



Early adolescent Internet game addiction in context: How parents, school, and peers impact youth



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ABSTRACT

The aim of this study was to identify the underlying mediating mechanisms between the parent–adolescent relationship and Internet game addiction (IGA). A sample of 833 adolescents initially in the 7th grade completed anonymous questionnaires regarding the parent–adolescent relationship, school connectedness, deviant peer affiliation, and IGA during a one year period. Structural equation models showed that both school connectedness and deviant peer affiliation fully mediated the association between the parent–adolescent relationship and adolescent IGA. School connectedness also significantly predicted deviant peer affiliation, forming a sequential mediation model. In general, the results indicated that a low quality parent–adolescent relationship predicted IGA by way of diminishing school connectedness and enhancing affiliations with deviant peers. The non-significant pathway from parent–adolescent relationship to adolescent IGA supports the idea that a distal parent–adolescent relationship still retains a substantial influence on the development of adolescents' IGA, but through the more important proximal variables of school connectedness and deviant peer affiliation. Identifying the processes by which the parent–adolescent relationship is associated with adolescents' IGA has important implications for developing an integrative framework of theory and prevention.

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1. Introduction

Since the first massive multiplayer online role-playing game was introduced in Korea, more and more adolescents enjoy Internet games for reasons such as the satisfaction of competence, autonomy and relaxation (Griffiths, 2003; Ryan, Rigby, & Przybylski, 2006). Appropriate Internet game use has been identified as advantageous for adolescents' growth and development. For instance, Subrahmanyam, Kraut, Greenfield, and Gross (2000) suggested that Internet game use enhances cognitive skills through emphasizing visual information processing. However, due to the increased amount of time that adolescents spend with Internet games, playing may become addictive for some persons when the activity becomes dysfunctional, harming the individual's social, occupational, family, school, and psychological functioning (Gentile et al., 2011; Kuss, 2013). Internet game addiction (IGA) is an important sub-type of Internet addiction (Young, Pistner,

O'MARA, & Buchanan, 1999). Because of the multiplicity of conceptualizations and measures, the estimated prevalence of IGA varies (0.2–10%) across cultures (Festl, Scharkow, & Quandt, 2013; Gentile, 2009; Hur, 2006). In June, 2013, Internet gaming addiction as one disorder was first brought into the appendix of the updated version of the Diagnostic and Statistical Manual for Mental Disorders (DSM-5). Given the rapidly increasing attention given to IGA, efforts to explain why and how adolescents are profoundly involved in Internet games have become important research issues.

Researchers have begun to highlight developmental-ecological models (Bronfenbrenner, 1979) to identify protective and risk factors across contexts and mediational pathways leading to adolescent problematic behaviors (Catalano, Oesterle, Fleming, & Hawkins, 2004; Dodge et al., 2009). Multiple protective and risk factors for IGA have already been identified across multiple domains (e.g., parents, school and peer influence). In order to fully understand the determinants of adolescent IGA and emphasize the changing relative impact of ecological forces on adolescent development, we propose that family (i.e., parent–adolescent relationship), school (i.e., school connectedness) and peer (i.e., deviant peer affiliation) systems should be taken into consideration simultaneously. We used a short-term longitudinal design with multiple time points to examine whether school connectedness

Abbreviations: PAR, parent–adolescent relationship; IGA, internet game addiction; SC, school connectedness; DPA, deviant peer affiliation.

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and deviant peer affiliation function as mediators of the link between parent–adolescent relationship and adolescent IGA. Following are the relevant theoretical and empirical works that have led us to the current model.

1.1. Parent–adolescent relationship and IGA

The Self-Determination Theory (SDT), which holds that self-determination either facilitates or undermines adolescent intrinsic motivation and internalization, provides great insight into the link between the parent–adolescent relationship and adolescent IGA (Ryan & Deci, 2000). Przybylski, Rigby, and Ryan (2010) pointed out that the appeal of Internet games was based in their potential to satisfy basic psychological needs (i.e., competence, autonomy, and relatedness), and thus we can infer that a positive parent–adolescent relationship may protect against IGA under the SDT frame. An undesirable parent–adolescent relationship may frustrate basic psychological needs (Joussemet, Landry, & Koestner, 2008), and adolescents may seek satisfaction of those needs through Internet gaming (Ryan et al., 2006; Xu, Turel, & Yuan, 2012). Indeed, several studies have shown that a positive parent–adolescent relationship is a protective factor in that it is negatively associated with Internet addiction in general, not limited to IGA (Liu, Fang, Deng, & Zhang, 2012; Liu, Fang, Zhou, Zhang, & Deng, 2013; van Den Eijnden, Spijkerman, Vermulst, van Rooij, & Engels, 2010). More importantly, in a three year longitudinal study, van Den Eijnden et al. (2010) provided evidence that high quality parental communication about Internet use was an effective tool to prevent Internet addiction.

Although Koo and Kwon (2014) asserted that IGA and Internet addiction might be associated with similar psychological factors and they were distinctive expressions of the same underlying vulnerability, the link between the parent–adolescent relationship and IGA is not as clear as that between the parent–adolescent relationship and Internet addiction. Some studies have found a negative association between parental relationship and IGA (Kim, Son, Yang, Cho, & Lee, 2007; Kwon, Chung, & Lee, 2011). For instance, Kwon et al. (2011) documented that adolescents tended to increase the time spent on Internet games when they perceived a poor relationship with their parents, who were ignorant of their activities, oppressed them and showed hostility toward them. However, some studies also acknowledged that influence from parents might not be an significant correlate of IGA (Rehbein & Baier, 2013; Willoughby, 2008). Moreover, a meta-analysis exploring influences on IGA in Korea found that the weighted average correlation of IGA and the parental relationship was lower than correlations involving school and peer factors (Koo & Kwon, 2014). Given that the predictive value of family effect on IGA has been found to be relatively small (Kweon & Park, 2012; Kwon et al., 2011; Xu, 2009), the fact that school and peer factors become more critical during adolescence as they spend more time away from home (Kotchick, Shaffer, Miller, & Forehand, 2001), and contradictory findings in earlier research, the parent–child relationship may be a more distal predictor rather than a direct predictor of IGA. Thus, it is important to examine the mechanisms through which the parent–adolescent relationship impacts adolescent IGA.

