

# School Connectedness and Problematic Internet Use in Adolescents: A Moderated Mediation Model of Deviant Peer Affiliation and Self-Control

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**Abstract** Although a growing body of research documents the negative association between school connectedness and adolescent problematic Internet use (PIU), little is known about the mediating mechanism (i.e., how school connectedness relates to PIU?) and moderating mechanism (i.e., when the protection is most potent?) underlying this relation. The present study examined whether deviant peer affiliation mediated the relationship between school connectedness and PIU, and whether this mediating process was moderated by adolescent self-control. A total of 2,758 Chinese adolescents (46 % male; mean age=13.53 years,  $SD=1.06$ ) from 10 middle schools completed anonymous questionnaires regarding school connectedness, deviant peer affiliation, self-control, and PIU. After controlling

for gender, age, socioeconomic status, and parental attachment, it was found that the negative association between school connectedness and adolescent PIU was partially mediated by deviant peer affiliation. Moreover, this indirect link was stronger for adolescents with low self-control than for those with high self-control. These findings underscore the importance of integrating the social control theory and organism-environment interaction model to understand how and when school connectedness impacts adolescent PIU.

**Keywords** School connectedness · Problematic Internet use · Deviant peer affiliation · Self-control · Protective-attenuating hypothesis

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The Internet has become an indispensable tool for information, communication, and entertainment among adolescents (Tsitsika et al. 2009). Despite many advantages, the Internet is not without its problems, especially when its use becomes excessive or inappropriate. Problematic Internet use (PIU) refers to “use of the Internet that creates psychological, social, school and/or work difficulties in a person’s life”<sup>1</sup> (Beard and Wolf 2001). It consists of particular behaviors such as excessive gaming, sexual preoccupations, and e-mail/text messaging that share the following characteristics: excessive use, withdrawal, tolerance and impaired social and psychological functioning (Block 2008; Ko et al. 2005). Ample research evidence

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<sup>1</sup> Although some researchers used terms such as “Internet addiction”, “pathological Internet use”, or “Internet dependency” to describe this maladaptive behavior, we prefer the term PIU for two reasons. First, adopting the addiction perspective is inadequate because it remains debatable whether excessive Internet use constitutes an addiction (Ang et al. 2012; Holden 2010). Second, compared to “pathological” or “dependency”, the term “problematic” describes the behavior in a more inclusive manner covering the entire range of problematic behavior from mild to severely disturbed behavior and thus can address a wide segment of the population (Ang et al. 2012).

has indicate that adolescent PIU is common (2 %~11 %) around the world (Aboujaoude 2010; Young and de Abreu 2011), and is associated with a variety of physical, mental, interpersonal, and academic problems (Ko et al. 2012; Shapira et al. 2000; Young and de Abreu 2011). Therefore, it is essential to understand mechanisms that place adolescents at risk for PIU and develop protective intervention programs.

Among many factors influencing adolescent PIU, the role of school connectedness has received increased attention over the past few years. School connectedness refers to a student's relationship to school and his/her feelings about school (Libbey 2004). Students who experience positive school connectedness enjoy school life, believe that they are cared for and supported by their teachers and peers, and have better sense of belonging in school. There is considerable evidence suggesting that school connectedness is a powerful predictor for adolescents' physical, educational, and socio-emotional well-being (Anderman 2002; Catalano et al. 2004; Resnick et al. 1997). Research has also indicated that adolescents who feel connected to school are less likely to develop PIU (Sun et al. 2005; Wang et al. 2011; Yen et al. 2009). For instance, Jiang and Huang (2008) found that school connectedness was negatively associated with PIU among high school students. Similarly, Wang and colleagues (2011) concluded that school connectedness (positive relationships with teachers and classmates) was a protective factor for adolescent PIU. These findings highlight the value of increasing school connectedness (an important aspect of students' socio-emotional needs) in reducing adolescent PIU.

Nonetheless, prior research has focused primarily on the direct link between school connectedness and adolescent PIU. The mediating mechanism (i.e., how school connectedness relates to PIU?) and moderating mechanism (i.e., when the protection is most potent?) underlying this relation remain largely unknown. Answers to these questions are essential for a better understanding of the etiology of adolescent PIU and the development of targeted intervention programs. In the present study, we aim to investigate two questions: first, whether school connectedness reduces deviant peer affiliation, which in turn reduces the likelihood of adolescent PIU; second, whether the indirect association between school connectedness and PIU is moderated by important individual characteristics such as self-control.

