

A Longitudinal Study of Adolescent Internet Addiction: The Role of Conscientiousness and Classroom Hostility

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Abstract

Over the last decade, research on Internet addiction (IA) has increased. However, almost all studies in the area are cross-sectional and do not examine the context in which Internet use takes place. Therefore, a longitudinal study examined the role of conscientiousness (as a personality trait) and classroom hostility (as a contextual factor) in the development of IA. The participants comprised 648 adolescents and were assessed over a 2-year period (while aged 16–18 years). A three-level hierarchical linear model was carried out on the data collected. Findings revealed that (a) lower conscientiousness was associated with IA and this did not change over time and (b) although being in a more hostile classroom did not initially have a significant effect, it increased girls' IA vulnerability over time and functioned protectively for boys. Results indicated that the contribution of individual and contextual IA factors may differ across genders and over time. More specifically, although the protective effect of conscientiousness appeared to hold, the over-time effect of classroom hostility increased the risk of IA for girls. These findings are discussed in relation to the psychological literature. The study's limitations and implications are also discussed.

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adolescence, Internet addiction, conscientiousness, hostility, context, gender, classroom

Introduction

Over the last 20 years, the use of the Internet has greatly changed both work and leisure practices. This has led to many benefits and has been cited as a contributing factor to the flourishing of users' mental health, facilitating relationships with others, and providing individuals with meaningful virtual activities that may induce a sense of accomplishment (Jones, Scholes, Johnson, Katsikitis, & Carras, 2014). However, there may also be a downside for a small minority of Internet users. More specifically, excessive engagement with the Internet may in some cases lead to Internet addiction (IA), resulting in detrimental effects for the users. Various terms have been suggested to define this problematic syndrome, such as "Problematic Internet Use" (Davis, Flett, & Besser, 2002) and "Cyberspace Addiction" (Hur, 2006). Most recently, the appendix of the updated fifth edition of the *Diagnostic and Statistical Manual for Mental Disorders* (5th ed.; *DSM-5*; American Psychiatric Association [APA], 2013) suggested *Internet Gaming Disorder* (IGD) as a condition requiring further research. IGD refers to "persistent and recurrent use of the Internet to engage in games, often with other players, leading to clinically significant impairment or distress" (APA, 2013, p. 795). It should be noted that online gaming is included in the group of high-risk Internet applications, which has resulted in a growing research base focusing on online gaming specifically (Kuss & Griffiths, 2012b). However, IA researchers have contended that there are also other online activities that can be addictive, such as social networking, online gambling, and online sex (e.g., Griffiths, 2012; Griffiths, Kuss, & Demetrovics, 2014; Young, Pistner, O'Mara, & Buchanan, 1999).

The present study adopted the "Internet Addiction" definition (Young, 1998) and measurement instruments that have been widely used by other Greek (Stavropoulos, Alexandraki, & Motti, 2013) and international researchers (Korkeila et al., 2008). Here, IA has been characterized by an excessive preoccupation with the Internet that causes impairment or distress to the individual. The syndrome has been associated with a range of possible significant repercussions in relation to adolescents in particular. These include a negative impact on the areas of identity formation, cognitive functioning, academic performance, dietary behavior, interpersonal relationships, involvement in risky activities, self-injury tendencies, as well as brain development (Y.

Kim et al., 2010; Y.-R. Kim et al., 2012; Kuss & Griffiths, 2012a, 2012b; Kuss, Griffiths, Karila, & Billieux, 2014; Lam, Peng, Mai, & Jing, 2009; Lin et al., 2012; Milani, Osualdella, & Di Blasio, 2009; Park et al., 2011; Tsitsika et al., 2011; Winkler, Dörsing, Rief, Shen, & Glombiewski, 2013; Yuan et al., 2011). Consequently, identifying factors that may explain the risk of IA could provide useful clinical recommendations for emerging prevention and treatment interventions.

To better define and assess such risk factors, it was considered that the risk for any form of psychopathology dynamically changes with development according to the interplay between individual and contextual characteristics (Bronfenbrenner & Morris, 2006). However, to the best of the authors' knowledge, there is a lack of longitudinal studies assessing contextual effects regarding IA. To serve this longitudinal goal, the present research adopted a comprehensive conceptual framework that combined elements of the bioecological model of human development (Bronfenbrenner & Morris, 2006), principles of the developmental psychopathology approach (Cicchetti, 2013), and the risk and resilience framework (Masten, 2014), alongside integrated and multilevel biopsychosocial addiction models (Griffiths, 2005; Kuss, Shorter, van Rooij, Griffiths, & Schoenmakers, 2014) as well as a model of understanding IA (Douglas et al., 2008).

More specifically, the bioecological model of human development contends that all behaviors constantly evolve on a continuum due to the interaction of individual and contextual factors over time (Bronfenbrenner & Morris, 2006). Following this line of thought, the developmental psychopathology approach suggests that the same combination of factors may produce different outcomes (i.e., multifinality), while contrariwise different combinations of factors may result in the same behaviors (i.e., equifinality), depending on the interplay of specific developmental and contextual conditions (Cicchetti, 2013). Subsequently, the developmental psychopathology approach advises the necessity of conducting multiple levels of analysis to better examine the over-time interactions of various factors within different contexts (Cicchetti, 2013). This need is equally highlighted in the risk and resilience framework that further describes the contribution of risks, resources, and moderating effects on each of the levels involved (i.e., individual and contextual), placing particular emphasis on the significance of developmental timing (Masten, 2014).

Similarly, the biopsychosocial framework of addiction illustrates that addictions are the result of biopsychosocial processes that involve the effects of both individual and social factors, as well as their dynamic interactions (Griffiths, 2005). Considering IA in particular, Douglas et al. (2008) explained that it is caused by the interplay between "push and pull factors."

The individual's inner needs and offline antecedents (i.e., peer influences) are presented as factors that may push the individual to Internet dependency, while the attractive features of Internet applications are understood as factors that could pull the user into developing IA. These aforementioned theoretical perspectives appear to overlap to the extent that they explain the development of behaviors, including addictions and IA, as a result of the dynamic interplay between individual and ecological risks and resources over time. Consequently, in the integrative conceptualization adopted, IA behavior is conceptualized as being a continuum (ranging from minimum to maximum risk), taking into account push factors that entail age-related changes, characteristics of the individual user, factors within Internet users' proximate context, and pull factors that refer to characteristics of the medium (e.g., online context and activity), as well as their interactions. The present study emphasizes the effects of push factors, which are operationalized by the three levels of the multilevel analysis applied—the temporal factors (i.e., behavior over time), individual psychosocial factors, and the contextual factors, as well as their interactions.

Age-Related Changes

Considering age-related changes in IA behavior, the present study emphasizes adolescence (and more specifically the 16- to 18-year-old age range). Adolescence is a critical developmental period (Luengo Kanacri et al., 2014), a vulnerable time for addictions to develop (Hurd, Michaelides, Miller, & Jutras-Aswad, 2014), and a time of high leisure involvement with activities on the Internet (Madden, Lenhart, Duggan, Cortesi, & Gasser, 2013) that could potentially increase IA risk (Kuss et al., 2014). More specifically, given that adolescent behavior demonstrates flexibility and plasticity (Luengo Kanacri et al., 2014), the initiation of IA behaviors could significantly influence adolescents' future development. Furthermore, addictive patterns that commence during adolescence have been suggested to often hold over the lifespan (Englund, Egeland, Oliva, & Collins, 2008). Moreover, older adolescents (i.e., aged between 16 and 18 years) forego developmentally the age of highest prevalence of Internet access (Madden et al., 2013), while they have been shown to be at high risk for IA (Stavropoulos, Alexandraki & Motti, 2013).

Consequently, researchers have argued that it is particularly important to investigate IA among adolescents, because they are in the middle of their personality and psychological development and they are likely more vulnerable than adults to the negative repercussions of IA, especially in relation to the development of their social skills (Kaltiala-Heino, Lintonen, & Rimpelä,

2004). In the present study, these potential age-related effects are investigated in the light of their interaction with critical individual and contextual IA risk (push) factors.

Conscientiousness as an Individual Factor

Numerous individual factors, such as psychopathological symptoms and socialization difficulties, have been associated with IA (Kuss et al., 2014). The present study emphasizes the effect of conscientiousness as a personality trait on IA. According to the widely studied Five Factor Model of personality, conscientiousness entails responsibility, reduced impulsivity, and compliance to social rules (Costa & McCrae, 1992). The choice to assess conscientiousness in the context of IA was based on two main reasons. First, lower conscientiousness has been consistently associated with various forms of addiction including substance abuse (Kotov, Gamez, Schmidt, & Watson, 2010), alcoholism (Alminhana & Farias, 2014), and smoking (Terracciano & Costa, 2004). Second, although decreased conscientiousness has been related to IA through cross-sectional findings (Kuss, van Rooij, Shorter, Griffiths, & van de Mheen, 2013; Peters & Malesky, 2008; Wilson, Fornasier, & White, 2010), there is a dearth of evidence regarding possible age-related variations of its link with IA.

