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ABSTRACT

Internet addiction (IA) has become an increasingly researched topic. In the present study, IA symptoms in adolescents were investigated longitudinally with specific focus on the individual's hostility, gaming use (of Massively Multiplayer Online Role Playing Games [MMORPGs]) and gaming on the classroom level (calculated using the percentage of MMORPG players within classes). The sample comprised 648 Greek adolescents who were assessed over a two-year period (aged 16-18 years). IA symptoms were assessed with the Internet Addiction Test (IAT), and hostility with the relevant subscale of the Symptom Checklist-90 (SCL-90). A three-level hierarchical linear model was used to differentiate individual and classroom-level influences on IA symptoms at age 16 years and over time. MMORPG gamers and more hostile adolescents presented more symptoms of IA. However, being a member of a classroom with a higher percentage of MMORPG gamers appeared to be a protective factor for IA. These longitudinal data emphasize the importance of contextual factors at the level of the classroom in determining differences in IA symptoms during adolescence.

Keywords: Internet Addiction, Adolescence, MMORPG, Hostility, Classroom

1. Introduction

Over the past decade, research into problematic Internet use among both adolescents and adults has increased (Kuss et al., 2014). Internet use can reinforce individuals' social ties and professional development, and contribute to adaptation to their everyday life environments (Rice & Barman-Adhikari, 2014). However, a minority of Internet users – including adolescents – exhibit excessive Internet use, often described as addictive, with serious repercussions for their wellbeing and future development (Thorsteinsson & Davey, 2014). This behavior has been termed in a number of different ways, including problematic or compulsive Internet use, and Internet Addiction (IA) (Kuss et al., 2014). In the present paper, IA is conceptualized as an excessive preoccupation with the Internet that causes impairment or distress, while its symptoms may vary from minimum to extreme (Young, 1998).

The different severity levels of IA symptoms could be particularly significant in adolescence and especially the ages 16 to 18 years. This period precedes the age range of highest Internet access (18-24 years) both in Greece and internationally (Madden et al., 2013; Society of Information Observatory, 2011). Moreover, addictive patterns emerging in late adolescence have been suggested to continue into adulthood (Englund et al., 2008).

To examine factors that explain IA symptoms severity in adolescence, the present paper integrates the model of development and maintenance of Internet addiction (Brand, Young & Laier, 2014) with Griffiths' (2005) biopsychosocial addiction framework. The first model differentiates between functional and dysfunctional Internet use, suggesting that it is the interaction over time between individual and Internet activity-related factors (e.g., online gaming) that explains IA. Griffiths additionally illustrated the contribution of contextual influences to the level of addiction symptoms. Therefore, IA symptoms are conceived as the

outcome of the interplay between individual, Internet activity, and contextual factors over time.

1.1.Hostility

Considering individual IA factors, the role of hostility has been studied among adolescents (Kuss et al., 2014; Yen et al., 2007). Additionally, clinical entities closely related to hostility (e.g., lack of self-control and Attention Deficit Hyperactivity Disorder symptoms) have been consistently associated with IA (La Rose, Lin, & Eastin, 2003; Yen et al., 2007). In the present paper, hostility is conceived as comprising thoughts, feelings, and/or behaviors characterizing the negative affect state of anger, including qualities such as aggression, irritability, rage, and resentment (Holi, 2003).

Although hostility is relatively common in adolescence (Gilmore & Meersand, 2014; Moffitt, 1993), it has been linked to the onset of various addictive behaviors during this period, including alcohol and substance abuse (Dom, Hulstijn & Sabbe, 2006; Patel & Greydanus, 1999). Considering IA more specifically, longitudinal research studies using Asian adolescent samples have resulted in contradictory findings, with some supporting and others not confirming hostility as a causal factor for IA (Ko te al., 2009; Hong, You, Kim, & No, 2014). Nevertheless, there is a consensus among longitudinal studies considering the reverse association in adolescence, where hostility was a consequence of IA rather than a cause (Gentile et al., 2011; Lemmens, Valkenburg, & Peter, 2011). Researchers explain the Hostility-IA association as bidirectional (Yen et al., 2008). That is, hostility may engender Internet escape-avoidance and withdrawal as a way of coping with emotional stress. Furthermore, the absence of limitations on Internet use may provide an outlet for more hostile adolescents, enabling them to express their aggression in ways not acceptable offline (Ko et al., 2009). As an ineffective form of coping, IA could result in poor adjustment in early