### Deviant Peer Affiliation as a Mediator

Students spend increasingly more time with their peers in adolescent years, and their susceptibility to peer influence increases and peaks during adolescence (Steinberg and Monahan 2007). According to the social development model (Hawkins and Weis 1985), adolescent school connectedness may influence the likelihood of deviant peer affiliation, which may in turn influence their deviancy. In other words, deviant

peer affiliation may mediate school connectedness effects. Likewise, Oetting and Donnermeyer's (1998) primary socialization theory postulates that the link between social connectedness (such as school connectedness) and deviant behaviors may not be a direct one; rather, it is deviant peer affiliation that mediates the relationship between social connectedness and adolescent deviancy. Consistent with these theoretical frameworks, abundant empirical evidence has demonstrated the mediating effect of deviant peer affiliation in the association of school connectedness with adolescent substance use (Henry 2008; Swaim et al. 1998) and delinquency (Zhang and Messner 1996). For instance, in an American longitudinal study, Henry (2008) found adolescents who were poorly connected to school demonstrated a higher level of drug abuse, and this association was mediated by affiliating with drug-using peers. Although not yet tested, it is reasonable to expect that deviant peer affiliation will also mediate the association between school connectedness and adolescent PIU. In the following section, previous research findings would be reviewed to support our argument.

First, adolescents with strong school connectedness are less likely to affiliate with deviant peers. This is because they are consistently reinforced by maintaining good connection with school, and they are reluctant to compromise the good relationships with teachers and peers. In contrast, adolescents with low school connectedness have limited social reinforcement in school settings for positive conventional goal pursuit, and tend to engage in deviant peer relationships that maximize negative social reinforcement (Hawkins and Weis 1985; Oetting and Donnermeyer 1998). Previous research has also confirmed that school connectedness decreased the likelihood of adolescents' deviant peer affiliation (Hawkins and Weis 1985; Murguia et al. 1998; Oetting and Donnermeyer 1998).

Second, when adolescents affiliate with deviant peers (including, but not limited to friends who engage in PIU), they are more likely to develop PIU. Specifically, adolescents are negatively influenced by deviant peers presumably through processes of peer norms, modeling, and pressure (Beard 2011), and are more likely to engage in various socially disapproved behaviors and less likely to be accepted by the community. Therefore, they might indulge themselves in the virtual world to escape from the stressful realities. For example, they might play massively multiplayer online games that are potentially addictive to distract themselves from the real lives. A large body of empirical evidence supports the idea that deviant peer affiliation plays an important role in shaping adolescent PIU (Ko et al. 2008; Wang et al. 2011). Yang et al. (2008) found that having computer game addicted friends was associated with higher tendency on computer game addiction among elementary students. Similarly, Yen and colleagues (2009) reported that high school students whose friends engaged in alcohol use or deviant behaviors (not including PIU) were at greater risk for PIU. These findings suggest that

deviant peer affiliation is a significant risk factor for adolescent PIU.

In fact, two studies (Wang et al. 2011; Yen et al. 2009) had specifically examined the influence of school connectedness and deviant peer affiliation on adolescent PIU. However, both studies treated one variable (e.g., deviant peer affiliation) as a nuisance variable by statistically controlling for or removing its influence when they were interested in the impact of the other one (e.g., school connectedness). In other words, they assumed that the two variables operated independently. Unlike the above studies, we take into account the potential association of school connectedness with deviant peer affiliation. Based on the literature reviewed above, we propose the following hypothesis:

*Hypothesis 1* deviant peer affiliation will mediate the relationship between school connectedness and adolescent PIU.