For instance, cross-sectional findings in a sample of 196 players (mean age = 24.34) of Massively Multiplayer Online Role-Playing Games (MMORPGs) assessed with the Problematic Usage–Engagement Questionnaire (Peters & Malesky, 2008) and the NEO Personality Inventory–Revised (Costa & McCrae, 1992) indicated that IA negatively correlated with higher conscientiousness (Peters & Malesky, 2008). A more recent study by Kuss and her colleagues (2013) investigated IA and its risk factors in 3,105 adolescents in the Netherlands using the Compulsive Internet Use Scale (Meerkerk, Van Den Eijnden, Vermulst, & Garretsen, 2009) and the Quick Big Five Scale (Vermulst & Gerris, 2005). Their findings demonstrated that higher conscientiousness was a protective factor among online gamers. Finally, similar results have been found regarding the use of social networking sites (SNSs; Wilson et al., 2010). Wilson and colleagues (2010) assessed the psychological predictors of SNS use in 201 young Australians aged 17 to 24 years using self-reports of SNS use, addictive tendencies (i.e., degree of experienced salience, loss of control, and withdrawal), the NEO Five-Factor Personality Inventory (Costa & McCrae, 1992) and the Coopersmith Self-Esteem Inventory (Coopersmith, 1981). Their results suggested that individuals with low levels of conscientiousness spent more time using SNS and had higher addictive tendencies (Wilson et al., 2010). A negative association

between adolescents' conscientiousness and IA was also revealed in a study of 339 Chinese adolescent students (Yang, Li, & Mingxin, 2006). The study additionally supported that the relationship between IA and Internet socialization was negative for adolescents low in conscientiousness. The link between lower conscientiousness and IA risk in adolescence in particular, has been interpreted on the basis of its associated lower sense of impulse control, control over behavior in general, and in accordance with social rules (Gnisci, Perugini, Pedone, & Di Conza, 2011). In addition, it has been contended that less conscientious adolescents may choose to use the Internet over other less pleasurable activities, such as their homework (Kuss et al., 2013). Consequently, one could assume that they may be less motivated to control or regulate their addictive patterns.

However, both IA risk and the level of conscientiousness as a personality trait have been found to change over time. More specifically, developing individuals have been shown to progressively increase their level of conscientiousness, possibly as a result of their increasing conformity with societal expectations over time (Leikas & Salmela-Aro, 2015). In addition, IA risk has been found to decrease among older individuals because of maturation effects (Vollmer, Randler, Horzum, & Ayas, 2014), as well as the possible reduction of interest in Internet applications due to longer exposure to them (Young, 1998). Given the dearth of relevant previous studies, investigating possible age-related changes in the relationship between lower conscientiousness and IA may significantly contribute to the existing literature. More specifically, it may clarify the possible IA risk age ranges and mitigate concerns regarding IA risks that could decrease in the course of psychosocial maturation.

The Classroom

In addition to the aforementioned age-related and individual factors, the present study aimed to examine the possible role of the social context of Internet users as an IA push factor. The significance of contextual influences has been repeatedly highlighted in relation to behavioral development in general (Bronfenbrenner & Morris, 2006), the development of addictions (Griffiths, 2005), and the development of IA in particular (Douglas et al., 2008). More specifically, Douglas and colleagues (2008) suggested that social context factors have the capability to function as antecedents of IA. They argued that the Internet user's social state within his or her real context could introduce feelings of loneliness and/or boredom, which may reinforce IA behaviors, in a way of using virtual relationships to achieve feelings of comfort and community. Furthermore, adolescents are said to be very vulnerable to effects of

their context, and more specifically their classroom and peers (Ryan & Patrick, 2001). Consequently, recent studies have indicated that the classroom context contributes to cyberbullying behaviors (Festl, Scharkow, & Quandt, 2013). Following this line of thought, Bronfenbrenner and Morris supported the theory that the influence of proximal context factors, such as classroom characteristics, is filtered and critically depends on its interaction over time with characteristics (e.g., gender) of the individual (Bronfenbrenner & Morris, 2006). Therefore, the present study investigated the classroom context of the adolescent participants in relation to gender over time, utilizing the nesting of the data collected (from 648 teenage participants nested within 34 classrooms).

Despite the richness of relevant theoretical suggestions regarding the importance of context for behavioral development (Bronfenbrenner & Morris, 2006; Douglas et al., 2008; Griffiths, 2005), there is a scarcity of similar research findings regarding IA. This lack of empirical research becomes more prominent considering contextual conditions that have been repeatedly associated with addictions and appear to induce feelings of loneliness, such as hostility (Collins & Steinberg, 2006; Miller, 2013), providing a rationale to assess classroom hostility in the present study. Exposure to hostility has been associated with risk for adolescents' well-being and the manifestation of addictive behaviors (Collins & Steinberg, 2006; Miller, 2013). For example, individuals who have experienced widely differing forms of hostility from others in their childhood, including physical and emotional abuse, have been found to present higher risk for alcohol abuse (Bácskai, Czobor, & Gerevich, 2009; Sartor et al., 2007). Likewise, the incidence of victimization has been associated with the development of substance abuse behaviors (Banducci, Hoffman, Lejuez, & Koenen, 2014). In relation to adolescents more specifically, it has been found that individuals who are exposed to mental or physical hostility have increased chances of developing substance abuse independent of their gender, grade, ethnicity, and past involvement with substances (Tharp-Taylor, Haviland, & D'Amico, 2009). Therefore, there are robust theoretical grounds to investigate the role of classroom hostility in more depth.

It has also been suggested that addictions often function as emotion regulation strategies that help individuals to handle the repercussions of experiences of aggression and hostility and to escape from their negative feelings (e.g., Banducci et al., 2014; Wood & Griffiths, 2007). Accordingly, addictions such as pathological gambling have been characterized as behaviors through which an individual tries to address the pressure of a stressful reality (Wood & Griffiths, 2007). Regarding IA in particular, it has been suggested that some individuals may use the Internet as a way to

mentally escape from adverse situations in their everyday life (Young, 2009). This is in consensus with the theory of compensatory Internet use, which assumes that users who excessively use the Internet often manifest it as a way to compensate the challenges of their offline context (Kardefelt-Winther, 2014). Past studies have provided empirical evidence that strengthens this hypothesis revealing that escapism (from a negatively experienced real context) predicts excessive Internet use among online gamers (Yee, 2006) and that Internet use decreases arousal in children and adolescents in particular (Leung, 2007). In addition, a recent study with a representative sample of 1,357 adolescents concluded that there is a strong association between peer victimization and IA, partially explained by psychological symptoms (Strittmatter et al., 2014). Given that IA often functions as a way to escape from an unpleasant reality (Griffiths, 1998; Widyanto & Griffiths, 2009; Young, 1998, 2009), it is expected that being in classrooms higher in hostility might increase the risk of IA. However, this depends on the interaction of classroom hostility with individual characteristics over time (Bronfenbrenner & Morris, 2006).

In particular, it has been suggested that there are gender differences regarding interaction with peers and addressing contextual discomfort (Rose & Rudolph, 2006). For example, girls appear to conform more easily to peer pressure (Rose & Rudolph, 2006), whereas boys appear to be more competent in handling hostility (Hyde, 2014). In addition, adolescent girls have been found to use more passive and support seeking ways of addressing stress than adolescent boys (Piko, 2011). This has been attributed to gender socialization differences that place more emphasis on autonomy and independence for boys and social relations for girls (Piko, 2011). In general, it has been explained that adolescent boys tend to develop more active ways to deal with contextual challenges than adolescent girls, who tend to withdraw (Piko, 2011), possibly putting themselves at higher risk for IA.

Empirical findings have also indicated a normative shift toward less confrontational responses to contextual discomfort (Cairns, Cairns, Neckerman, Ferguson, & Garipey, 1989) and a gradually increased emphasis to more tension-reducing behaviors (Frydenberg & Lewis, 1993) over development in adolescence in general. Consequently, it is expected that girls may be at higher risk of developing IA over time, when situated in more hostile classrooms, because their need to escape online, possibly to find social support in their virtual relationships (Douglas et al., 2008), might be stronger than that of boys. It should also be noted that the possible contribution of classroom hostility to IA has neither been studied longitudinally, nor in relation to gender. Therefore, the present study aims to fill these gaps in empirical knowledge.

Hypotheses in the Present Study

To address the contribution of conscientiousness and hostility at the classroom level in the context of adolescents developing IA, the present study assessed a normative sample of adolescents longitudinally over a period of 2 years (16-18 years of age). In addition, IA risk was measured on a continuum, using the entire range of IA scores from minimum to maximum risk, and utilizing nested data in classrooms to investigate possible contextual effects due to classroom level of hostility. More specifically, the following two overarching hypotheses, formulated in the context of the integrative model adopted, were addressed:

Hypothesis 1: Lower conscientiousness will act as an individual-level risk (push) factor in the development of IA.

This hypothesis was based on previous empirical findings that supported the association of lower conscientiousness with different forms of addictions (Alminhana & Farias, 2014; Kotov et al., 2010; Terracciano & Costa, 2004) and cross-sectional findings indicating a significant association between lower conscientiousness and IA risk in adolescence (Gnisci et al., 2011; Kuss et al., 2013). In particular, it has been suggested that lower sense of orderliness, work effort, and impulse control, as well as Internet use preference over less pleasurable activities (e.g., homework) explains the higher IA risk of less conscientious adolescents (Gnisci et al., 2011; Kuss et al., 2013).

Hypothesis 2: Higher average level of classroom hostility will act as a contextual risk (push) factor, especially for girls, in the development of IA.