1.2. School connectedness as a mediator

Defined as students' enjoyment and interest in school activities, closeness with teachers and classmates, and willingness to do one's schoolwork (Upadaya & Salmela-Aro, 2013), school connectedness has emerged as a potential major predictor of adolescents' psycho-social problems, academic achievement, and well-being (Eisenberg, Neumark-Sztainer, & Perry, 2003; Li & Lerner, 2011; Shochet & Smith, 2012). In the current study, we ask

whether it can also be a mediator between the parent–adolescent relationship and IGA. Grounded on attachment theory, attachment behaviors can be strengthened through interaction with the primary caregiver (i.e., parent), who contributes most to the adolescent's formation of psychological structures that provide stable representations of the self, others, and the environment (Bowlby, 1969; Shochet, Homel, Cockshaw, & Montgomery, 2008). Parent–adolescent attachment resembles an ongoing bond, and can be regarded as a cognitive experience of warmth, trust, and open communication (Murray, 2009). The relatedness, competence and autonomy derived from parents may become internalized and will promote adaptation and exploration in school contexts (Connell & Wellborn, 1991). Furrer and Skinner (2003) have verified that a high quality parent–adolescent relationship could operate as a motivational resource that had an impact on youths' better school connectedness. In a longitudinal study, Simons-Morton and Chen (2009) showed that a supportive parent–adolescent relationship, including authoritative parenting and parental involvement, played a critical role in promoting long-term school connectedness. Another study examined the influence of adolescent supportive relationships with parents on trajectories of different dimensions of school engagement, and also demonstrated that perceived support from parents was an important buffer against the general declines in emotional connectedness to school found during the secondary school years (Wang & Eccles, 2012). Likewise, low levels of parent–adolescent relationship will impose a restriction on developing school connectedness, and ultimately result in basic psychological needs not being met, a lack that the adolescent may compensate for through Internet games. None of the preceding studies has focused on this question of whether school connectedness as a mediator can buffer the impact of a low quality parent–adolescent relationship on IGA.

The notion that school connectedness slows down escalations in adolescent IGA has been preliminarily advocated by some authors (Kweon & Kim, 2014; Kweon & Park, 2012). In a survey of 557 middle school students in Korea, Kweon and Kim (2014) demonstrated that adolescents with high levels of satisfactory school life were less likely to develop IGA. A similar process was proposed by Kweon and Park (2012), who argued that school connectedness, characterized by conforming to school norms and relationships with peers and teachers, could be identified as a protective factor against IGA during early adolescence. More importantly, a two-wave longitudinal survey in Germany reported that adolescents who were more integrated in their class were less likely to engage in Internet games in a problematic manner during the course of their further development (Rehbein & Baier, 2013). Results above mentioned are consistent with Social Control Theory (Hirschi, 1969), which emphasizes that adolescents with high levels of school connectedness will endeavor to meet the values, norms, and beliefs that are shaped in the school, and for this reason, display fewer problematic behaviors such as IGA.

Although no research has directly examined the presumption of school connectedness as a mediator between the parent–adolescent relationship and IGA, there have been a small number of studies that have played an important role in documenting that the association between family factors and adolescent development can be mediated by school connectedness (Li, Lerner, & Lerner, 2010; Shochet et al., 2008). For instance, Shochet et al. (2008) pointed to the ubiquitous role of parental attachment in depressive symptoms, not only as a direct influence but also an indirect one in its role as a possible precursor to the important proximal variable of school connectedness. In a longitudinal study, it was reported that adolescents who received higher levels of maternal warmth and parental involvement were more likely to have higher perceived academic competence, but only via school connectedness (Li et al., 2010). Based on these findings it is not difficult to

conclude that the parent–adolescent relationship remains influential on development, but is constantly being affected by a more proximal factor (i.e., school connectedness). It stands to reason that a similar mediational mechanism may be operating such that the distal parent–adolescent relationship and proximal school connectedness contribute to IGA.

1.3. Deviant peer affiliation as a mediator

It is of critical importance to identify whether a poor parent–adolescent relationship as a risk may provide entrance into a deviant social cluster. Based on the stage–environment fit perspective (Eccles et al., 1993), being unable to satisfy basic psychological needs through the parent–adolescent relationship results in a context that is a poor fit for young adolescents, who may be more likely to seek intimacy and support from peers (Pires & Jenkins, 2007). Simons and Robertson (1989) showed that low quality parent–adolescent relationship characterized by parental rejection increased the probability that a youth became involved with deviant peers. Additionally, a longitudinal study suggested that overly high parental supervision, as a reflection of a disturbed affective relationship between parents and adolescents, might bring about a mismatch between adolescent developmental needs and the levels of autonomy their parents permitted, and amplified the possibility that adolescents would affiliate with deviant peers (Keijsers et al., 2012). Thus, the lack of a high quality parent–adolescent relationship is thought to increase access to deviant peers, creating more possibility to develop IGA.