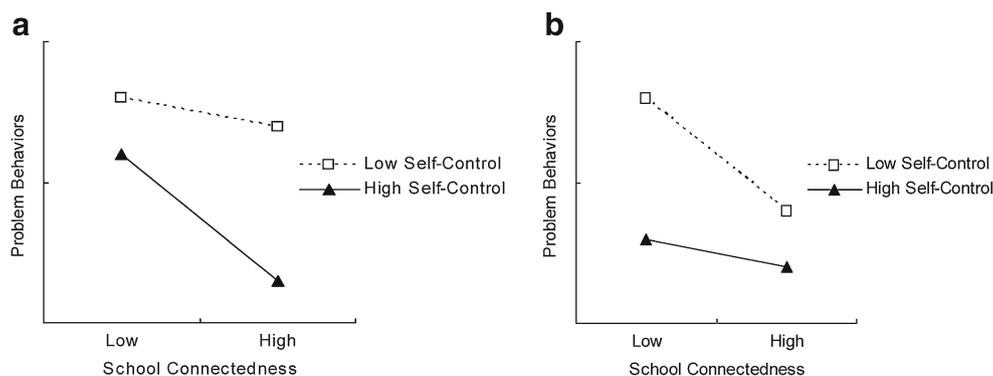
### Self-Control as a Moderator

Although school connectedness is generally protective against PIU, not all adolescents are equally influenced by school connectedness. Consequently, it is important to examine variables that may moderate the relationship between school connectedness and PIU. The organism-environment interaction model (Cummings et al. 2002, p. 135) proposes that “individuals with certain intrapersonal attributes respond differently, or more specifically, with greater maladaptation, to similar environmental contexts”. However, to our knowledge, no research to date has examined the moderating effect of adolescent intrapersonal characteristics on direct or mediating pathways from school connectedness to PIU. In this study, we

investigated whether the direct and/or indirect pathways would vary as a function of adolescent self-control.

Self-control refers to the ability to monitor, inhibit, persevere and adapt one’s behavior, emotions, thoughts and desires in order to achieve a certain goal (Duckworth 2011). Adolescents with good self-control are “more adept than their impulsive counterparts at regulating their behavioral, emotional, and attentional impulses to achieve long-term goals” (Duckworth 2011, p. 2639). We have the following reasons for examining self-control as a moderator: (a) a substantive body of research has established self-control as a protective factor against adolescent PIU (Kim et al. 2008; LaRose et al. 2003; Li et al. 2010; Li et al. *in press*); and (b) it helps to examine how self-control and social control such as school connectedness (Hirschi 1969) interact to impact children’s development, an important theoretical issue which attracts heightened interest among developmentalists (Baker 2010; Loukas et al. 2010; Wright et al. 2001).

The organism-environment interaction perspective generally emphasizes that the effect of school connectedness will be moderated by adolescent characteristics such as self-control. Theorists disagree, however, about the nature of the School Connectedness  $\times$  Self-Control interaction. The protective-enhancing hypothesis holds that one protective factor enhances the positive effect of another protective factor (Fergus and Zimmerman 2005; Pluess and Belsky *in press*; Wang et al. 2009). According to this perspective, the beneficial effect of school connectedness would be stronger for adolescents with high rather than low self-control (Fig. 1a). In contrast, the protective-attenuating hypothesis maintains that one protective factor generally confers advantages, and this beneficial effect is particularly strong among individuals at low levels of another protective factor (Wang et al. 2009). From this perspective, the beneficial effect of school



**Fig. 1** Hypothetical School Connectedness  $\times$  Self-Control interaction effects. **a** Protective-enhancing model, an interaction in which the beneficial effect of school connectedness on problem behaviors is more pronounced for adolescents with higher levels of self-control. **b** Protective-attenuating model, an interaction in which the beneficial effect of school connectedness on problem behaviors is more pronounced for adolescents with lower levels of self-control. Note that

adolescent school connectedness and self-control were arbitrarily labeled as high or low depending on whether their scores on the school connectedness scale and the self-control scale were 1 standard deviation above or below the mean scale score in line with Dearing and Hamilton (2006). As such, the labels “high” and “low” are used in relative terms to the overall mean scale score and not in absolute sense *per se*

connectedness would be stronger for adolescents with low as opposed to high levels of self-control (Fig. 1b). These two hypotheses imply very different practical implications: the former suggests that intervention programs that seek to promote school connectedness will particularly benefit adolescents who have higher levels of self-control; whereas the latter suggests that this kind of intervention will particularly benefit those who score low in self-control.