This hypothesis was based on IA studies that suggest social context factors as antecedents of IA, to the extent that they reinforce feelings of loneliness and discomfort that may induce IA as an escaping and compensatory behavior (Douglas et al., 2008; Kardefelt-Winther, 2014; Young, 2009). Furthermore, research findings have supported the contention that adolescents' behavior and Internet use patterns are highly influenced by their context and their classroom in particular (Festl et al., 2013; Ryan & Patrick, 2001). Accordingly, contextual hostility has been related to higher feelings of loneliness and discomfort in adolescence (Collins & Steinberg, 2006), while girls have been suggested to adopt more passive and social support seeking ways to address these issues than boys (Piko, 2011), which may contribute to a higher IA risk for girls. Finally, empirical findings indicated a normative shift toward less

confrontational responses to contextual discomfort (Cairns et al., 1989) and a gradually increased emphasis on more tension-reducing behaviors for girls (Frydenberg & Lewis, 1993), such as online escape. Consequently, it is anticipated that IA risk, especially for girls in more hostile classrooms, would increase over time.

Method

Participants

This study was conducted by the Department of Psychology of the University of Athens in Greece in the schools of the adolescent students. The study received approval from the (a) Greek Ministry of Education and (b) the Teachers' Council of each school that participated in the study. In addition, parental consent was granted for all participants. The sample was selected from the capital metro area of Athens, and the prefecture of Korinthia (North East Peloponnese) using randomized stratified selection based on the latest inventory card of the Greek Ministry of Education regarding these two areas. Consecutively, the ratios of high schools and students were identified between (a) the extended capital metro area and the selected regional population, and (b) academic and vocational track high schools within these areas. Based on these quotas, school units and classrooms of participants were randomly selected via a lottery. It is noted that in order to assess the effect of the classroom context, all students of each classroom were enrolled in the study. In addition, chi-square analysis confirmed that the distribution of the valid sample did not differ significantly from that of the original population ($\chi^2 = 3.83$, $p < .05$).

The study sample comprised 648 students attending 34 classes in 13 Greek public, academic, and vocational track high schools. With respect to the parents' and guardians' socioeconomic profile, 78.7% were married, 8.3% of the mothers and 8.6% of the fathers were unemployed, and 89% of the mothers and 87% of the fathers had completed high school. Parental consent and response rates were obtained for over 95% of the initial sample. The estimated maximum sampling error with a sample size of 648 was 3.85% at the 95% confidence level ($Z = 1.96$).

The students were assessed twice using a "paper-and-pencil" survey over a period of 2 years (Wave 1: age = 15.75 years, $SD = 0.57$ years, boys = 46.4%, girls = 53.6%, Academic Track High Schools = 89%, Vocational Track High Schools = 11%, Athens Metro Area = 92.7%, Korinthia = 7.3%; Wave 2: age = 17.75 years, $SD = 0.54$ years, boys = 49.9%, girls = 50.1%, Academic Track High Schools = 80.3%, Vocational Track High Schools = 19.7%, Athens

Table 1. Assessment of the Effects of Attrition in Hierarchical Linear Modelling (HLM) Analysis.

	Fixed effects with robust standard errors				
	b_i	SE	T	df	p_i
Attrition	7.21	7.51	.96	32	.344
Gender \times Attrition	.34	2.76	.12	33	.904
Conscientiousness \times Attrition	-1.41	2.29	-.62	33	.541
Classroom Hostility \times Attrition	7.91	5.59	1.41	32	.167
Attrition \times Time	-4.22	2.65	-1.59	33	.121

Metro Area = 89.9%, Korinthia = 10.1%). Retention between the two waves was 56%. The frequency of assessments for each individual varied (1-2, $M = 1.57$). Although attrition was unsystematic, it required a careful evaluation of attrition effects regarding the studied variables. Therefore, attrition was used as an independent variable to assess whether it affected IA scores and whether it interacted with the other independent variables (e.g., time, gender, conscientiousness, average level of hostility in the classroom) in relation to IA scores. Results confirmed that attrition did not associate with the studied variables and neither did it affect correlations between IA and the independent variables in the tested model (Table 1).

Measures

Internet Addiction Test (IAT). The IAT (Young, 1998) was used to assess IA. The IAT is a widely used IA measure (Korkeila et al., 2008), which has been translated into Greek and provides (a) standardized cutoff points for Greek adolescents (Stavropoulos et al., 2013) and (b) comparability of the findings with other Greek studies (Stavropoulos et al., 2013) in addition to international studies (Korkeila et al., 2008). The IAT contains 20 questions examining the negative consequences of Internet use (e.g., "How often do you find that you stay online longer than you intended?" "How often do you choose to spend more time online over going out with others?" "How often do others in your life complain to you about the amount of time you spend online?" "How often do your grades or schoolwork suffer because of the amount of time you spend online?" "How often do you block out disturbing thoughts about your life with soothing thoughts of the Internet?"). There are six possible responses for each question on a 6-point Likert-type scale ranging from 0 (*it does not concern me*) to 5 (*always*).

The IAT's internal reliability was satisfactory with a Cronbach's $\alpha = .93$. Moreover, a principal component analysis (direct oblimin rotation) was performed to assess the factorial structure of the instrument in relation to previous studies. The Kaiser–Meyer–Olkin value was 0.94 and Bartlett's Test of Sphericity was 9,110.56 ($p < .001$), both within acceptable limits. Three components with eigenvalues greater than 1 were extracted, explaining 42.68%, 6.75%, and 5.03% of the variance, respectively (overall explained variance 54.46%). These three factors referred to symptoms of withdrawal and social difficulties, time management issues, and ritual use of the Internet to acquire satisfaction. Findings were similar to previous studies (e.g., Khazaal et al., 2008; Stavropoulos et al., 2013).

Five-Factor-Questionnaire for Children (Fünf-Faktoren-Fragebogen für Kinder, FFFK): Conscientiousness subscale. To assess conscientiousness, the relevant subscale of the FFFK was used (Asendorpf & Van Aken, 2003). The FFFK is an internationally used instrument for investigating personality traits (Neuenschwander, Cimeli, Röthlisberger, & Roebbers, 2013) and has been translated into Greek, and has been used effectively for studying Greek adolescents (Motti-Stefanidi & Asendorpf, 2012). The questionnaire comprises five subscales: Extraversion, Emotional Stability (emotional stability refers to inverse neuroticism), Conscientiousness, Agreeableness, and Openness to Experience. Each scale includes eight bipolar adjectives that are answered on a 5-point scale (i.e., *very, somewhat, neither/nor, somewhat, and very*). Given the emphasis of the present study on conscientiousness, only the eight items comprising the Conscientiousness subscale were used in the analysis. Items related to conscientiousness concern responsibility, reduced impulsivity, and compliance to social rules. The internal consistency of the Conscientiousness subscale in the present study was adequate with a Cronbach's $\alpha = .67$.

Symptom Check List–90–Revised (SCL-90-R): Hostility subscale. To assess hostility levels, the Hostility subscale of the SCL-90-R was used (Derogatis & Savitz, 1999). The SCL-90 has previously been used widely for assessing the associations between psychopathology symptoms and IA, both in Greece and internationally (Floros, Siomos, Stogiannidou, Giouzepas, & Garyfallos, 2014; Jang, Hwang, & Choi, 2008). The Hostility subscale describes thoughts, feelings, or behavioral characteristics of the negative state of anger. More specifically, it includes six items that reflect qualities such as aggression, irritability, rage, and resentment. Participants respond on a 5-point Likert-type scale regarding how much they have suffered from each of the symptoms covered over the last 6 months (e.g., “Temper outbursts that you could not control,” “Shouting or throwing things”). The internal consistency of the

subscale was high with a Cronbach's $\alpha = .85$. To assess the effect of hostility as a classroom characteristic, the methodology used by McCrae and Terracciano (2005) for assessing group effects was used. Individual scores of hostility within the same classroom were aggregated to calculate the classroom mean.

Procedures

The first time point measurements were collected in the school year 2009-2010 and the second time point measurements were collected in the school year 2011-2012. The process of data collection was identical between the two time points. A specially trained research team of 13 undergraduate, postgraduate, and PhD students of the Department of Psychology of the University of Athens collected the data in the participants' classrooms during the first two or the last two school hours (45 minutes each) of a school day, according to the permission provided by the Ministry of Education. The adolescents were motivated to participate in the study by the fact that they would not have to attend subjects taught during the time of the study and they would not be considered as absent from lessons. It should be noted that according to the Greek school regulation, students are allowed to progress to the next grade on the condition that they have not exceeded 50 school hours of unjustified absence per school year.

Results

Descriptive Statistics and Correlations

Prior to conducting the analysis, the means, standard deviations, and correlations between the variables used in this study were calculated (see Table 2). Gender (0 = girls, 1 = boys) significantly negatively correlated with conscientiousness at Wave 1, indicating that boys at the age of 16 years were less conscientious than girls ($r = -.09, p < .05$). Moreover, gender positively correlated with IA scores at Wave 2 ($r = .20, p < .001$), revealing that boys presented higher IA scores than girls at the age of 18 years. Conscientiousness at Wave 1 significantly positively correlated with conscientiousness at Wave 2 ($r = .89, p < .001$) and significantly negatively correlated with IA scores at Wave 1 ($r = -1.40, p < .01$) and at Wave 2 ($r = -1.80, p < .001$). These indicated that less conscientious adolescents at the age of 16 years were more likely to be less conscientious at the age of 18 years, while they were less likely to be at higher risk for IA both at the age of 16 and 18 years. Similarly, conscientiousness at Wave 2 significantly negatively correlated with IA

Table 2. Means, Standard Deviations, and Correlations of the Hierarchical Linear Modelling (HLM) Analysis Variables.