Affiliation with deviant peers has been conceptualized as a proximal influence that promotes risky behavior, including aggression, alcohol abuse, violence victimization and crime (Farmer et al., 2003; Fergusson, Swain-Campbell, & Horwood, 2002; Vézina et al., 2011). Ko et al. (2008) pointed out that the psychosocial proneness of problematic behaviors was associated with IGA, because games online could provide a chance to perceive virtual success that might be utilized to cope with lower self-esteem and poorer life satisfaction in the real world. Owing to shared features, one might expect that processes linking deviant peer affiliation to other problem behaviors could be generalized to the appearance of IGA. Zhang, Chen, Liu, Deng, and Fang (2012) have verified that peers' Internet behaviors not only had a direct effect on Internet addiction, but also had an indirect effect through peer pressure. Peer pressure may also urge adolescents to develop IGA through imitation or modeling from deviant peers (Akers, Krohn, Lanza-Kaduce, & Radosevich, 1979). Importantly, Yang, Chen, Wang, and Wang (2008) reported that 4th–6th grade pupils in urban areas were more likely to become addictive gamers when they affiliated with peers fascinated with Internet games. Thus, deviant peer affiliation may have a proximal impact on IGA, as a mechanism through which the parent–adolescent relationship operates.

A small set of studies has uncovered that deviant peer clustering could be a mediating mechanism governing the process leading from family factors to adolescent externalizing problems. For instance, Keijsers et al. (2012) found in a 3-wave multi-informant study that the negative impact of parental prohibition of friendships on adolescent delinquency was mediated by involvement with deviant peers. Additionally, deviant peer affiliation mediated the association between mothers' negative parental practices and adolescent anti-social behavior (Lott, 2009). Moreover, in a recent study Song et al. (2014) revealed that parent–adolescent relationship characterized by parental behavioral control was positively associated with deviant peer affiliation, which in turn was associated with Internet addiction. Taken together, it is important for us to ascertain whether the association between parent–adolescent relationship and IGA can be mediated by deviant peer affiliation.

1.4. School connectedness and deviant peer affiliation

Based on social control theory (Hirschi, 1969), if adolescents are close to the prosocial contexts that constitute school connectedness, they will obey the conventional standards of conduct in school and avoid the deviant peer cluster. In contrast, adolescents less connected to school may not perceive the support and intimacy available from teachers and classmates, and may be under-socialized regarding prosocial rules (Catalano et al., 2004). This may result in a poor fit for their needs and simultaneously enhance their tendencies toward deviant peer clusters. The link between school connectedness and deviant peer affiliation has been particularly well documented. Kelly et al. (2012) reported that school connectedness was associated with peer drinking networks for grade 6 students. Similarly, Li et al. (2013) proposed that children with strong school connectedness were less likely to affiliate with deviant peers. Moreover, in a longitudinal study across a critical developmental stage, the year after the transition to middle school, Rudasill, Niehaus, Crockett, and Rakes (2014) found that students who reported more declines in school connectedness were more likely to report growth in affiliation with deviant peers across sixth grade.

School and peer effects are viewed as becoming more important with age, as adolescents spend less time at home and more time at school or with peers (Kotchick et al., 2001). Although recent studies have demonstrated the role of both school connectedness and deviant peer affiliation (Li et al., 2010; Song et al., 2014) as mediators of parents' effects, few have empirically tested the mediating role of the both micro-systems in the same model. In the current study we examine the impact of factors in various contexts (e.g., family, school, peer) on IGA as intertwined with each other rather than isolated, and ascertain the process that influences the role of parent–adolescent relationship.

1.5. The present study

In order to organize the extensive literature and to identify causal pathways to adolescent IGA, it is necessary to integrate distal and proximal factors across contexts. In the current study, we used a longitudinal design within the developmental-ecological framework to examine how the parent–adolescent relationship was associated with adolescent IGA, highlighting school connectedness and deviant peer affiliation as the mediators of the process. It was hypothesized that a high quality parent–adolescent relationship could positively impact school connectedness, with higher levels of school connectedness leading to a lower tendency for IGA. It was also hypothesized that a low quality parent–adolescent relationship would have an indirect effect on IGA by increasing affiliations with deviant peers. Meanwhile, because school connectedness can be a direct predictor of deviant peer affiliation, we also posited that deviant peer affiliation would be a part of a sequential mechanism in which the parent–adolescent relationship was associated with school connectedness, which in turn was associated with deviant peer affiliation, in the prediction of IGA. Guided by existing evidences and theories, the full proposed model is shown in Fig. 1. Taken together, the two mediators of school connectedness and deviant peer affiliation are expected to shed light on the relationship between the parent–adolescent relationship and adolescent IGA. Identifying the process by which the parent–adolescent relationship is associated with IGA has important implications for theory and prevention, constituting a further step toward an integrative framework to understand the complicated relations among variables in our study.

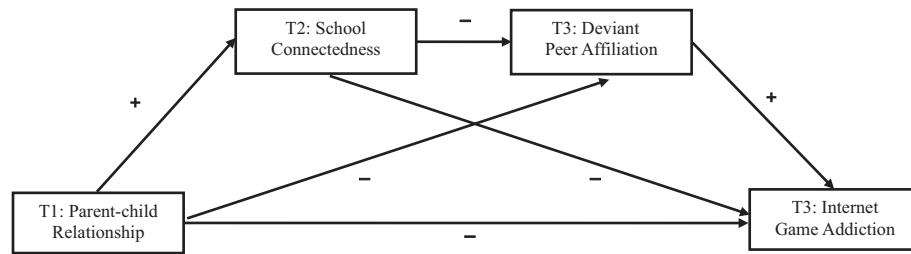


Fig. 1. Proposed mechanism of the association between parent–adolescent relationship and IGA.