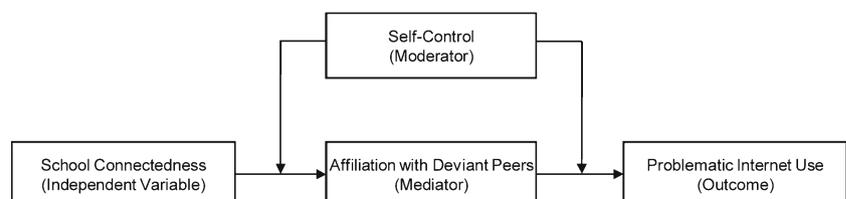
In the current study, we examine both protective-enhancing and protective-attenuating patterns of the School Connectedness  $\times$  Self-Control interaction. Empirical findings, although relatively limited and not directly related to PIU, have suggested the likelihood of a protective-attenuating pattern. Specifically, a small but important literature has confirmed that self-control attenuated the associations of school connectedness with alcohol use, antisocial behavior, and adolescent delinquency (Baker 2010; Loukas et al. 2010; Wright et al. 2001). Also, several studies have found that self-control attenuated the association between deviant peer affiliation and problematic behaviors (Gardner et al. 2008; Goodnight et al. 2006), although there are some negative results in the literature (Wills et al. 2002; Yarbrough et al. 2012). The Deviant Peer Affiliation  $\times$  Self-Control interaction might be attributable to, at least in part, the reduced susceptibility of high self-control adolescents to deviant peers' negative reinforcement. Besides, to our knowledge, no research has examined whether the relationship between school connectedness and deviant peer affiliation was moderated by self-control. Based on the above theoretical analyses and empirical evidence, we propose the following hypothesis:

*Hypothesis 2* adolescent self-control will moderate the negative indirect association between school connectedness and PIU. This indirect association will be significant among low self-control adolescents but much weaker among high self-control adolescents, which will support our protective-attenuating hypothesis.

## The Present Study

In summary, the present study brings together two hitherto largely separate lines of research (the social development model and organism-environment interaction model) to

**Fig. 2** The proposed moderated mediation model



account for the mechanisms by which school connectedness is associated with adolescent PIU. The first and second hypothesis, taken together, constitute a “moderated mediation” model whereby the mediating process that is responsible for the relationship between the predictor and the outcome depends on the value of a moderator variable (Edwards and Lambert 2007; Muller et al. 2005). Particularly, our purpose is twofold: (a) to examine whether deviant peer affiliation will mediate the relationship between school connectedness and adolescent PIU, and (b) to test whether this indirect relationship will be moderated by self-control. This integrated model can address questions about both mediation (i.e., how school connectedness relates to less PIU) and moderation (i.e., when the protection is most potent) in one model. Figure 2 illustrates the proposed research model. Given prior research showing that adolescents' gender, age, family socioeconomic status, and parent-adolescent attachment were correlated with PIU (Siomos et al. 2012), we include them as control variables in statistical analyses.

## Method

### Participants

We recruited participants from 10 middle schools in southern China through stratified and random cluster sampling. The sample was first stratified by region (urban versus rural areas); then stratified by school type (selective schools versus regular schools, selective schools usually have more quality teachers, enjoy better facilities and resources, thus attract stronger students). Random cluster sampling was used to randomly choose two classes in each grade of each school. A total of 2,758 adolescents participated in this study. Forty-six percent of the participants were males. The mean age of the participants was 13.53 years ( $SD=1.06$ , range=10–19). Research has shown that adolescents at this age have a relatively higher tendency to engage in PIU (Dong and Lin 2011). Reflecting the demographics of this area, 60 % of their fathers and 69 % of their mothers had less than a high school education; 35 % of their fathers and 58 % of their mothers had an unskilled or semi-skilled occupation. In addition, we have less than 2 % missing data and the missing data were handled with mean imputation (Little and Rubin 2002).

## Measures

**School connectedness** Adolescent school connectedness was measured by the School Connectedness Scale developed by Bao et al. (2013). This scale contains six items, which reflect students' relationships with their school (e.g., "I like my school", "I am proud to be part of the school"). Adolescents indicated how often they feel connected to their school on a 4-point scale ranging from 1=*never* to 4=*always*. Responses across the six items were averaged, with higher numbers representing greater school connectedness. Evidence for validity includes confirmatory factor analysis (one factor structure) and a nomological network of associations with other constructs (significant and positive correlations with perceptions of teacher support, student support, academic achievement, and a negative correlation with depression). For the current study, the measure demonstrated good reliability ( $\alpha=0.85$ ).