Wave	M	SD	Gender	1	2	3	4	5
1. Conscientiousness Wave 1	3.15	0.45	-.09*					
2. Conscientiousness Wave 2	3.58	0.62	-.13	.89***				
3. Classroom hostility Wave 1	1.17	0.24	-.01	.00	-.08			
4. Classroom hostility Wave 2	1.15	0.29	-.02	-.05	-.08	.42***		
5. IA Wave 1	29.53	17.54	.01	-1.40**	-.22***	.02	.03	
6. IA Wave 2	24.49	17.65	.20***	-1.80***	-.23***	-.01	.07	.43***

Note. Girls = 0, Boys = 1. IA = Internet addiction.

* $p \leq .05$. ** $p \leq .01$. *** $p \leq .001$.

scores at Wave 1 ($r = -.22, p < .001$) and Wave 2 ($r = -.23, p < .001$), revealing that less conscientious adolescents at the age of 18 years were more likely to present higher IA scores both at the age of 16 years and at the age of 18 years. Furthermore, classroom hostility at Wave 1 significantly positively correlated with classroom hostility at Wave 2 ($r = .42, p < .001$). Finally, IA scores at Wave 1 significantly positively correlated with IA scores at Wave 2 ($r = .43, p < .001$), indicating that adolescents who were at higher risk for IA at the age of 16 years were similarly at higher risk for IA at the age of 18 years.

Model Testing Procedures

The two measurements were embedded within individuals, and individuals were embedded within classrooms (see Figure 1.). Therefore, multilevel analysis using HLM 6.0.8 software was applied (Raudenbush, 2004). To evaluate the extent to which the three levels of analysis (age-related change, individuals, classrooms) were associated with the overall variation in IAT scores, the variance components of each level from the unconditional model (a three-level model without independent variables) were calculated. Results confirmed the need of applying HLM (χ^2 Level 2 = 1,272.85, $p < .001$; χ^2 Level 3 = 46.93, $p < .05$).

Furthermore, to treat missing values at Level 2/individual multiple imputation was applied (in HLM, the missing values do not present a problem at Level 1/time-related change and did not occur at Level 3/classrooms in the data). This approach was followed for three reasons: (a) missing values with respect to the studied variables were unsystematic in our data (see Table 1), (b) to avoid list-wise deletion that would reduce the sample; and (c) to follow relevant previous literature recommendations (Van Buuren, 2012). Therefore,

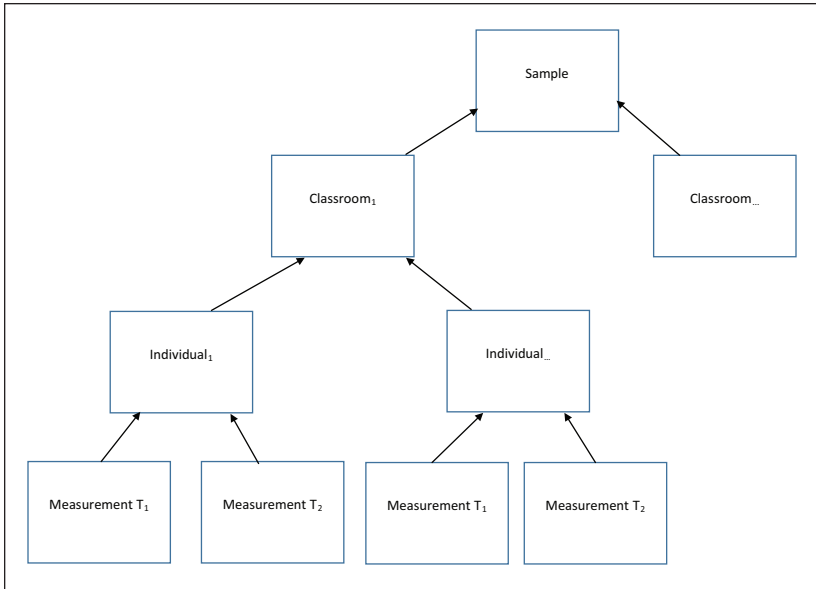


Figure 1. Data nesting.

multiple imputation was performed using all available Level 2 variables. All multilevel analyses were run using the multiple imputation option of HLM 6.0.8. Thus, all multilevel analyses were run 5 times, and the results of the five runs were averaged. At the age-related change level (Level 1), IA score was regressed on time; at the individual level (Level 2), the Level 1 coefficients were regressed on conscientiousness and gender; and at the classroom level (Level 3), the Level 2 coefficients were regressed on the average level of classroom hostility. The interest of the study was in both the main effects of the predictor variables at Levels 2 and 3, as well as in the interactions of age-related, individual-level, and classroom-level variables. Thus, in subsequent analyses all regression slopes were fixed. More specifically,

Level 1 (Measurements Within Individuals): The IAT score was predicted for each individual at Level 1 by wave (time) in the study. Wave was centered at Wave 1, such that the individual intercepts referred to the initial level of IA risk. Thus, Wave 1 was recoded as 0, Wave 2 as 1. As a result, the following equation was formulated:

$$Y = \pi_0 + \pi_1 \times (WAVE) + \varepsilon.$$

Level 2 (Individual Level): Conscientiousness and gender were used as independent variables at Level 2, respectively. Gender was centered at girls. Therefore, girl was recoded as 0 and boy as 1. As a result, the following equations were formulated:

$$\pi_0 = \beta_{00} + \beta_{01} \times (GENDER) + \beta_{02} \times (FFFK_CON) + \rho_0,$$

$$\pi_1 = \beta_{10} + \beta_{11} \times (GENDER) + \beta_{12} \times (FFFK_CON) + \rho_1.$$

Level 3 (Individual Within Groups/Classes): The classroom mean level of hostility was (grand centered) added in the third level (classroom) of the model. As a result, the following equations were formulated:

$$\beta_{00} = \gamma_{000} + \gamma_{001} \times (SCL_ANGE) + u_{00},$$

$$\beta_{01} = \gamma_{010} + \gamma_{011} \times (SCL_ANGE) + u_{01},$$

$$\beta_{02} = \gamma_{020} + \gamma_{021} \times (SCL_ANGE) + u_{02},$$

$$\beta_{10} = \gamma_{100} + \gamma_{101} \times (SCL_ANGE) + u_{10},$$

$$\beta_{11} = \gamma_{110} + \gamma_{111} \times (SCL_ANGE) + u_{11},$$

$$\beta_{12} = \gamma_{120} + \gamma_{121} \times (SCL_ANGE) + u_{12}.$$

Levels 1, 2, and 3 (Between Measurements, Between Individuals, and Between Classes)

To summarize the analyses performed, (a) time was used as predictor of IAT scores at Level 1, (b) conscientiousness and gender were added at Level 2 to predict both initial levels, age slopes, different slopes between genders, and different slopes between classrooms with different mean levels of hostility, and (c) classroom mean level of hostility was used at Level 3 to test for its effect and its possible interactions with conscientiousness and gender on the initial level and on age slopes, respectively. Table 3 contains the results of these analyses.

More specifically, Table 3 summarizes the main results regarding the individual and classroom factors, examined along with their interactions, and is divided into four parts. The upper left part presents the cross-sectional findings without controlling for random effects. The lower left part presents the

Table 3. Hierarchical Linear Modelling (HLM) Analysis Predicting Adolescents' Internet Addiction Scores.

	IAT score																				
	Cross-sectional findings							Over time findings													
	Without controlling for random effects			Controlling for random effects				Without controlling for random effects			Controlling for random effects										
	<i>b</i> ₁	SE	<i>T</i>	<i>df</i>	<i>p</i> ₁	<i>b</i> ₁	SE	<i>T</i>	<i>df</i>	<i>p</i> ₁	<i>b</i> ₁	SE	<i>T</i>	<i>df</i>	<i>p</i> ₁						
Intercept	28.91	1.37	21.13	32	.000	28.91	1.44	20.12	32	.000	-6.23	1.56	-3.99	32	.000	-6.23	1.46	-4.27	32	.000	
Individual level																					
Conscientiousness	-5.44	1.82	-2.99	32	.006	-5.45	1.71	-3.19	32	.004	.47	2.27	.21	32	.84	.47	2.20	.21	32	.83	
Contextual level																					
Hostility within classroom	1.92	5.40	.36	32	.72	1.93	5.70	0.34	32	.74	11.39	6.60	1.73	32	.09	11.38	5.08	2.24	32	.03	
Cross-level interactions																					
Conscientiousness × Hostility within classroom	-3.96	7.23	-.55	32	.59	-3.96	6.62	-0.60	32	.55	6.78	9.04	.75	32	.46	6.78	6.58	1.03	32	.31	
Gender × Hostility within classroom	.19	7.62	.03	32	.98	.19	9.09	.02	32	.98	-16.92	8.96	-1.89	32	.07	-16.93	6.49	-2.61	32	.01	

Note. Reported are the significances *p*₁ for increased fit by adding predictors of initial level and age-related changes of IAT scores and the unstandardized initial regression coefficients *b*₁ with the Level 1 predictors: (a) wave is centered at age 16 and (b) gender is centered on girls. Conscientiousness and gender were used as predictors at Level 2 (individual) and hostility within classroom as predictor at Level 3 (classroom). IAT = Internet Addiction Test.

over-time change results without controlling for random effects. The upper right part presents the cross-sectional findings after controlling for random effects at Levels 2 (individual) and 3 (Classroom). The lower right part presents the over-time change results after controlling for random effects at Levels 2 (individual) and 3 (Classroom).