2. Method

2.1. Participants

Participants were from a multiwave longitudinal study of 833 adolescents, recruited in Zhaoqing and Zhongshan, Southern China. At Time 1 (October, 2012), 1037 adolescents (550 boys and 487 girls) in 7th grade, ranging from 11–14 years of age, participated in the study and filled in a self-report questionnaire tapping their parent–adolescent relationship. The data collection at Time 2 occurred six months later (April, 2013), and 922 (88.9% of the original sample, 481 boys and 441 girls) adolescents were asked to fill in the school connectedness questionnaire. At Time 3 (October, 2013), the data were collected when most of the adolescents were in 8th grade. A total of 876 students (95.0% of the secondary sample, 457 boys and 419 girls) participated in the study again, and completed the deviant peer affiliation and IGA questionnaires. The results of Chi-square tests and *t* tests indicated that participants who had missing data did not differ from the participants who provided data at all three time points in relation to gender, age, SES, or any other study variables.

Of these last adolescents retained for longitudinal study, 90.1% of their fathers' and 91.8% of their mothers' highest educational level was senior middle school. The sample contained a range of social economic status (SES) based on family per capita monthly income, with most students (66.8%) falling between ¥0 and ¥5000, 13.0% below ¥1000 (low status), and 5.1% above ¥9000 (upper class status).

2.2. Measures

2.2.1. parent–adolescent relationship

The parent–adolescent relationship was adapted from the Parent–Adolescent Relationship questionnaire (Stattin & Kerr, 2000). Respondents were asked to indicate the quality of their relationships with their mothers and fathers, respectively. Eight items reflect the mother–adolescent relationship (e.g., “How often do you feel disappointed with your mother?”) and eight items reflect the father–adolescent relationship. They answered the same questions about fathers and mothers. All items were rated on a 3-point scale ranging from 1 (*never*) to 3 (*frequently recurring*). Given the high correlations between mother–adolescent relationship and father–adolescent relationship in the current sample ($r = .57$, $p < .01$), the responses were averaged across the sixteen items, with higher scores indicating higher levels of parent–adolescent relationship. In the current study, the Cronbach's alpha was .81.

2.2.2. School connectedness

School connectedness was measured with eight items by using the Emotional Engagement subscale from the School Engagement scale (Wang, Willett, & Eccles, 2011). Respondents were asked to indicate the school belonging and valuing of school education (e.g., “In general, I feel like a real part in this school”, “Getting a

good education is the best way to get ahead in life for the kids in my neighborhood.”). All items were rated on a 5-point scale ranging from 1 (*never*) to 5 (*frequently recurring*). The responses were averaged across the eight items, with higher scores indicating higher levels of school connectedness. In the current study, the Cronbach's alpha was 0.79.

2.2.3. Deviant peer affiliation

Affiliation with deviant peers was measured with twelve items adapted from prior published questionnaires (Fergusson & Horwood, 1999; Fergusson et al., 2002; Keijsers et al., 2012). Respondents were asked to indicate how many of your close friends during the past six months displayed conducts such as fighting, cheating, Internet addiction, truancy, stealing, smoking, alcohol use, threat, cheating on exams, and running away from home. All items were rated on a 5-point scale ranging from 1 (*never*) to 5 (*six or more*). Item scores were averaged to create a composite of deviant peer affiliation, with higher scores indicating higher levels of deviant peer affiliation. In the current study, this measure demonstrated a good internal consistency ($\alpha = .92$).

2.2.4. Internet game addiction

Internet game addiction was measured with eight items adapted from Young's Internet Addiction Scale based on the DSM–IV criteria for pathological gambling (IAS; Young, 1998). It has been used in many other studies to assess IGA by adding a specification for Internet games (Gentile, 2009; Kwon et al., 2011). Respondents were asked to indicate the level of their pre-occupation with the Internet game (e.g., “Do you feel the need to use the Internet game for increasing amounts of time in order to achieve satisfaction?”). All items were rated on a 3-point scale ranging from 1 (*never*) to 3 (*frequently recurring*). Item scores were averaged to create a composite of IGA, with higher scores indicating higher levels of IGA. In the current study, the Cronbach's alpha was 0.87.

2.2.5. Covariates

Given prior research reporting that adolescent gender, age, family socioeconomic status, were correlated with IGA (Kim, Namkoong, Ku, & Kim, 2008; Whang & Chang, 2004), we controlled for these variables in statistical analyses. Age was measured by the respondent's age in years. Gender (male = 1; female = 0) was a dichotomous variable. Social Economic Status (SES) was measured by family per capita monthly income, a ten-category variable (from $1 \leq \text{¥}1000$ to $10 \geq \text{¥}9000$).

2.3. Procedure

Permission to implement the study was granted by the research ethics committee of our institution. Verbal consent was also obtained from the headmasters, teachers and students of the selected schools. Moreover, trained researchers administered the self-report questionnaires to students during class time. In order

to encourage honest reporting, the anonymity of the study was emphasized at the beginning of collection session. Participants were also told that they must respond to the questionnaire items by themselves, and that they were free to withdraw at any time during data collection.