**Deviant peer affiliation** Adolescent affiliation with deviant peers was assessed with eight items adapted from prior published questionnaires (Fergusson and Horwood 1999; Kendler et al. 2007). Peers' deviant behaviors included smoking, alcohol use, cheating on school tests, stealing or shoplifting, misbehaving, Internet addiction, skipping or cutting school, and physical and verbal aggression<sup>2</sup>. Previous research on PIU often used only one item to measure peer deviancy (Wang et al. 2011; Yang et al. 2008), whereas this study used multiple items. Validity is enhanced because no one singular item adequately captures the full meaning of the construct of interest (Evans et al. *in press*). Adolescents indicated how many of their friends had shown each of the eight deviant behaviors during the prior year (e.g., "How many of your friends got drunk in the last year?") on a 5-point scale ranging from 1=*none* to 5=*almost all*. Responses were averaged across the eight items, with higher scores representing greater deviant peer affiliation. For the current study, the measure demonstrated good reliability ( $\alpha=0.83$ ).

**Self-control** Adolescent self-control was assessed by the Self-Control Scale developed by Bao et al. (2013). This scale contained seven items drawn from prior similar instruments (e.g., Duckworth and Seligman 2005).

Adolescents indicated how true each item (e.g., "I am very self-disciplined") was of them on a 4-point scale ranging from 1=*never* to 4=*always*. Recent research suggests that adolescent self-report is a relatively valid approach for measuring self-control (Duckworth & Kern 2011). Responses across the seven items were averaged, with higher numbers representing greater self-control. Evidence for validity includes confirmatory factor analysis (two moderately correlated subscales of activation and inhibitory control) and significant associations with theoretically-relevant constructs such as effortful control, academic achievement, substance use, and delinquent behavior. In the present study, the Cronbach's  $\alpha$  coefficient of this scale was 0.68 ( $< 0.70$ ). However, the composite reliability for this measure was 0.71, which indicated that the reliability of this measure was acceptable (Wen and Ye 2011).

**PIU** Adolescent PIU was assessed with 10 items from Young's (1996) questionnaire for screening of Internet dependency. This scale has demonstrated good reliability and validity in Chinese samples (Li et al. 2010) and similar items have been used in the National Children's Study of China project (Dong and Lin 2011). A representative item was: "Do you use the Internet as a way of escaping from problems or of relieving an unhappy mood?" Note that Young's PIU index is an index of self-reported addictive feelings/impulses to general online activities—global PIU (Ang et al. 2012; Davis 2001) rather than to specific types/categories of activities (e.g., gaming). Adolescents indicated how true each item was of them on a 6-point scale ranging from 1=*not at all true* to 6=*always true*. Responses across the 10 items were averaged, with higher scores representing greater PIU. For the current study, the measure demonstrated good reliability ( $\alpha=0.92$ ).

**Control variables** This study controlled for adolescents' gender, age, family socioeconomic status, and parent-adolescent attachment. Family socioeconomic status was comprised of a single factor derived from principal component analysis of multiple indicators (parental education, family financial status, and parental occupation status), with higher scores representing higher socioeconomic status. In addition, adolescent attachment to their parents was assessed by the Chinese version of the Inventory of Parent and Peer Attachment-Short Version (Li et al. 2009). This inventory contains 13 items (e.g., "My parents respect my feelings"), which reflect the quality of the child-parents relationship. Adolescents indicated how true each item was of them on a 5-point scale ranging from 1=*never* to 5=*always*. Responses across the 13 items were averaged, with higher numbers representing greater attachment security. For the current study, the measure demonstrated good reliability ( $\alpha=0.87$ ).

<sup>2</sup> Some of the friend behaviors (e.g., drinking) seem broadly knowable by adolescents, but cheating in school exams and Internet addiction seems relatively private and difficult for adolescents to report. However, we still included these items because: (a) many cheating behaviors of Chinese adolescents (e.g., copying from other students on a test or exam) require collaboration with others and many adolescents who have cheated in school exams are often criticized/punished "openly" by their teachers, and (b) unlike in the United States, where computers are often accessed from the home, in China adolescents often go together to Internet cafés and discuss what they have done there. These characteristics enable adolescents to provide reliable and valid information about their friends' behaviors.