As expected, controlling for random effects differentiated the results, and therefore, only the results after controlling for random effects were considered (right side of the table). More specifically, the Level 1 intercept for the cross-sectional findings is 28.91. This is the estimated mean IA score for adolescents of average conscientiousness situated in classrooms of average hostility at age 16 years. Regarding Hypothesis 1, the coefficient for conscientiousness was -5.45 ($p < .01$) and indicated that adolescents who scored 1 point lower than the estimated mean in conscientiousness are predicted to have an IA score that is 5.45 points higher than the mean IA score. Consequently, the average IA score of adolescents who scored 1 point lower than the estimated mean in conscientiousness was 34.46 ($28.91 + 5.45 = 34.46$). Considering the over-time effect of conscientiousness (Time \times Conscientiousness), the coefficient was $.47$, $p > .05$, and indicated that the interaction of conscientiousness with time was not significant. Consequently, the effect of conscientiousness on IA scores at the age of 16 years did not significantly change over time, having controlled for random effects at both the individual and the classroom level.

In addition, results revealed that the effect of the interaction between conscientiousness and classroom hostility was not significant. The coefficient was -3.96 , $p > .05$, and suggested that the IA score of an adolescent with 1 point lower than the estimated average level of conscientiousness, who was situated in a classroom of 1 point higher than the estimated average level of hostility at the age of 16 years, would be 32.87 ($28.91 + 3.96 = 32.87$). However, this change was not statistically significant. Furthermore, this association was not moderated by time. More specifically, the coefficient for the interaction of time with conscientiousness and classroom hostility was 6.81 ($p > .05$), indicating that the effect of conscientiousness did not significantly change across classrooms of different average levels of hostility over time.

Regarding Hypothesis 2, the coefficient for classroom hostility was 1.93 , $p > .05$. This indicated that IA scores of adolescents, who were situated in classrooms with 1 point higher than the estimated mean of classroom hostility at the age of 16 years reached 30.84 ($28.91 + 1.93 = 30.84$). Nevertheless, this change was not statistically significant. In addition, results revealed that the effect of classroom hostility did not differentiate across genders at the age of 16 years. The coefficient of the interaction of gender with classroom hostility was $.19$, $p > .05$. Considering the over-time effect of classroom hostility,

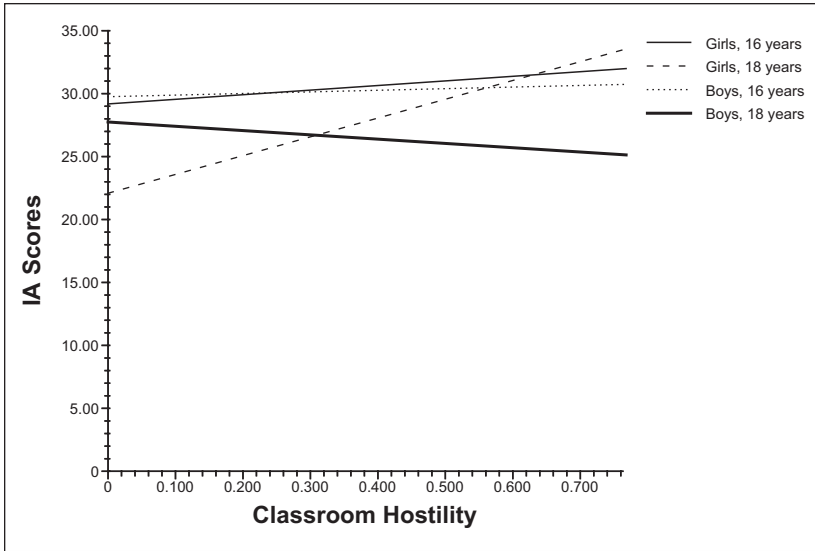


Figure 2. The change in IA scores between 16 and 18 by gender and classroom hostility.

Note. IA = Internet addiction.

the coefficient was 11.38, $p < .05$, and indicated that adolescents who were in classrooms that scored 1 point higher than the average in classroom hostility at the age of 16 years were predicted to have an IA score higher per 11.38 at the age of 18.

Finally, gender was found to significantly moderate the over-time effect of classroom hostility. More specifically, the coefficient for the interaction of time at Level 1 with gender at Level 2 and classroom hostility at Level 3 was -16.93 , $p < .05$. This supported that a boy, who was situated in a classroom of 1 point higher than the estimated average level of classroom hostility at the age of 16 years, would have a lower IA score per 16.93 at the age of 18 years. Results demonstrated that although classrooms with higher level of hostility did not associate with IA risk at the age of 16 years, they posed a risk for girls at the age of 18 years. However, classrooms higher on hostility at the age of 16 were associated with reduced IA vulnerability for boys at the age of 18 years. Figure 2 illustrates the increase of IA scores for girls at the age of 18 years, when situated in classrooms of higher average level of hostility compared with a decline of IA scores for boys. Overall, the model including all the predictors analyzed explained 22.93% of the variance in IAT scores.

Discussion

The present research investigated the risk of IA on a continuum using an integrative conceptual framework. More specifically, the study investigated the associations between critical individual and contextual characteristics, such as conscientiousness (as a personality trait) and classroom hostility, in a normative and sample of adolescents between 16 and 18 years old longitudinally. In addition, possible gender differences were assessed in terms of IA risk when being in more hostile classrooms. The results of the multilevel model that was applied confirmed previous cross-sectional findings regarding the association between lower conscientiousness and IA and contributed knowledge to the existing literature in three aspects: (a) the relationship between lower conscientiousness and IA appears to be stable between 16 and 18 years, (b) higher levels of classroom hostility contribute to IA risk over time, and (c) girls appear to be at higher IA risk than boys when in more hostile classrooms. Accordingly, the present study further highlights the need of adopting a more holistic point of view in relation to IA, embracing both contextual and developmental parameters when studying individual IA risk factors.

Conscientiousness

When considering individual factors, the findings of the present study confirm that lower levels of conscientiousness that increase IA risk are in consensus with the existing literature (Gnisci et al., 2011; Kuss et al., 2013). The important contribution of individual characteristics has been repeatedly illustrated in relation to behavioral development in general (Bronfenbrenner & Morris, 2006), the development of addictions (Griffiths, 2005), and the development of IA in particular (Douglas et al., 2008). Furthermore, lower conscientiousness has been associated with increased risk for a range of addictions, including smoking, substance abuse, and alcohol abuse (Alminhana & Farias, 2014; Kotov et al., 2010; Terracciano & Costa, 2004). Reduced conscientiousness has also been linked to IA risk in several cross-sectional studies considering young adults, excessive gamers, and adolescents (e.g., Kuss et al., 2013; Peters & Malesky, 2008; Wilson et al., 2010; Yang et al., 2006). The association between lower conscientiousness and IA in adolescence in particular can be explained in two ways. First, reduced conscientiousness may induce lower impulse control increasing the vulnerability for IA (Gnisci et al., 2011). Second, less conscientious adolescents may learn to use the Internet over other less preferred activities related to their school or home obligations (e.g., studying, tidying their room), placing

themselves at risk to develop IA (Kuss et al., 2013). These tendencies can act as individual risks that might prompt adolescents to excessively use the Internet for enjoyment, especially when they are experiencing negative feelings. Following this line of thought, Douglas et al. (2008) adopted the previously suggested description of enjoyment-driven Internet overuse as “ritualistic” in their model of understanding IA and highlighted it as a main characteristic of a significant group of IA users (Douglas et al., 2008; Mafé & Blas, 2006). Therefore, from the perspective of the risk and resilience framework (Masten, 2014), it is likely that lower conscientiousness functions as a risk factor that may increase the possibility for an adolescent to develop IA.

The results also demonstrated that the association between conscientiousness and IA did not significantly change between 16- and 18-year-olds. This indicates that this association is relatively stable during this particular developmental period. In the light of the significance of developmental timing, as this was highlighted in the risk and resilience framework (Masten, 2014), it appears the critical period to develop IA for adolescents who are less conscientious could precede the age of 16 years. However, given the dearth of relevant research, cautious interpretations of this finding are required. Although the international literature has suggested an increase in the levels of conscientiousness over the developmental period of adolescence (Leikas & Salmela-Aro, 2015), this increase has been particularly observed in those aged between the 20s and 40s (Roberts, Walton, & Viechtbauer, 2006). For example, it has been suggested that after the 20s and until the 40s, there is a significant increase in social dominance, conscientiousness, and emotional stability (Roberts et al., 2006) that reaches a plateau around the 50s (Roberts & DelVecchio, 2000). However, levels of conscientiousness as well as extraversion and agreeableness have been found to be relatively stable between 12- and 18-year-olds (McCrae et al., 2002). This could explain why the association between conscientiousness and IA risk may not change between the ages of 16 and 18 years. Similarly, the findings of the present study emphasize the need to study how developmental changes in conscientiousness may affect IA during adulthood.

Classroom Hostility

In relation to contextual factors, the findings demonstrated that while classroom hostility did not increase IA at the age of 16 years, it related to an elevated IA risk particularly for girls over time. Studies have emphasized the interaction of context with characteristics of the individual regarding the development of certain behavioral patterns and addictions, as well as its relationship with IA (Bronfenbrenner & Morris, 2006; Douglas et al., 2008;

Griffiths, 2005). Moreover, the importance of classroom influences considering adolescents' behavior and cyberbullying behavior in particular has been highlighted by researchers (Festl et al., 2013; Ryan & Patrick, 2001).