2.4. Statistical analysis

We estimated mediation effects through structural equation modeling (SEM) methods. Models were estimated using Mplus Version 7.0 (Muthén & Muthén, 2012), adopting the full information maximum-likelihood estimation procedure to accommodate missing data. A bootstrapping procedure was used to test and verify the paths for statistical significance (Erceg-Hurn & Miroseovich, 2008). Model fit was assessed using multiple fit indices including ratio chi-square over degrees of freedom (χ^2/df), comparative fit index (CFI), root mean square error of approximation (RMSEA), and Tucker-Lewis index (TLI). SEM literature suggests that model fit is good when $\chi^2/df \leq 3$; CFI $\geq .95$, TLI $\geq .95$, and RMSEA $\leq .06$ (Hoyle, 2012; Kline, 2011).

We compared some alternative models, and adopted the final model with paths fit significantly better than others. We conducted formal tests of mediation using a bootstrapping procedure (95% confidence interval, CI), which computes an estimation of the indirect effect with a 95% CI. The indirect effect is deemed to be significant when zero is excluded from the confidence interval.

3. Results

3.1. Descriptive statistics

Means, standard deviations, and correlations are displayed in Table 1. On average, adolescents reported medium to high levels of parent–adolescent relationship and school connectedness. Meanwhile, they suggested low levels of deviant peer affiliation and IGA. Both parent–adolescent relationship and school connectedness were negatively correlated with IGA ($r_1 = -.11$, $p < .01$; $r_2 = -.15$, $p < .001$), indicating that they might be protective factors for adolescent IGA. Deviant peer affiliation was positively correlated with IGA ($r = .24$, $p < .001$), meaning that adolescents who were affiliated with more deviant peers were more likely to show IGA. Moreover, the significant correlations appeared among parent–adolescent relationship, deviant peer affiliation and IGA.

3.2. The Mediating Role of School Connectedness and Deviant Peer Affiliation on the Association between Parent–Adolescent Relationship and IGA

We conducted our mediation model testing in several steps. We first evaluated the fit of the full proposed model (Model 1) which included: (a) the direct path from parent–adolescent

relationship \rightarrow IGA, (b) the indirect path from parent–adolescent relationship \rightarrow school connectedness \rightarrow IGA, (c) the indirect path from parent–adolescent relationship \rightarrow deviant peer affiliation \rightarrow IGA, (d) the direct path from school connectedness \rightarrow deviant peer affiliation. Table 2 summarizes the results of the model comparisons. The full proposed model fit the data well (Model 1: $\chi^2/df = 0.09$, CFI = 1.00, TLI = 1.03, and RMSEA = .00; see Fig. 2), but the path from parent–adolescent relationship to IGA was non-significant.

After dropping the direct effect of parent–adolescent relationship on IGA, the fit indices still suggested a good fit (Model 2: $\chi^2/df = 1.55$, CFI = 1.00, TLI = .98, and RMSEA = .03). The trimmed model did not significantly affect the fit, so we selected the more compact one (Model 2; see Fig. 3). Finally, in order to ascertain the link from school connectedness to deviant peer affiliation, we excluded the path between them (Model 3: $\chi^2/df = 5.02$, CFI = .96, TLI = .87, and RMSEA = .07; see Fig. 4), and the process significantly decreased the model fit (Model 3 vs. Model 2, $\Delta\chi^2 = 11.97$, $p < 0.001$). These results indicated the significant role of deviant peer affiliation sequential to school connectedness in the mechanism explaining parent–adolescent relationship and IGA. Thus, Model 2 was the final model.

We used multiple group analysis to examine gender difference by comparing the fit of the final model in which the structural paths were constrained to be equal across gender with the fit of the final model in which were free to differ across gender. The fit of the constrained models was not significantly worse than the unconstrained model, $\Delta\chi^2(5) = 5.607$, $p > .05$. Therefore, the overall sample was used in the final model. Consistent with the hypothesized pathway (see Fig. 3), parent–adolescent relationship at Time 1 significantly predicted school connectedness at Time 2 ($b = .27$, $p < .001$), which in turn predicted IGA ($b = -.12$, $p < .01$); parent–adolescent relationship at Time 1 significantly predicted deviant peer affiliation at Time 3 ($b = -.16$, $p < .001$), which in turn predicted IGA ($b = .19$, $p < .001$); school connectedness at Time 2 significantly predicted deviant peer affiliation at Time 3 ($b = -.12$, $p < .001$).

Finally, the indirect effects are reported in Table 3. Bootstrapping analyses suggested that all the mediating effects of school connectedness alone, deviant peer affiliation alone, and the combination of school connectedness and deviant peer affiliation in the association between parent–adolescent relationship and IGA were significant and negative (indirect effects = $-.02$, $-.03$, $-.01$, respectively; $ps < .05$).

4. Discussion

The current study investigated the potential influence of contextual factors for IGA in adolescence using a longitudinal design within a developmental–ecological model. Some conclusions regarding the association between parent–adolescent relationship

Table 1
Descriptive statistics and correlations for all variables.

Variables	M	SD	1	2	3	4	5	6
1. Gender	0.52	0.50	1					
2. Age (years)	12.52	0.67	0.07*	1				
3. SES	3.89	2.41	0.06	−0.05	1			
4. Parent–adolescent relationship, T1	2.45	0.32	0.03	−0.09	0.03	1		
5. School connectedness, T2	3.66	0.69	−0.01	−0.03	−0.03	0.27***	1	
6. Deviant peer affiliation, T3	1.45	0.74	0.09**	0.02	0.08*	−0.19***	−0.16***	1
7. Internet game addiction, T3	1.34	0.38	0.35***	0.06**	0.07	−0.11**	−0.15***	0.24***

Note. Gender was dummy coded such that 1 = male and 0 = female. SES = socioeconomic status.