adulthood, precipitating hostility (Yen et al., 2008). Nevertheless, developmental maturation between the ages of 16 and 18 years might allow adolescents to develop more advanced coping strategies, such as interpersonal and problem solving skills (Williams & McGillicuddy-De Lisi, 1999) to deal with hostility symptoms rather than using the Internet. These developmental changes combined with the dearth of relevant prospective studies in European populations and the controversial findings in Asian samples indicate a significant gap in the literature.

1.2. Massively Multiplayer Online Role-Playing Games (*MMORPGs)*

Various online activities have been associated with IA, including social networking, video gaming, and gambling (Kuss et al., 2014; Griffiths et al., 2014). Among these, online gaming has received significant attention with the latest (fifth) edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) advocating *Internet Gaming Disorder* as a condition in need of further study (American Psychiatric Association, 2013), and research has placed particular emphasis upon the playing of Massively Multiplayer Online Role-Playing Games (MMORPGs) (Wallace, 2014). MMORPGs are online games in which individuals can develop a character, compete, and interact with other players without time and space limitations (Kuss, Louws & Wiers, 2012). While MMORPGs have been consistently associated with IA (Kuss & Griffiths, 2012; Gentile et al., 2011), their likely positive effects in the areas of social interactions and facilitating educational learning have also been noted (Cole & Griffiths, 2007; De Freitas & Griffiths, 2011; Skoric & Kwan, 2011; Jones, Scholes, Johnson, Katsikitis, & Carras, 2014). Continuously increasing challenges, scoring, and immediate gratification in MMORPGs enable players to achieve a sense of self-actualization (Wan & Chiou, 2006), and this has been linked to IA (Hull, Williams & Griffiths, 2013).

MMORPGs also function as a catalyst for social contact and can supplement face-to-face relationships, potentially leading to various beneficial effects of gaming (Jones et al., 2014). Therefore, for an adolescent gamer who plays MMORPGs with their real-life friends, socialization would be higher compared to an isolated gamer, possibly decreasing IA risk. Given the importance of classroom context for the development of adolescents, and Greek adolescents in particular (because their classmates remain the same throughout their school education), and their Internet use behaviors (Ryan & Patrick, 2001; Festl, Scharkow & Quandt, 2013; Stavropoulos, Kuss, Griffiths & Motti-Stefanidi, 2015), assessing the influence of peer involvement in MMORPGs in relation to IA severity appears important. Given the lack of relevant findings, the present study utilized the nesting of adolescent data within classrooms. In that context, the classroom percentage of MMORPG players was calculated in line with applied methods of assessing classroom composition effects (Motti-Stefanidi, Asendorpf & Masten, 2012).

The present study

The present study is a part of a wider longitudinal research project at the University of Athens (Greece) that aims to highlight the significance of the interplay over time of individual and contextual factors in relation to IA symptoms[1]. Specifically, multilevel modeling was applied to longitudinally examine hostility and MMORPG-playing as individual factors and the percentage of classroom participation in MMORPGs as a proximal context factor. A normative sample of Greek adolescents and their classroom peers were assessed in relation to their IA symptoms at both 16 and 18 years (i.e., longitudinally over a two-year period). The following hypotheses were formulated:

H_1: It is hypothesized that higher hostility will be associated with higher IA symptom severity. This is because more hostile adolescents may overuse the

Internet to cope with their emotional distress and/or behave in a hostile way avoiding repercussions in real life (Kuss at al., 2014; Ko et al., 2009).

H_2: It is hypothesized that based on the constantly evolving and interactive structure of MMORPGs, MMORPG-playing will be associated with higher IA symptom severity (Kuss & Griffiths, 2012; Gentile et al., 2011).

H_3: Given the socializing effects of MMORPGs, it is hypothesized that classrooms with higher percentages of gamers will be associated with decreased IA symptom severity (Jones et al., 2014).