Accordingly, exposure to contextual hostility and abuse has been consistently associated with the development of various forms of addiction over the lifespan (Bácskai et al., 2009; Banducci et al., 2014; Miller, 2013; Sartor et al., 2007; Tharp-Taylor et al., 2009). These findings have been explained on the basis of addictions functioning as emotion regulation strategies that help individuals to handle the repercussions of experiences of aggression and hostility (Banducci et al., 2014). This explanation is further reinforced by studies showing that addictions often function as a pathway to escape from a stressful reality (Wood & Griffiths, 2007) and that contextual hostility increases isolation (Collins & Steinberg, 2006). Regarding IA in particular, it has been suggested that an Internet user's social context could induce feelings of loneliness and isolation that may prompt IA behaviors, mainly due to the use of virtual relationships as a means to achieve feelings of comfort and community (Douglas et al., 2008). Furthermore, it has been suggested that Internet use along with the feeling of being in the virtual world may "remove" offline obstacles and discrepancies, including intrapersonal and interpersonal difficulties, enabling the individual to compensate experiences and feelings that he or she may lack in reality (Douglas et al., 2008). In consensus with Douglas and colleagues' (2008) suggestions, the theory of compensatory Internet use has suggested that individuals may use the Internet as a way to compensate for adverse conditions in reality (Kardefelt-Winther, 2014), such as a more hostile classroom. These assumptions are complimentary to the "escapism" hypothesis, which supports that individuals less competent to address pressure in reality may use the Internet as a way to escape from stressful situations in their life (Griffiths, 1998; Young, 2009). Empirical findings have confirmed that escaping from an unpleasant condition, such as a hostile classroom, is a significant predictor of online gaming addiction (Kuss, Louws, & Wiers, 2012; Yee, 2006) and that Internet use reduces arousal in children and adolescents (Leung, 2007). However, the interpretation of the present findings appears more challenging regarding the non-significant association between (a) classroom hostility and IA at the age of 16 years and (b) the higher IA risk of girls compared with boys over time when situated in more hostile classrooms. These results should be interpreted within the context of the bioecological model of human development, which suggests that the over-time interaction of contextual factors with individual characteristics often produces different behavioral outcomes (Bronfenbrenner & Morris, 2006).

More specifically, the non-significant association between classroom hostility and IA risk at the age of 16 years might be indicative of specific age-related

characteristics. As previously noted, IA often compensates feelings of loneliness, isolation, and distress due to experiences within the real social context of the users (Douglas et al., 2008; Kardefelt-Winther, 2014). However, emotion regulation and compensation strategies differentiate over the course of psychosocial development, while the types of reported stressors depend upon age (Aldwin, Sutton, Chiara, & Spiro, 1996). For instance, a 6-year longitudinal study of aggressiveness during the transition between childhood and adolescence indicated significant normative shifts with more confrontational and less conflict avoiding responses earlier in development (Cairns et al., 1989). Furthermore, it has been suggested that older adolescents use more tension-reducing strategies, including forms of addiction, in comparison with younger adolescents (Frydenberg & Lewis, 1993).

Therefore, it is likely that adolescents either feel less isolated within a more hostile classroom at the age of 16, or tend to handle classroom hostility in more offline and confrontational ways in comparison with the age of 18. Classroom hostility might have been experienced as a less important stressor initially, thus not leading to escapism and/or seeking of online social support associated with IA at the age of 16. This hypothesis is in line with suggestions that the quality of stressors changes over time and in relation to the consistency of life experiences, from "episodic" to "chronic," affecting on the emotion regulation behaviors applied (Aldwin et al., 1996). Therefore, possible perceived episodic stress due to classroom hostility at the age of 16 years could have induced less escapism and IA risk in comparison with those aged 18 years and may have been perceived as a more chronic condition (i.e., a more permanent stressor, after 2 years of exposure to it). Accordingly, the higher vulnerability shown for IA at the age of 18 years could perhaps be explained by an increased level of experiencing discomfort in a classroom of a higher average level of hostility, greater need of online escapism and virtual support seeking, as well as the use of more tension-reducing strategies over time.

In addition, the findings of increased IA risk for girls and the decreased IA risk for boys over time when exposed to classrooms higher in hostility appear to be supported by the available developmental literature (Cairns et al., 1989; Rose & Rudolph, 2006). In particular, gender differences have been highlighted regarding peer-relationship processes such as behavioral and social-cognitive mechanisms and stress responses, suggesting that girls are less confrontational and more passive than boys (Rose & Rudolph, 2006). Furthermore, longitudinal findings from childhood to adolescence have shown a developmental persistence of direct confrontation and brutality in boys compared with girls, with boys found to progressively increase levels of social aggression and aggressive disengagement from relationships (Cairns et al., 1989). In addition, adolescent girls present more compliant and support

seeking ways of addressing contextual discomfort than boys, possibly due to gender socialization differences (Piko, 2011). More specifically, boys' reactions are mainly driven by their need for autonomy and independence, whereas girls' reactions are primarily influenced by their social relationships (Piko, 2011). Overall, adolescent boys demonstrate more active behaviors than adolescent girls, who tend to withdraw (Piko, 2011). In such a case, it is likely that girls in the present study responded to classroom hostility by seeking more online support over time. This could eventually increase their need to escape online, reinforcing their IA risk. Furthermore, it is possible that girls respond to classroom hostility with online social hostility while using interactive online applications, such as SNSs (Griffiths et al., 2014). Similarly, boys might respond to their constant exposure to classroom hostility by increasing their offline hostility and confrontational tendencies, eventually reducing their IA risk.

The lack of relevant previous findings in the international empirical literature illustrates the novelty of results in the present study. More specifically, from a risk and resilience perspective (Masten, 2014), the findings illustrate that IA in adolescence is not exclusively attributed to characteristics of the individual (i.e., the nature of the adolescent), but is related to ecological factors and the relationships formed between the individual and their context over time.

Implications, Limitations, and Further Research

The present study highlighted the utility of adopting a longitudinal, contextualized approach when studying IA in adolescence. This study's strengths include the (a) longitudinal design, (b) target population's representativeness, and (c) investigation of both contextual factors (i.e., the classroom environment) and individual differences variables (i.e., conscientiousness) in predicting IA risk. Furthermore, the sophisticated multilevel analysis allowed for the variables on individual and classroom level to be examined over time. Accordingly, the findings have implications for IA prevention and treatment of adolescents, research, and public policy. In terms of addressing IA risk in adolescents, it appears that a treatment approach including cognitive-behavioral learning and application of conscientiousness facets, such as order, dutifulness, and regular day structure, may prove beneficial in reducing symptom severity and increasing perceived control over one's life and mental health, specifically if treatment is initiated before the age of 16 years. The present findings also suggest that girls may benefit from learning externalizing coping methods as this study showed that they

might cope with higher levels of classroom hostility by dysfunctional use of the Internet. Group-based therapy may prove effective in providing girls with a physical and metaphorical space to discuss perceived stress and vent their frustrations and anxiety in a real life context, allowing for a more healthy coping strategy to be adopted. Finally, public policy may benefit from developing and applying health campaigns of IA awareness, which target the needs and requirements of adolescent boys and girls specifically, paying attention to their different coping strategies.

Irrespective of its merits, the present study suffers from a number of limitations. First, self-reports were used to assess the relevant variables in this study. Self-reports rely on the respondents' truthfulness and self-perception and therefore their reliability and validity may be limited (Frankfort-Nachmias & Nachmias, 1996), along with issues concerning social desirability. However, self-report measures are also easy to administer and score (Ruben, 1999) and are therefore preferable over other more time- and cost-consuming methods such as behavioral and biological measures, particularly in light of large samples. Second, the IAT (Young, 1998) does not contain a time criterion that assesses the presence of IA symptoms over a specific period of time. The simultaneous co-occurrence of multiple problems as a consequence of excessive Internet use appears a better indicator of IA and should therefore be assessed in future studies. Finally, the assumption that differentiated gender responses to discomfort may explain the higher IA risk of girls within more hostile classrooms needs further investigation because coping behaviors have not been directly measured in the present study. However, the interpretation of this result was based on solid theoretical grounds and empirical findings considering the use of the Internet as a way to cope with and compensate for stress and adverse conditions in real life (Douglas et al., 2008; Kardefelt-Winther, 2014; Leung, 2007; Yee, 2006; Young, 2009) and gender differences (Piko, 2011).

With regard to future research, the findings of the present study set the foundation upon which several factors can be studied and understood in the context of IA including (a) protective individual factors, (b) detrimental contextual factors, and (c) gender differences in coping and stress response. Future research could also extend the period of longitudinal investigations of the relationship between conscientiousness and IA to cover individuals in their 20s and 40s given that conscientiousness appears to increase during this time period (Roberts et al., 2006). IA is a recently emergent health concern and it appears of utmost importance to deepen and broaden our understanding of it in order to be able to help those who experience the negative consequences arising from it.