*** $p < .001$.

** $p < .01$.

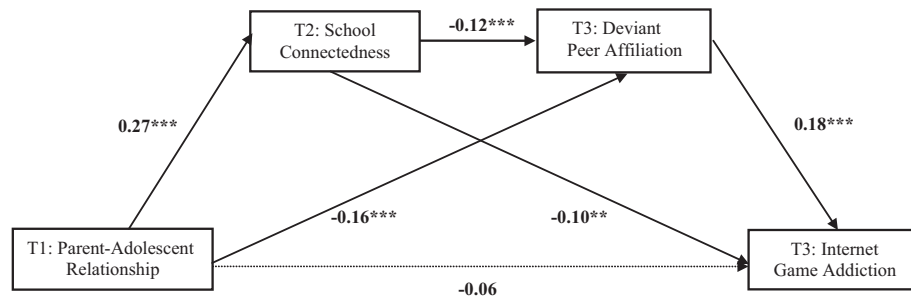
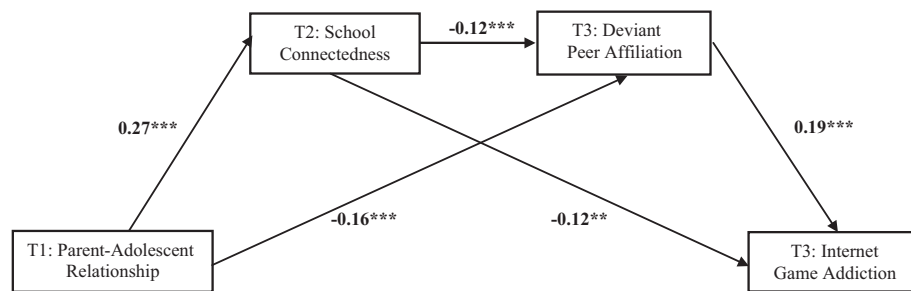
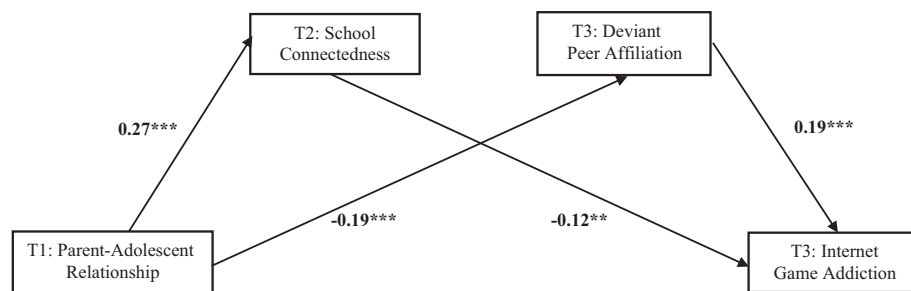
* $p < .05$.

Table 2

Model fit statistics and chi-square difference tests comparing fit.

Model	χ^2 (df)	CFI	TLI	RMSEA	$\Delta\chi^2$ (df)	p
Model 1 (full model)	0.09 (1)	1.00	1.03	0.00	–	
Model 2 (delete: parent–adolescent relationship → IGA)	3.09 (2)	1.00	0.98	0.03	3.00 (1)	>0.05
Model 3 (delete: school connectedness → deviant peer affiliation)	15.06 (3)	0.96	0.87	0.07	11.97 (1)	<0.001

Note. CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation.

**Fig. 2.** Full proposed model (Model 1) for the mediating effect in the association between parent–adolescent relationship and IGA. Significant standardized paths are displayed by the solid line, nonsignificant by the dotted line. Not displayed are paths between controlled variables (i.e., age, gender, SES, IGA at time 1) and each of the variables in the models. Of those paths, the following were significant: gender to deviant peer affiliation and IGA at Time 3 ($b_1 = .10^{**}$, $b_2 = .25^{***}$).**Fig. 3.** Trimmed model (Model 2) for the mediating effect in the association between parent–adolescent relationship and IGA. Significant standardized paths are displayed by the solid line, nonsignificant by the dotted line. Not displayed are paths between controlled variables (i.e., age, gender, SES, IGA at time 1) and each of the variables in the models. Of those paths, the following were significant: gender to deviant peer affiliation and IGA at Time 3 ($b_1 = .10^{**}$, $b_2 = .33^{***}$).**Fig. 4.** Alternative model (Model 3) for the mediating effect in the association between parent–adolescent relationship and IGA. Significant standardized paths are displayed by the solid line, nonsignificant by the dotted line. Not displayed are paths between controlled variables (i.e., age, gender, SES, IGA at time 1) and each of the variables in the models. Of those paths, the following were significant: gender to deviant peer affiliation and IGA at Time 3 ($b_1 = .10^{**}$, $b_2 = .33^{***}$).

and adolescent IGA have been arrived at (Kwon et al., 2011; Rehbein & Baier, 2013). However, the underlying mediating mechanisms, which are equally, and perhaps even more important, have not been identified. This study expanded existing empirical knowledge by constructing and testing a model with school connectedness and deviant peer affiliation as important mediators of the link between the parent–adolescent relationship and IGA. Moreover, multiple developmental influences were estimated simultaneously. The final model showed that school connectedness and deviant peer affiliation each fully mediated the relationship

between parent–adolescent relationship and adolescent IGA. Meanwhile, school connectedness significantly predicted deviant peer affiliation, representing a sequential mediation mechanism.

One notable finding was that in the context of the included mediators, a direct pathway from parent–adolescent relationship to IGA was not evident in the final model, which contradicted the widespread notion that the parent–adolescent relationship could be a strong predictor of Internet addiction (Liu et al., 2012; Liu, Fang, Zhou, Zhang, & Deng, 2013; van Den Eijnden et al., 2010), even in particular to IGA (Kim et al., 2007; Kwon et al.,

Table 3
Indirect effects.

