents with problematic technology usage. Emotional abilities, such as those in EI, can be strengthened by teaching about problem solving in emotional reasoning (Mayer et al., 2016). The efficacy of these interventions has been proven in different settings (Hodzic, Scharfen, Ripoll, Holling, & Zenasni, 2018; Kotsou, Mikolajczak, Heeren, Grégoire, & Leys, 2019; Mattingly & Kraiger, 2019). Mental health and educational researchers and practitioners could design and implement EI interventions in order to help adolescents cope with the psychological distress that characterizes PIU/PSU (e.g. Moreno et al., 2013) and suicidal ideation (Klonsky, May, & Saffer, 2016).

4.1. Limitations and future studies

Some limitations in the present study must be addressed. First, the cross-sectional nature of our data makes it difficult to determine causality. From our theoretical model we propose that suicidal ideation is one of the many distressful outcomes that people with PIU/PSU suffer. However, Elhai et al. (2017) have underlined that might be possible that people who experience psychological maladjustment may report higher tendency to use technology as a coping mechanism (e.g. Kim, Seo, & David, 2015; Snodgrass et al., 2014). However, there is also empirical evidence in the opposite direction, finding that people who use computers and smartphones more frequently end up feeling more stressed and depressed after their use (e.g. Thomée, Eklöf, Gustafsson, Nilsson, & Hagberg, 2007; Thomée, Härenstam, & Hagberg, 2011). Future studies should attempt to replicate this research from a prospective design in order to clarify the temporal relation between PIU/PSU and suicidal ideation.

Even though we used a large sample, another limitation could be that it was quite homogenous (i.e. adolescents from the south of Spain). Aiming at a more heterogeneous sample (i.e. more culturally diverse, a larger age range, different socio-economic background) may allow for a better generalization of the findings. Unexpectedly, the grade level was not a significant predictor in our model. It is possible that the age of our sample was within a limited range to find this effect significant, therefore, further research to use samples with a larger age difference to generalize our findings.

Furthermore, it is worth noting that, although anonymity was warranted, the use of self-report measures might be affected by social desirability biases or shared method variance, more especially in psychology research involves collecting self-report data on personal or socially sensitive issues (i.e. problematic internet usage or suicide ideation). It would be important for future studies to include social desirability measures or other sources of information such as peers, parents and teachers to minimize these effects. While reliability coefficient for measures were satisfactory, the low convergent validity for constructs suggest that certain measures might need future refinement and empirical

testing, at least when Spanish versions will be used in adolescent samples.

In spite of these limitations, our research has contributed to the field that studies psychological processes in relation to digital technology by expanding on protective factors that may mitigate the negative effects of internet and smartphone maladaptive usage. To our knowledge, this is the first study to examine the buffering role of EI in the association between PIU, PSU and suicidal ideation, setting a strong antecedent for future research.

Role of the funding source

This research has been supported and funded in part by research projects from University of Málaga and Junta de Andalucía / FEDER (UMA18-FEDERJA-147).

Uncited references

Billieux, 2012; Extremera et al., 2006; Extremera and Rey, 2016; Fernández-Berrocal and Extremera, 2016; Rajappa et al., 2012; Resurrección et al., 2014.

CRedit authorship contribution statement

Christiane Arrivillaga: Investigation, Writing - original draft, Writing - review & editing, Visualization. **Lourdes Rey:** Conceptualization, Methodology, Investigation, Supervision, Funding acquisition. **Natalio Extremera:** Conceptualization, Methodology, Formal analysis, Investigation, Supervision, Funding acquisition.

Declarations of competing interest

All authors declare they have no conflict of interest.

Acknowledgements

Our heartfelt gratitude goes to the adolescents, families and schools that agreed to participate in this study.

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