Conclusion

In the present study, the interplay between individual and contextual factors was assessed in the context of IA in adolescence. More specifically, findings showed that conscientiousness serves as a protective factor at 16 years of age and over time, whereas higher levels of classroom hostility have a different impact on IA behaviors across gender and over time. Adolescent girls appear particularly vulnerable in resorting to excessive Internet use when faced with elevated levels of contextual hostility over time. Adolescent boys, on the other hand, appear to be differently equipped to address classroom hostility without developing IA behaviors. Overall, the differences identified across genders concerning responses to specific environmental situations are particularly significant as they suggest that boys and girls react to contexts of higher level of hostility in different ways, leading to an elevated risk of Internet-related problems among one group (i.e., girls), but serving as protective factor in the other (i.e., boys). In sum, the research findings emphasize the utility and necessity to pay respect to both individual differences and context as potential risk and protective factors for IA and have significant implications for IA prevention, research, and public policy guidelines.

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References

- Aldwin, C. M., Sutton, K. J., Chiara, G., & Spiro, A. (1996). Age differences in stress, coping, and appraisal: Findings from the normative aging study. *The Journals of Gerontology, Series B: Psychological Sciences & Social Sciences*, 51, 179-188.
- Alminhana, L. O., & Farias, M. (2014). The missing link: What mediates the relationship between religiosity and alcohol use? *Revista Brasileira de Psiquiatria*, 36(1), 3-3.
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.

- Asendorpf, J. B., & Van Aken, M. A. (2003). Validity of Big Five personality judgments in childhood: A 9 year longitudinal study. *European Journal of Personality, 17*, 1-17.
- Bácskai, E., Czobor, P., & Gerevich, J. (2009). Suicidality and trait aggression related to childhood victimization in patients with alcoholism. *Psychiatry Research, 165*, 103-110.
- Banducci, A. N., Hoffman, E. M., Lejuez, C. W., & Koenen, K. C. (2014). The impact of childhood abuse on inpatient substance users: Specific links with risky sex, aggression, and emotion dysregulation. *Child Abuse & Neglect, 38*, 928-938. doi:10.1016/j.chiabu.2013.12.007
- Bronfenbrenner, U., & Morris, P. A. (2006). The bioecological model of human development. In R. M. Lerner & W. E. Damon (Eds.), *Handbook of Child Psychology. Theoretical models of human development* (Vol. 8, pp. 793-828). Hoboken, NJ: John Wiley & Sons Inc.
- Cairns, R. B., Cairns, B. D., Neckerman, H. J., Ferguson, L. L., & Garipey, J. L. (1989). Growth and aggression: I. Childhood to early adolescence. *Developmental Psychology, 25*, 320-330.
- Cicchetti, D. (2013). The legacy of development and psychopathology. *Development and Psychopathology, 25*, 1199-1200.
- Collins, W. A., & Steinberg, L. (2006). Adolescent development in interpersonal context. In R. M. Lerner & W. Damon (Eds.), *Handbook of child psychology* (pp. xx-1063). Hoboken, NJ: John Wiley.
- Coopersmith, S. (1981). *Self-esteem inventories*. Palo Alto, CA: Consulting Psychologists Press.
- Costa, P. T., & McCrae, R. R. (1992). *Revised NEO Personality Inventory (NEO-PI-R) and the NEO Five-Factor Inventory (NEO-FFI): Professional manual*. Odessa, FL: Psychological Assessment Resources.
- Davis, R. A., Flett, G. L., & Besser, A. (2002). Validation of a new scale for measuring problematic Internet use: Implications for pre-employment screening. *CyberPsychology & Behavior, 5*(4), 331-345.
- Derogatis, L. R., & Spitz, K. L. (1999). The SCL-90-R, Brief Symptom Inventory and matching clinical rating scales. In M. E. Maruish (Ed.), *The use of psychological testing for treatment planning and outcomes assessment* (2nd ed., pp. 679-724). Mahwah, NJ: Lawrence Erlbaum.
- Douglas, A. C., Mills, J. E., Niang, M., Stepchenkova, S., Byun, S., Ruffini, C., & Blanton, M. (2008). Internet addiction: Meta-synthesis of qualitative research for the decade 1996-2006. *Computers in Human Behavior, 24*, 3027-3044.
- Englund, M. M., Egeland, B., Oliva, E. M., & Collins, W. A. (2008). Childhood and adolescent predictors of heavy drinking and alcohol use disorders in early adulthood: A longitudinal developmental analysis. *Addiction, 103*(Suppl. 1), 23-35.
- Festl, R., Scharrow, M., & Quandt, T. (2013). Peer influence, internet use and cyber-bullying: A comparison of different context effects among German adolescents. *Journal of Children and Media, 7*, 446-462.

- Floros, G., Siomos, K., Stogiannidou, A., Giouzevas, I., & Garyfallos, G. (2014). Comorbidity of psychiatric disorders with internet addiction in a clinical sample: The effect of personality, defense style and psychopathology. *Addictive Behaviors, 39*, 1839-1845.
- Frankfort-Nachmias, C., & Nachmias, D. (1996). *Research methods in the social sciences* (5th ed.). London, England: St Martin's Press.
- Frydenberg, E., & Lewis, R. (1993). Boys play sport and girls turn to others: Age, gender and ethnicity as determinants of coping. *Journal of Adolescence, 16*, 252-266.
- Gnisci, A., Perugini, M., Pedone, R., & Di Conza, A. (2011). Construct validation of the Use, Abuse and Dependence on the Internet Inventory. *Computers in Human Behavior, 27*, 240-247.
- Griffiths, M. D. (1998). Internet addiction: Does it really exist? In J. Gackenbach (Ed.), *Psychology and the internet: Intrapersonal, interpersonal and transpersonal applications* (pp. 61-75). New York, NY: Academic Press.
- Griffiths, M. D. (2005). A "components" model of addiction within a biopsychosocial framework. *Journal of Substance Use, 10*, 191-197.
- Griffiths, M. D. (2012). Internet sex addiction: A review of empirical research. *Addiction Research & Theory, 20*, 111-124.
- Griffiths, M. D., Kuss, D. J., & Demetrovics, Z. (2014). Social networking addiction: An overview of preliminary findings. In K. Rosenberg & L. Feder (Eds.), *Behavioral addictions: Criteria, evidence and treatment* (pp. 119-141). New York, NY: Elsevier.
- Hur, M. (2006). Demographic, habitual, and socioeconomic determinants of internet addiction disorder: An empirical study of Korean teenagers. *CyberPsychology and Behavior, 9*, 514-525.
- Hurd, Y. L., Michaelides, M., Miller, M. L., & Juras-Aswad, D. (2014). Trajectory of adolescent cannabis use on addiction vulnerability. *Neuropharmacology, 76*, 416-424.
- Hyde, J. S. (2014). Gender similarities and differences. *Annual Review of Psychology, 65*, 373-398.
- Jang, K. S., Hwang, S. Y., & Choi, J. Y. (2008). Internet addiction and psychiatric symptoms among Korean adolescents. *Journal of School Health, 78*, 165-171.
- Jones, C. M., Scholes, L., Johnson, D., Katsikitis, M., & Carras, M. C. (2014). Gaming well: Links between videogames and flourishing mental health. *Frontiers in Psychology, 5*, Article 260. doi:10.3389/fpsyg.2014.00260
- Kaltiala-Heino, R., Lintonen, T., & Rimpelä, A. (2004). Internet addiction? Potentially problematic use of the internet in a population of 12-18 year-old adolescents. *Addiction Research & Theory, 12*, 89-96.
- Kardefelt-Winther, D. (2014). The moderating role of psychosocial well-being on the relationship between escapism and excessive online gaming. *Computers in Human Behavior, 38*, 68-74.
- Khazaal, Y., Billieux, J., Thorens, G., Khan, R., Louati, Y., Scarlatti, E., & Zullino, D. (2008). French validation of the internet addiction test. *Cyberpsychology & Behavior, 11*(6), 703-706.

- Kim, Y., Park, J. Y., Kim, S. B., Jung, I.-K., Lim, Y. S., & Kim, J.-H. (2010). The effects of internet addiction on the lifestyle and dietary behavior of Korean adolescents. *Nutrition Research and Practice*, 4, 51-57.
- Kim, Y.-R., Son, J.-W., Lee, S.-I., Shin, C.-J., Kim, S.-K., Ju, G., . . . Ha, T. H. (2012). Abnormal brain activation of adolescent internet addict in a ball-throwing animation task: Possible neural correlates of disembodiment revealed by fMRI. *Progress in Neuro-Psychopharmacology & Biological Psychiatry*, 39, 88-95.
- Korkeila, J. A., Kaarlas, S., Jääskeläinen, M., & Taiminen, T. (2008). Using the Finnish internet addiction test version to measure heavy use of the web. *European Psychiatry*, 23, S312.
- Kotov, R., Gamez, W., Schmidt, F., & Watson, D. (2010). Linking "big" personality traits to anxiety, depressive, and substance use disorders: A meta-analysis. *Psychological Bulletin*, 136, 768-821.
- Kuss, D. J., & Griffiths, M. D. (2012a). Internet gaming addiction: A systematic review of empirical research. *International Journal of Mental Health and Addiction*, 10, 278-296.
- Kuss, D. J., & Griffiths, M. D. (2012b). Online gaming addiction in children and adolescents: A review of empirical research. *Journal of Behavioral Addictions*, 1, 3-22.
- Kuss, D. J., Griffiths, M. D., Karila, L., & Billieux, J. (2014). Internet addiction: A systematic review of epidemiological research for the last decade. *Current Pharmaceutical Design*, 20, 4026-4052.
- Kuss, D. J., Louws, J., & Wiers, R. W. W. (2012). Online gaming addiction? Motives predict addictive play behavior in Massively Multiplayer Online Role-Playing Games. *Cyberpsychology, Behavior, and Social Networking*, 15, 480-485.
- Kuss, D. J., van Rooij, A., Shorter, G. W., Griffiths, M. D., & van de Mheen, D. (2013). Internet addiction in adolescents: Prevalence and risk factors. *Computers in Human Behavior*, 29, 1987-1996.
- Lam, L. T., Peng, Z., Mai, J., & Jing, J. (2009). The association between internet addiction and self-injurious behaviour among adolescents. *Injury Prevention*, 15, 403-408.
- Leikas, S., & Salmela-Aro, K. (2015). Personality trait changes among young Finns: The role of life events and transitions. *Journal of Personality*, 83, 117-126. doi:10.1111/jopy.12088
- Leung, L. (2007). Stressful life events, motives for internet use, and social support among digital kids. *CyberPsychology and Behavior*, 10, 204-214.
- Lin, F., Zhou, Y., Du, Y., Qin, L., Zhao, Z., Xu, J., & Lei, H. (2012). Abnormal white matter integrity in adolescents with internet addiction disorder: A tract-based spatial statistics study. *PLoS ONE*, 7(1), e30253.
- Luengo Kanacri, B. P., Pastorelli, C., Eisenberg, N., Zuffianò, A., Castellani, V., & Caprara, G. V. (2014). Trajectories of prosocial behavior from adolescence to early adulthood: Associations with personality change. *Journal of Adolescence*, 37, 701-713. doi:10.1016/j.adolescence.2014.03.013