Pathways that are evident in the final structural model	<i>b</i>	95% CI
Parent–adolescent relationship → school connectedness → IGA	−.03	−.049, −.031
Parent–adolescent relationship → deviant peer affiliation → IGA	−.03	−.050, −.012
Parent–adolescent relationship → school connectedness → deviant peer affiliation	−.03	−.052, −.011
School connectedness → deviant peer affiliation → IGA	−.02	−.039, −.006
Parent–adolescent relationship → school connectedness → deviant peer affiliation → IGA	−.01	−.011, −.001

2011). The reason for this finding may be that parent effects are more distal as youth spend less time with parents, and thus have weaker effect on IGA, especially when other proximal socialization factors (e.g., school, peers) are taken into account. The possibility has been supported by two longitudinal studies, which suggested that parental relationship, paternal devotion and parental supervision should not prove to be a predictive factor for higher frequency of computer game use or video game addiction (Rehbein & Baier, 2013; Willoughby, 2008). Kim et al. (2008) suggested that addictive use of online games could leave less time for adolescents' communication with family members in the household, or, alternatively, more time on Internet games may result from parents of adolescents with problematic behaviors (e.g., IGA) being less communicative with their children (Moilanen, Shaw, Criss, & Dishion, 2009). Periods of estrangement will further decrease the adolescent's disclosure to parents (Kerr, Stattin, & Burk, 2010), and cumulatively weaken the impact of parents on IGA. The current study employed a longitudinal design to test the temporal order of these processes, allowing stronger inferences about causality, and the results lead us to conclude that the substantial influence of the parent–adolescent relationship on the development of adolescents' IGA must be through the extra-familial system.

The current study indicated a fully indirect effect of parent–adolescent relationship on IGA via school connectedness, highlighting the protective role of school connectedness in early adolescence. This result was consistent with theories of parental attachment and social control (Bowlby, 1969; Hirschi, 1969). The parent–adolescent relationship as a precursor launches adolescents onto a projectory of healthy growth and development by establishing patterns of relationship (Bowlby, 1969), which then play a role in other more proximal interpersonal contexts such as the school. Because of this, the stress of living in a family with a poor parent–adolescent relationship likely disrupts school functions. The warmth, trust, and open communication acquired from parents can be generalized into interaction with teachers and classmates and help to form positive appraisals of self that facilitate satisfactory patterns of action at school (Connell & Wellborn, 1991), thus causing them to experience a sense of belonging at school. Baumeister and Leary (1995) argued that belonging was a source of motivation in a substantial variety of settings, and it influenced cognitive, emotional and behavioral patterns; failing to satisfy the need to belong could breed long lasting pathological consequences, such as IGA. Adolescents who perceive high levels of school connectedness are more likely to learn and to meet conventional expectations, and then keep themselves from IGA. As previously mentioned, evidence has suggested that school connectedness characterized by satisfactory school life, conforming to school norms and relationships with teachers was associated with adolescent IGA (Kweon & Kim, 2014; Kweon & Park, 2012). It is likely that the positive effect of school connectedness contributes to the attenuation of the association between low levels of parent–adolescent relationship and IGA.

The current study also suggested that deviant peer affiliation fully mediated the relationship between parent–adolescent relationship and IGA. The result can be understood from the stage-environment fit perspective (Eccles et al., 1993). This perspective points out that a mismatch between adolescent developmental needs (e.g., relatedness and autonomy) and the support or warmth derived from the parent–adolescent relationship may advance the likelihood of staying together with peers. Adolescents with problematic parental relationships may have difficulty forming intimate ties to mainstream peers (Furrer & Skinner, 2003) so that they are more inclined to be tempted by deviant peers, and acquire security, support, and intimacy deriving from them. Deviant peers are likely to provide opportunities and support to engage in excessive Internet games, increase the perception that Internet games are normative, and shape erroneous attitudes toward IGA. Additionally, adolescence is a critical stage in which adolescent dependence on parents can be replaced by dependence on peers (Steinberg, 1990), which may, in turn, provide fertile opportunities for delinquent behaviors strengthened by direct peer pressure or deviant practice (Patterson, Dishion, & Yoerger, 2000). Research has repeatedly indicated that association with a deviant peer cluster, such as one that is involved with aggression, alcohol use or delinquency, has been related to participation in excess Internet applications (Li et al., 2013; Zhang et al., 2012). Self-organization into deviant peer groups appears to be a contextual amplifying process that influences the damage of a negative parent–adolescent relationship, and ultimately results in IGA.

In addition to the demonstration of the full mediation effect, the result that school connectedness significantly predicted deviant peer affiliation is notable. This finding adds to research reporting that school connectedness is a protective factor for decreasing adolescent affiliation with deviant peers (Kelly et al., 2012; Rudasill et al., 2014). Meanwhile, the result partially explains why deviant peer affiliation mediate the link between the parent–adolescent relationship and IGA. An undesirable parent–adolescent relationship may result in a lack of school connectedness, which may weaken the bond to prosocial interactions and involvements (Catalano et al., 2004), thus increasing opportunities to affiliate with deviant others. Based on social control theory, adolescents who perceive high levels of school connectedness are more likely to learn and to meet conventional expectations, and then keep themselves from deviant peers. Moreover, because of this process, a sequential mediation path appears in the final model, which is one of the significant contributions of the current study.