**Table 1** Univariate and bivariate statistics for all study variables

Variables	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8
1. Gender	0.46	0.50	–							
2. Age	13.53	1.06	0.00	–						
3. SES	0.00	1.00	0.05*	–0.19***	–					
4. Parental attachment	3.45	0.72	–0.02	–0.18***	0.19***	–				
5. School connectedness	2.91	0.76	–0.01	–0.15***	0.17***	0.36***	–			
6. Deviant peer affiliation	1.55	0.54	0.19***	0.17***	–0.20***	–0.25***	–0.32***	–		
7. Self-control	3.86	0.83	–0.05**	–0.10***	0.10***	0.40***	0.30***	–0.22***	–	
8. PIU	2.47	1.02	0.28***	0.04*	–0.02	–0.30***	–0.22***	0.32***	–0.40***	–

Gender was dummy coded such that 0=male and 1=female. SES socioeconomic status; PIU problematic Internet use

\* $p < 0.05$ . \*\* $p < 0.01$ . \*\*\* $p < 0.001$

## Procedure

This study was approved by the research ethics committee of our institution. Because the protocol was judged to pose low risk and the data were collected and processed anonymously, oral consent was recommended and obtained from school administrators and participants before data collection. After a complete description of the study, participants were told that they could omit any uncomfortable questions and were free to withdraw at any time during data collection. They were also assured that their responses would be kept completely anonymous and confidential. The survey was conducted in classrooms. Trained data collectors administered the questionnaires using scripts and a manual of procedures so as to standardize the data collection process.

## Results

### Preliminary Analyses

According to Young's (1996) diagnostic criterion for Internet dependency, 6.3 % ( $n=174$ ) of the participants in the current sample displayed severe PIU, which is consistent with the Chinese national data (Dong and Lin 2011) and recent literature (Aboujaoude 2010; Lei 2010; Young and de Abreu 2011). Note that this rate is for descriptive purposes only; all of the subsequent analyses maintained the continuous nature of the PIU variable. Table 1 contains univariate statistics and bivariate correlations for all study variables. Both school connectedness and self-control were negatively associated with adolescent PIU ( $r=-0.22$ ,  $p < 0.001$ ;  $r=-0.40$ ,  $p < 0.001$ , respectively), suggesting that school connectedness and self-control are protective factors for PIU. In addition, deviant peer affiliation was positively associated with PIU,  $r=0.32$ ,  $p < 0.001$ , indicating that deviant peer affiliation is a viable risk factor for PIU. Finally, school connectedness was negatively associated with

deviant peer affiliation,  $r=-0.32$ ,  $p < 0.001$ , which is in line with previous research.

Given that we were analyzing clustered data (i.e., students are nested within schools), which violated the assumption of ordinary least squares regression that each observation is independent of all other observations in the data set, we chose to use the SAS PROC SURVEYREG to obtain robust standard errors for regression parameter estimates. This method explicitly took into account the clustered nature of the data (SAS Institute Inc 2011).

### Testing for Mediation Effect

In Hypothesis 1, we anticipated that deviant peer affiliation would mediate the relationship between school connectedness and PIU. To test this hypothesis, we followed MacKinnon's (2008) four-step procedure to establish mediation effect, which requires (a) a significant association between school connectedness and PIU; (b) significant association between school connectedness and deviant peer affiliation; (c) significant association between deviant peer affiliation and PIU while controlling for school connectedness; and (d) significant coefficient for the indirect path between school connectedness and PIU via deviant peer affiliation. A Sobel test determines whether the last condition is satisfied. In all analyses, we included adolescents' gender, age, socioeconomic status, and parental attachment as covariates.

Regression analysis<sup>3</sup> indicated that, in the first step, school connectedness was significantly associated with

<sup>3</sup> Structural equation modeling (SEM) can also be used to test the theoretical model in the present study. However, (a) SEM often needs complex factor structure, but the measures in this study did not have complex factor structures (Cohen et al. 2003), and (b) SEM often increases standard errors and reduces power (Ledgerwood and Shrout 2011). Therefore, we used multiple regression to estimate the model.

**Table 2** Testing the mediation effects of school connectedness on adolescent *PIU*

Predictors	Model 1 (criterion <i>PIU</i> )		Model 2 (criterion deviant peer affiliation)		Model 3 (criterion <i>PIU</i> )	
	<i>b</i>	<i>t</i>	<i>b</i>	<i>t</i>	<i>b</i>	<i>t</i>
CO: Gender	0.55	12.31***	0.38	5.09***	0.47	11.24***
CO: Age	-0.02	-0.73	0.09	5.23***	-0.04	-1.53
CO: SES	0.03	1.00	-0.13	-4.43**	0.06	1.64
CO: Parental attachment	-0.26	-8.83***	-0.12	-5.11***	-0.24	-8.64***
X: School connectedness	-0.13	-11.58***	-0.24	-7.84***	-0.08	-5.67***
ME: Deviant peer affiliation					0.20	8.07***
<i>R</i> <sup>2</sup>	0.18		0.18		0.22	
<i>F</i>	94.82***		47.98***		311.08***	