2. Methods

2.1. Participants

This paper-and-pencil research study received approval from: (i) the Greek Ministry of Education, (ii), the Teachers' Council of each participating school, and (iii) the participants' parents. The sample was selected in the Athens metro area and a selected regional area (Korinthia) using the method of randomized stratified selection (Pan et al., 2000) based on the inventory card of the Greek Ministry of Education in 2010. The ratios of high schools and students were identified between the (i) extended capital metro area and the selected regional population, and (ii) academic and vocational track high schools within these areas. Based on these quotas, school units and participants were randomly selected via a lottery.

The sample comprised 648 Greek students embedded in 34 classrooms of 12 schools. The number of participants in each school was defined based on the size of each school and ranged from 7 to 76 students. Chi-square analysis confirmed that the sample did not differ from the original population regarding the area of residence and the type of school (X^2=1.22, p=.75). In relation to socio-economic characteristics of the participants, 78.2% of their parents were married, 40.3 % of their fathers, and 31.3% of their mothers had completed

secondary school, while 20.1% of their fathers and 21.9% of their mothers were private employees (see Table 1). Internet usage was 100%, while 314 participants (48.5%) stated that they were also MMORPG players. The estimated maximum sampling error with a size of 648 is 3.85% (Z = 1.96; C.I. = 95%).

-Place Table 1 about here. Socioeconomic characteristics of the sample-

Participants were assessed twice, two school years apart, using a re-identifiable code (Wave 1: age=15.75 years, *SD*=0.57, age range 15.5-16.5, males=46.2%, females=53.8%; Wave 2: age=17.75 years, *SD*=.0.54, age range 15.5-16.5). Retention was 56% (*n*=356) due to changes of school and those who dropped out. The frequency of assessments between individuals varied (1–2, *M*=1.57). Although attrition was unsystematic (i.e., it did not present specific patterns), it was used as an independent variable (1=attrition, 0=non-attrition) on HLM analysis Level 2 to confirm that it did not affect IA score and its associations with the other independent variables, i.e., gender and age (see Table 2).

-Place Table 2 about here. Assessment of the attrition effects in HLM analyses-

2.2. Materials

Internet Addiction Test

The Internet Addiction Test (IAT) was used to assess the entire continuum of IA symptoms from minimum to maximum (Young, 1998). The IAT comprises 20 questions evaluating negative consequences of excessive Internet use. Questions 2, 3 and 8 were appropriately modified to reflect age/adolescence-related content (i.e., in question 8, “job performance” was replaced by “school performance”). There were six possible answers for each question (1=“not at all” to 5= “always”, and 0= “does not apply”). Sum scores ranged from 0-100, where 0 indicated minimum and 100 indicated maximum IA symptoms. The instrument presented high concurrent validity in previous studies (Guan et al., 2012,

Stavropoulos, Alexandraki & Motti, 2013a) and its internal reliability in the present study was high (*Cronbach α*= 0.93).

Symptom Check-List 90 Revised (SCL-90-R): Hostility Subscale

To assess hostility levels, the Hostility subscale of the SCL-90–R (Derogatis & Savitz, 1999) was used. This subscale comprises six items that reflect qualities such as hostility and resentment. Participants answered on a 5-point Likert scale (0= "not at all" to 4= "all the time") concerning how much they have experienced each of the symptoms covered (e.g., "Temper outbursts that you could not control"). Mean scores ranged from 0-4, where 0 indicated minimum hostility and 4 indicated maximum hostility. The instrument presented high construct and predictive validity (Derogatis & Unger, 2010), and in the present study the internal consistency of the hostility subscale was high (*Cronbach α*=.85).

Playing MMORPGs

MMORPGs are online role-playing multiplayer games that allow a number of gamers to play online simultaneously in the game's evolving world, while concurrently developing their virtual characters-personas (Freeman, 2008). In the questions asked, examples of specific games were provided in parentheses (e.g., *World of Warcraft*). It was explained that MMORPGs differ from MMO First-Person Shooters (MMOFPS) and Multiplayer Online Battle Arena (MOBA)**,** where a number of players participate simultaneously in a game either in a first-person shooter or in a battle arena mode, without allowing for character development through progress in higher levels (leveling). Participants indicated whether they were MMORPG players or not (0=non-gamers, 1=gamers). To further assess the quality of MMORPGs, gamers and non-gamers were compared using five questions regarding high IA risk behaviors that were not assessed in the IAT (e.g., time spent online during schooldays and weekends, etc.). Finally, the percentage of MMORPG players per classroom was

calculated (mean-classroom % = 50.28, minimum-classroom % = 16.67, maximum-classroom %= 100).