Much previous research either tested family variables, school variables or peer variables in association with Internet addiction independently at different ecological levels (van Den Eijnden et al., 2010; Wang et al., 2011; Wang, Willett, & Eccles, 2011; Yang et al., 2008). In those studies predictor variables were combined into one specially appointed context, making it difficult to prove the mechanism explaining the integrated effect of various surroundings on IGA. This study demonstrated that there is a dynamic process to understanding the development of IGA. Adolescents who are unable to maintain a close attachment to family, which primes them to have difficulties in forming intimate ties at school, may be further inclined to permeate the deviant peer cluster and ultimately become an addictive gamer by imitating and modeling peers' behavior. Results from the current study highlight major contexts as intertwined and provide important clarification about the mechanisms by which the parent–adolescent relationship is associated with IGA. This association appears to be mediated by characteristics of the school and peer systems, rather than being simply a direct relationship. This provides strong supportive evidence that the parent–adolescent relationship indirectly impacts future growth and development as a possible precursor to the important proximal variable of school connectedness and

deviant peer affiliation. The current model also posits that family and school factors, along with deviant peer affiliation, have a cascading effect on the onset of IGA. From an applied standpoint, these findings bring to light that clarifying such processes is especially important to promote prevention and intervention that will have the potential to disrupt developmental cascades at different stages.

5. Limitation

Although the current study provides an important advancement in understanding three critical contexts (i.e., family, school and peer) as central to adolescent IGA in a longitudinal mediation model, there are some limitations that need to be taken into account. First, all measures were adolescent self-report, which may have increased shared method variance and biased findings. In order to ascertain this possibility, we used Harman's one factor test to test common method variance. A principal component factor analysis with varimax rotation was used on the items of all variables. This result revealed multiple factors with eigenvalues greater than 1. The first factor accounted for only 13.9% of total variance. The fit of the one-factor model was extremely dissatisfactory ($\chi^2/df = 12.37$; CFI = .37, TLI = .34, SRMR = 0.13 and RMSEA = .12). The results indicated that common method variance was not the major source of the variations in our study. Nevertheless, appropriate data source to include reports from parents, peers, and/or teachers should be utilized in the future to capture more accurate information. Second, this research was based on short-term longitudinal studies focusing on only three time points. Because the data on deviant peer affiliation and IGA were collected at the same time point, we failed to test the temporal order between them. Meanwhile, it is possible that the associations found with IGA at Time 3 might be overinflated by not accounting for the earlier effect of IGA. Future studies should include measures with multiple time points in long-term longitudinal studies to provide more detailed information. Third, our sample was representative of Chinese adolescents, which although in some respects is a strength, is a limitation in that it is unclear whether our findings can generalize to other cultural contexts.

6. Conclusion

In summary, although the current study should be replicated and extended, it is an important step in comprehending how the parent–adolescent relationship is linked to adolescents' IGA within the developmental-ecological model. The non-significant pathway from parent–adolescent relationship to IGA was surprising; however, these results highlight the important mediation role of school connectedness and deviant peer affiliation during adolescence. Moreover, these results provide support for a cascading pathways model on the onset of IGA. Clarifying such processes can be of great importance for an integrative framework of theory and prevention that has the potential to address different disadvantages at different developmental stages in order to reduce IGA.

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Appendix A

- Internet game addiction scale: 1 (never) to 3 (frequently recurring)
 1. Do you feel preoccupied with the Internet game (think about previous on-line game or anticipate next on-line game)?
 2. Do you feel the need to play the Internet game with increasing amounts of time in order to achieve satisfaction?
 3. Have you repeatedly made unsuccessful efforts to control, cut back, or stop Internet game use?
 4. Do you feel restless, moody, depressed, or irritable when attempting to cut down or stop Internet game use?
 5. Do you stay on the internet game longer than originally intended?
 6. Have you jeopardized or risked the loss of significant relationship, job, educational or career opportunity because of playing the Internet game?
 7. Have you lied to family members, therapist, or others to conceal the extent of involvement with the Internet game?
 8. Do you use the Internet game as a way of escaping from problems or of relieving a dysphoric mood (e.g., feelings of helplessness, guilt, anxiety, depression)?
- Parent–adolescent relationship scale: 1 (never) to 3 (frequently recurring)
 1. How often do you feel disappointed with your mother?
 2. How well do you and your mother understand each other?
 3. Do you wish that your mother was different?
 4. Do you and your mother quarrel and fight with each other?
 5. How often do you feel proud of your mother?
 6. Do you accept your mother the way she is?
 7. How often do you feel angry or irritated by your mother?
 8. How often do you feel disappointed with your father?
 9. How well do you and your father understand each other?
 10. Do you wish that your father was different?
 11. Do you and your father quarrel and fight with each other?
 12. How often do you feel proud of your father?
 13. Do you accept your father the way he is?
 14. How often do you feel angry or irritated by your father?
- School connectedness scale: 1 (never) to 5 (frequently recurring)
 1. I feel happy and safe in this school.
 2. In general, I feel like a real part in this school.
 3. I would recommend to other kids that they go to my school.
 4. I have to do well in school if I want to be a success in life.
 5. Schooling is not so important for kids like me.
 6. I learn more useful things from my friends and relatives than I learn in school.
 7. Getting good education is the best way to get ahead in life for the kids in my neighborhood.
 8. I often learn a lot from my school work.
- Deviant peer affiliation scale: 1 (never) to 5 (six or more)

During the past six months how many of your close friends displayed the conduct:

1. Fighting
2. Cheating
3. Internet addiction
4. Truancy
5. Stealing
6. Smoking

7. Alcohol use
8. Overnight outside without permission
9. Threat
10. Cheating on exams
11. Running away from home.
12. Watching violent or pornographic books

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