Each column is a regression model that predicts the criterion at the top of the column. Gender was dummy coded such that 0=*male* and 1=*female*. *SES* socioeconomic status; *CO* control variable; *X* independent variable; *ME* mediator; *PIU* problematic Internet use  
 \**p*<0.05. \*\**p*<0.01. \*\*\**p*<0.001

*PIU*, *b*=-0.13, *p*<0.001 (see Model 1 of Table 2). In the second step, school connectedness was significantly associated with deviant peer affiliation, *b*=-0.24, *p*<0.001 (see Model 2 of Table 2). In the third step, when we controlled for school connectedness, deviant peer affiliation was significantly associated with *PIU*, *b*=0.20, *p*<0.001. Finally, the Sobel test indicated that the indirect effect of school connectedness on adolescent *PIU* through deviant peer affiliation was significant, *Z*=-5.63, *p*<0.001. Overall, the above four criteria for establishing mediation effect were fully satisfied. Therefore, Hypothesis 1 was supported.

Testing for Moderated Mediation

As noted, Hypothesis 2 predicted that self-control would moderate the indirect association between school connectedness and adolescent *PIU* via deviant peer affiliation (Fig. 2). To test this moderated mediation hypothesis, we used the approach suggested by Muller et al. (2005). Specifically, we estimated parameters for three regression models. In Model 1, we estimated the moderation effect of self-control on the relationship between school connectedness and *PIU*. In Model 2, we estimated the moderation effect of self-control on the relationship between school

**Table 3** Testing the moderated mediation effects of school connectedness on adolescent *PIU*

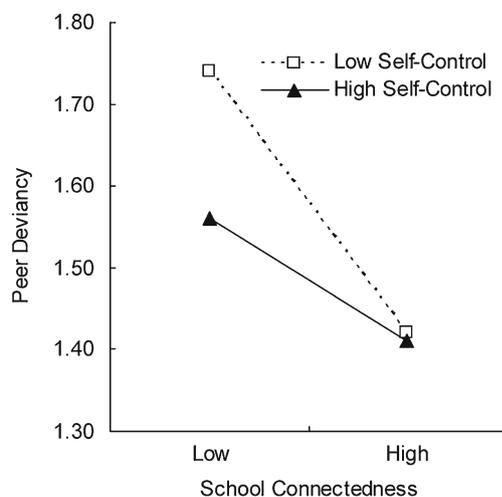
Predictors	Model 1 (criterion <i>PIU</i> )		Model 2 (criterion deviant peer affiliation)		Model 3 (criterion <i>PIU</i> )	
	<i>b</i>	<i>t</i>	<i>b</i>	<i>t</i>	<i>b</i>	<i>t</i>
CO: Gender	0.52	10.67***	0.37	5.14***	0.46	9.75***
CO: Age	-0.02	-1.02	0.09	4.78***	-0.04	-1.81
CO: SES	0.03	1.11	-0.13	-4.70***	0.06	1.69
CO: Parental attachment	-0.16	-6.16***	-0.09	-3.57**	-0.14	-5.76***
X: School connectedness	-0.07	-5.73***	-0.21	-8.81***	-0.03	-2.36*
MO: Self-control	-0.31	-18.51***	-0.09	-3.78**	-0.29	-17.15***
XMO: School Connectedness × Self-Control	0.01	0.63	0.07	3.19*	-0.00	-0.24
ME: Deviant peer affiliation					0.18	8.15***
MEMO: Deviant peer affiliation × Self-Control					-0.01	-0.32
<i>R</i> <sup>2</sup>	0.26		0.19		0.28	
<i>F</i>	429.59***		61.07***		455.31***	

Each column is a regression model that predicts the criterion at the top of the column. Gender was dummy coded such that 0=*male* and 1=*female*. *SES* socioeconomic status; *CO* control variable; *X* independent variable; *MO* moderator; *XMO* interaction between independent variable and moderator; *ME* mediator; *MEMO* interaction between mediator and moderator; *PIU* problematic Internet use  
 \**p*<0.05. \*\**p*<0.01. \*\*\**p*<0.001

connectedness and deviant peer affiliation. In Model 3, we allowed both the partial effect of deviant peer affiliation on PIU and the residual effect of school connectedness on PIU to be moderated by self-control. The specification of these models can be seen in Table 3. In each model, we also controlled for relevant covariates. All the predictors were standardized to minimize multicollinearity (Dearing and Hamilton 2006).