2.3. Rationale for chosen analysis

The present study longitudinally examined hostility and MMORPG-playing as individual factors (following adolescents over a two-year period from 16 to 18 years of age), with the percentage of classroom participation in MMORPGs as a proximal contextual factor. Hierarchical Linear Modeling (HLM) was used to analyze a data structure where measurements at two time points (Level 1) were nested within individuals (Level 2), who were nested within classrooms (Level 3). HLM 6.0.8 software was used (Raudenbush, Bryk, & Congdon, 2002). IA symptoms (Level 1 outcome variable) were predicted for each individual at Level 1 by wave in the study (Wave 1=0, Wave 2=1). The individual initial level and the individual linear change over the two assessments (slope) were predicted at Level 2 by hostility and MMORPG gaming. Finally, the percentage of players within each classroom was added at Level 3 (classroom) to test both its main effect and its cross-level interaction with time. To control for misspecification (i.e., lack of linearity) and the distributional assumptions at each level (lack of normality, heteroscedasticity), HLM results accounting for robust standard errors (which are insensitive to possible violations of these assumptions) were calculated.

3. Results

Prior to the HLM analyses, the means, standard deviations, and inter-correlations between the HLM variables were estimated (see Table 3). To further assess the quality of gaming, MMORPG-players and non-MMORPG-players were compared according to the presence or absence of five IA risk behaviors (see Table 4). For instance, MMORPG-players

were more likely to have spent more than three hours online during school days and during the weekend, and to have experienced online flow than non-MMORPG players.

-Place Table 3 about here. *Means, standard deviations and correlations of the HLM variables*

- Place Table 4 about here. MMORPG Players and IA Risk Behaviors-

The variance components for the three levels (age-related change, individual, classroom) were computed to confirm the HLM (X^2 = 1272.85, *df*= 596, *p*= .001 [Level 2]; X^2 = 46.93, *df*= 33, *p*=.001). Missing values did not present a problem at Level 1 in the HLM and did not occur at Level 3 (classrooms); missing values at Level 2 (individual) were addressed (Van Burren, 2010). Although they were unsystematic, to avoid list-wise deletion, multiple imputation was applied (five Maximum Likelihood imputations using SPSS) using all available Level 2 variables. All multilevel analyses (equations[2]) were calculated five times and their results were averaged.

The Level 1 intercept for the cross-sectional findings was 27.05, while for the longitudinal findings it dropped to *b*=-5.91, reaching 21.14 (27.05-5.91=21.14). These were the estimated mean IA scores for adolescents, non-players, of average hostility, situated in classrooms of average percentages of players at 16 and 18 years, respectively. Considering how hostility predicts IA, the hostility coefficient was *b*=7.03 (*p*=.001). Consequently, the average IA score for adolescents who scored one point higher than the estimated mean on hostility increased to 34.08 (27.05+7.03= 34.08). Considering the effect of hostility at Time 1 on IA score at Time 2, the coefficient was *b*=-.94, (*p*=.47), and indicated that the average IA score of adolescents who scored one point higher than the estimated mean in hostility decreased non-significantly to 20.20 at Time 2 (21.14-.94=20.20) (see Figure 3).

For predicting IA (research question 2), the coefficient for MMORPG gaming was *b*=4.05 (*p*=.01). This indicated that IA scores of adolescents who were MMORPG players increased to 31.1 (27.05+4.05= 31.10) at Time 1. The effect of the interaction of MMORPG gaming at 16 years with time on IA was non-significant, *b*=2.40 (*p*=.20). The coefficient for classroom percentage of MMORPG playing predicting IA (research question 3), was *b*=-.13 (*p*=.03). This indicated that IA scores of adolescents in classrooms with one point higher than the estimated mean percentage of classroom MMORPG players decreased to 26.92 (27.05-.13= 26.92) at Time 1. The interaction effect of classroom percentage of MMORPG players with time on IA was non-significant (*b*=.04, *p*=.68). The model explained 14.49% of the overall IAT score variance. Analyses controlled for random effects due to other individual (e.g., gender) and classroom characteristics (ε, ρ and u parameters refer to controls of random effects at the three levels; see Table 5).