- Madden, M., Lenhart, A., Duggan, M., Cortesi, S., & Gasser, U. (2013). *Teens and technology*. PEW Research Internet Project. Retrieved from <http://www.pewinternet.org/2013/03/13/teens-and-technology-2013/>
- Mafé, C. R., & Blas, S. S. (2006). Explaining internet dependency: An exploratory study of future purchase intention of Spanish internet users. *Internet Research, 16*, 380-397.
- Masten, A. S. (2014). Invited commentary: Resilience and positive youth development frameworks in developmental science. *Journal of Youth and Adolescence, 43*, 1018-1024.
- McCrae, R. R., Costa, P. T. Jr., Terracciano, A., Parker, W. L., Mills, C. J., De Fruyt, F., & Mervielde, I. (2002). Personality trait development from age 12 to 18: Longitudinal, cross-sectional, and cross-cultural analyses. *Journal of Personality and Social Psychology, 83*, 1456-1468.
- McCrae, R. R., & Terracciano, A. (2005). Personality profiles of cultures: Aggregate personality traits. *Journal of Personality and Social Psychology, 89*, 407-425.
- Meerkerk, G. J., Van Den Eijnden, R. J., Vermulst, A. A., & Garretsen, H. F. L. (2009). The Compulsive Internet Use Scale (CIUS): Some psychometric properties. *CyberPsychology and Behavior, 12*, 1-6.
- Milani, L., Osualdella, D., & Di Blasio, P. (2009). Quality of interpersonal relationships and problematic internet use in adolescence. *CyberPsychology and Behavior, 12*, 681-684.
- Miller, D. (2013). 2nd International Conference and Exhibition on Addiction Research and Therapy. *Addiction, 2013*.
- Motti-Stefanidi, F., & Asendorpf, J. B. (2012). Perceived discrimination of immigrant adolescents in Greece: How does group discrimination translate into personal discrimination? *European Psychologist, 17*, 93-104.
- Neuenschwander, R., Cimeli, P., Röthlisberger, M., & Roebers, C. M. (2013). Personality factors in elementary school children: Contributions to academic performance over and above executive functions? *Learning and Individual Differences, 25*, 118-125.
- Park, M.-H., Park, E. J., Choi, J., Chai, S., Lee, J.-H., Lee, C., & Kim, D.-J. (2011). Preliminary study of internet addiction and cognitive function in adolescents based on IQ tests. *Psychiatry Research, 190*, 275-281.
- Peters, C. S., & Malesky, L. A. (2008). Problematic usage among highly-engaged players of Massively Multiplayer Online Role Playing Games. *CyberPsychology and Behavior, 11*, 480-483.
- Piko, B. (2011). Gender differences and similarities in adolescents' ways of coping. *The Psychological Record, 51*(2), Article 4.
- Raudenbush, S. W. (2004). *HLM 6: Hierarchical linear and nonlinear modeling*. Scientific Software International.
- Roberts, B. W., & DelVecchio, W. F. (2000). The rank-order consistency of personality traits from childhood to old age: A quantitative review of longitudinal studies. *Psychological Bulletin, 126*, 3-25.

- Roberts, B. W., Walton, K., & Viechtbauer, W. (2006). Patterns of mean-level change in personality traits across the life course: A meta-analysis of longitudinal studies. *Psychological Bulletin, 132*, 1-25.
- Rose, A. J., & Rudolph, K. D. (2006). A review of sex differences in peer relationship processes: Potential trade-offs for the emotional and behavioral development of girls and boys. *Psychological Bulletin, 132*, 98-131.
- Ruben, D. H. (1999). Diagnosing alcoholism and its addictive patterns using self-report rating scales. *Alcoholism Treatment Quarterly, 17*, 37-46.
- Ryan, A. M., & Patrick, H. (2001). The classroom social environment and changes in adolescents' motivation and engagement during middle school. *American Educational Research Journal, 38*, 437-460.
- Sartor, C. E., Lyskey, M. T., Bucholz, K. K., McCutcheon, V. V., Nelson, E. C., Waldron, M., & Heath, A. C. (2007). Childhood sexual abuse and the course of alcohol dependence development: Findings from a female twin sample. *Drug and Alcohol Dependence, 89*, 139-144.
- Stavropoulos, V., Alexandraki, K., & Motti-Stefanidi, F. (2013). Recognizing internet addiction: Prevalence and relationship to academic achievement in adolescents enrolled in urban and rural Greek high schools. *Journal of Adolescence, 36*(3), 565-576.
- Strittmatter, E., Brunner, R., Fischer, G., Parzer, P., Resch, F., & Kaess, M. (2014). The relationship between bullying experiences, coping style and pathological internet use among adolescents. *Zeitschrift für Kinder-und Jugendpsychiatrie und Psychotherapie, 42*(2), 85-94.
- Terracciano, A., & Costa, P. T. (2004). Smoking and the Five-Factor Model of personality. *Addiction, 99*, 472-481.
- Tharp-Taylor, S., Haviland, A., & D'Amico, E. J. (2009). Victimization from mental and physical bullying and substance use in early adolescence. *Addictive Behaviors, 34*, 561-567.
- Tsitsika, A., Critselis, E., Louizou, A., Janikian, M., Freskou, A., Marangou, E., . . . Kafetzis, D. (2011). Determinants of internet addiction among adolescents: A case-control study. *The Scientific World Journal, 11*, 866-874.
- Van Buuren, S. (2012). *Flexible imputation of missing data*. London, UK: CRC press.
- Vermulst, A. A., & Gerris, J. R. M. (2005). *QBF: Quick Big Five Persoonlijkheidstest Handleiding* [Quick Big Five Personality Test Manual]. Leeuwarden, The Netherlands: LDC.
- Vollmer, C., Randler, C., Horzum, M. B., & Ayas, T. (2014). Computer game addiction in adolescents and its relationship to chronotype and personality. *SAGE Open, 4*(1), 1-9. doi:10.1177/2158244013518054
- Widyanto, L., & Griffiths, M. D. (2009). Unravelling the Web: Adolescents and internet addiction. In R. Zheng, J. Burrow-Sanchez, & C. Drew (Eds.), *Adolescent online social communication and behavior: Relationship formation on the internet* (pp. 29-49). Hershey, PA: Idea Publishing.
- Wilson, K., Fornasier, S., & White, K. M. (2010). Psychological predictors of young adults' use of social networking sites. *Cyberpsychology, Behavior, and Social Networking, 13*, 173-177.

- Winkler, A., Dörsing, B., Rief, W., Shen, Y., & Glombiewski, J. A. (2013). Treatment of internet addiction: A meta-analysis. *Clinical Psychology Review, 33*, 317-329.
- Wood, R. T. A., & Griffiths, M. D. (2007). A qualitative investigation of problem gambling as an escape-based coping strategy. *Psychology and Psychotherapy: Theory, Research and Practice, 80*, 107-125.
- Yang, Y., Li, L., & Mingxin, L. (2006). The relationship between adolescents' conscientiousness, internet service preference and internet addiction. *Psychological Science-Shanghai, 29*(4), 947-947.
- Yee, N. (2006). Motivations for play in online games. *CyberPsychology and Behavior, 9*, 772-775.
- Young, K. S. (1998). *Caught in the net: How to recognize the signs of internet addiction—And a winning strategy for recovery*. Chichester, UK: Wiley.
- Young, K. S. (2009). Internet addiction. *American Behavioral Scientist, 4*, 402-415.
- Young, K. S., Pistner, M., O'Mara, J., & Buchanan, J. (1999). Cyber disorders: The mental health concern for the new millennium. *CyberPsychology and Behavior, 2*, 475-479.
- Yuan, K., Qin, W., Wang, G., Zeng, F., Zhao, L., Yang, X., . . . Tian, J. (2011). Microstructure abnormalities in adolescents with internet addiction disorder. *PLoS ONE, 6*(6) e20708: 1-8.

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