-Place Table 5 about here. HLM Analysis Findings-

-Place Figure 1 about here. Model-

-Place Figure 2 about here. Hostility and IA over time-

4. Discussion

The present study longitudinally assessed a normative sample of Greek adolescents aged 16 to18 years, and applied a multilevel design to examine hostility and MMORPG playing at the individual level, and the effect of classroom percentage of MMORPG gamers on IA symptoms at the classroom level. Findings revealed that while more hostile adolescents and MMORPG players presented higher IA scores, classrooms with a higher percentage of MMORPG gamers predicted decreased IA symptoms, and these remained constant until 18 years.

4.1. Hostility

More hostile adolescents were found to present higher IA symptom severity. This did not significantly vary between the ages of 16 and 18 years (see the slope of the regression line in Figure 2). This finding corroborates several cross-sectional and longitudinal studies (Ko et al., 2009; Kuss et al., 2014; Yen et al., 2008), and it expands the existing knowledge by indicating that the risk effect of hostility holds until the age of 18 years (non-significant interaction with time). Research suggests more hostile adolescents develop IA behaviors as a way to escape or avoid the distress they experience due to their symptoms (Yen et al., 2007). Additionally, IA behavior among more hostile adolescents may constitute a form of passive hostility towards their real context, expressed through withdrawal from their real interactions. Ko and colleagues (2009) hypothesized that the Internet environment could be more accommodating for hostile behaviors due to the lack of real-life limitations and sanctions. Moreover, Mehroof and Griffiths (2010) added that if online aggression is rewarding, users are likely to continue the behavior, potentially resulting in online addiction. This interpretation supports the notion that the Internet is used to compensate for offline challenges (Kardefelt-Winther, 2014).

The non-significant interaction between hostility and time indicated that more hostile adolescents continue to present higher IA symptoms at 18 years. It has been found that older adolescents (compared to younger adolescents) have a variety of strategies at their disposal, such as problem-solving and reappraisal (Spear, 2000; Williams and McGillicuddy-De Lisi, 1999). However, these changes appear not to have been strong enough to compensate the risk effect of hostility on IA symptoms.

4.2. MMORPGs

The finding that individual MMORPG playing increases IA symptoms is in line with the relevant international literature (e.g., Gentile et al., 2011; Kuss et al., 2014). This association can be explained by online satisfaction and immediate gratification due to addressing the gradually increasing level of challenges in MMORPGs (Choi & Kim, 2004; Hull et al., 2013; Wan & Chiou, 2006). More specifically, MMORPGs may trigger high emotional involvement and an increased need to spending time online (Gentile et al., 2011), and thus reinforcing IA.

Additionally, the results revealed that the predictive power of MMORPG playing on IA remained constant. This corresponds with longitudinal studies showing stability of other forms of addiction during adolescence (Segal, 1991). Furthermore, the findings corroborate prospective studies' results including younger Asian adolescent samples (mean age of 11.2 years), which suggested that when gamers develop IA, their problems in real life may increase, in turn increasing their IA vulnerability (Gentile et al., 2011). However, recent longitudinal studies in adult samples have supported that addictive behaviors including gaming may be fairly transient for most individuals (Thege, Woodin, Hodgins & Williams, 2015). These disparities could be indicative of age related differences in the progress of addictions that need to be further investigated.

4.3. Percentage of MMORPGs gamers in the classroom

A higher classroom percentage of MMORPG players was found to decrease individuals' IA symptoms, and this did not change over time. Despite the theoretically acknowledged contribution of contextual factors for IA (Douglas et al., 2008), the importance of the classroom environment in adolescent development (Ryan & Patrick, 2001) and the likely positive effects of gaming in groups (Jones et al., 2014), there has been no previous

relevant study assessing this link, and therefore this requires careful interpretation. Although gaming is not permitted in the classroom, peers with a common interest of playing MMORPGs may be less isolated compared to gamers in classrooms with less MMORPG gamers because it is something they talk about and/or play together outside of the classroom. Collective gaming and talking about gaming may enhance face-to-face relationships, thus reinforcing classroom social ties and reducing IA symptoms. This interpretation is in line with studies suggesting that playing MMORPGs may enhance the level of bonding and social interactions (Skoric & Kwan, 2011) by providing an additional communication frame (Jones et al., 2014), and players often extend friendships made in-game to real life relationships outside of the game (Cole & Griffiths, 2007; Williams et al., 2006). Additionally, adolescents in classrooms with higher percentages of MMORPG gamers may play to be more socially integrated and not to achieve gratification in an addictive way. Studies suggest that the social acceptance of a behavior is reinforced by its prevalence within a group and that it is in turn related to higher popularity and sociability (Chang, 2004).

4.4. Limitations, Future Research and Implications

As with all research, the present study has limitations. Self-report measurements that rely on the participants' truthfulness and self-perception were used. MMORPG gamers were identified via a dichotomous question, which may have limited the scope of the results. The sample was assessed only twice and within a specific age range, and findings cannot be generalized across the life span. Moreover, cultural and socio-economic characteristics limitations should be considered. Studies in different age ranges and cultural populations should be conducted. In addition, further research should specifically address and assess the extent of social interactions among classmates both online and offline to be able to draw more conclusive findings with regards to the positive effect of the higher percentage of MMORPG gamers in the classroom.

Despite these limitations, the findings of this study expand current knowledge by: (i) indicating that more hostile adolescents continue to present higher IA symptom severity than their peers at 18 years; (ii) demonstrating that the relationship of MMORPG playing and IA symptoms holds over time and is therefore similar to other forms of addictions, and (iii) indicating that the effect of MMORPG playing may differentiate between the individual and the classroom (group) level.

These findings may provide useful guidelines for public health policies, as long as they are replicated in populations of other cultural backgrounds. According to the findings in the present study, emphasis should be placed on more hostile adolescents and MMORPG players before the age of 16 years, while possible socializing effects of gaming could be encouraged in future prevention and treatment initiatives.

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Footnotes

Note 1: The present data have been used in two more published studies which address different theoretical questions (Stavropoulos, Kuss, Griffiths & Motti-Stefanidi, 2015; Stavropoulos, Gentile & Motti-Stefanidi 2015). Instruments used in the data which are not analyzed in the present paper include the: (i) Internet Addiction Test IAT (Young, 1998a); (ii) Presence II questionnaire (Witmer & Singer, 1998); (iii) Online Flow Questionnaire (Chen, Wigand & Nilan, 1999); (iv) Symptom Check List 90 (Derogatis & Savitz, 1999); (v) Rosenberg Self-Esteem Scale (Rosenberg, 1965); (vi) Five Factor Questionnaire for Children (Fünf-Faktoren-Fragebogen für Kinder) (Asendorpf & Van Aken, 2003); (vii) Generalized Self-Efficacy Scale (Schwarzer, 1993); (viii) Family Adherence and Cohesion Evaluation Scale (Olson, 2000); (ix) Socio-mentric Questionnaire (Coie, Dodge & Coppotelli, 1982); (x) The Greek Version of the Experience of Close Relationships Revised (Tsagarakis, M., Kafetsios, K., & Stalikas, A., 2007); (xi) Demographic and Internet Use Questions and; (xii)) School grades of the participants were retrieved from their school records.

Note 2: Level-1: $Y = \Pi_0 + \Pi_1 *(WAVE) + \varepsilon$

Level-2: $\Pi_0 = \beta_{00} + \beta_{01} *(MMORPG) + \beta_{02} (Hostility) + \rho_0$

$\Pi_1 = \beta_{10} + \beta_{11} *(SCL_OCD) + \beta_{12} (Hostility) + \rho_{01}$

Level-3: $\beta_{00} = \gamma_{000} + \gamma_{001} *(MMORPG\%) + u_{00}$

$\beta_{01} = \gamma_{010} + \gamma_{011} *(MMORPG\%) + u_{01}$

$\beta_{02} = \gamma_{020} + \gamma_{021} *(MMORPG\%) + u_{02}$

$\beta_{10} = \gamma_{100} + \gamma_{101} *(MMORPG\%) + u_{10}$

$\beta_{11} = \gamma_{110} + \gamma_{111} *(MMORPG\%) + u_{11}$

$\beta_{12} = \gamma_{120} + \gamma_{121} *(MMORPG\%) + u_{12}$