For present purposes, moderated mediation was established if either or both of two patterns existed (Edwards and Lambert 2007; Muller et al. 2005): (a) the path from school connectedness to deviant peer affiliation was moderated by self-control, and/or (b) the path from deviant peer affiliation to adolescent PIU was moderated by self-control.

As Table 3 illustrates, in Model 1, there was an overall effect of school connectedness on adolescent PIU,  $b=-0.07$ ,  $p<0.001$ . This effect was not moderated by self-control,  $b=0.01$ ,  $p>0.05$ . In Model 2, the mediator, deviant peer affiliation, was the criterion. Here, there was a significant main effect of school connectedness,  $b=-0.21$ ,  $p<0.001$ , and a significant School Connectedness  $\times$  Self-Control interaction effect on adolescent PIU,  $b=0.07$ ,  $p<0.05$ . For descriptive purposes, we plotted the predicted deviant peer affiliation against school connectedness, separately for low and high levels of self-control (1 *SD* below the mean and 1 *SD* above the mean, respectively) (Fig. 3). Simple slope test (Dearing and Hamilton 2006) indicated that for low self-control adolescents, higher school connectedness was associated with lower deviant peer affiliation,  $b_{\text{simple}}=-0.29$ ,  $p<0.001$ . However, for high self-control adolescents, the effect of school connectedness on deviant peer affiliation was weaker,  $b_{\text{simple}}=-0.14$ ,  $p<0.001$ . Finally, Model 3



**Fig. 3** Deviant peer affiliation among adolescents as a function of school connectedness and self-control. Functions are graphed for two levels of self-control: 1 standard deviation above the mean and 1 standard deviation below the mean. Note that the graph is for descriptive purpose only. All inferential analyses maintained the continuous values of school connectedness and self-control

showed that the effect of deviant peer affiliation on PIU was significant,  $b=0.18$ ,  $p<0.001$ , and this effect was not moderated by self-control (the Deviant Peer Affiliation  $\times$  Self-Control interaction effect was non-significant).

Overall, the indirect effect of school connectedness on adolescent PIU via deviant peer affiliation was moderated by self-control. For adolescents low in self-control, school connectedness had protective effect on PIU through reduced deviant peer affiliation,  $Z=-6.72$ ,  $p<0.001$ . In contrast, the indirect effect was smaller for adolescents high in self-control,  $Z=-4.52$ ,  $p<0.001$ . Given that self-control only affected the first stage of the mediation process, we called this type of model the first stage moderation model, which is one form of moderated mediation model (Edwards and Lambert 2007). Thus, Hypothesis 2 was supported.

## Discussion

The beneficial effect of school connectedness on adolescent PIU has garnered considerable empirical support (Jiang and Huang 2008; Sun et al. 2005; Wang et al. 2011; Yen et al. 2009). However, the underlying mediating mechanism (i.e., how school connectedness relates to PIU) and moderating mechanism (i.e., when the protection is most potent) remain as questions of inquiry. This study formulated and tested a moderated mediation model based on an integration of existing theories (i.e., the social development model and organism-environment interaction model). Findings suggest that the protective effect of school connectedness on adolescent PIU is explained in part by decreased deviant peer affiliation. Moreover, this indirect link is stronger for adolescents with poor self-control than for those with good self-control. We discuss each of our research hypotheses in light of this moderated mediational model of school connectedness and adolescent PIU.

First, consistent with our hypothesis, we found that deviant peer affiliation is an important, underlying psychosocial mechanism that helps explain why strong school connectedness is associated with less PIU. When youth have positive experiences and are closely tied to school, they are less likely to involve with deviant peers, which in turn is associated with less PIU. This finding is congruent with the social development model (Hawkins and Weis 1985) and primary socialization theory (Oetting and Donnermeyer 1998), as well as the previous research which showed that the protective effects of school connectedness were mediated by deviant peer affiliation (Henry 2008; Swaim et al. 1998; Zhang and Messner 1996). This finding also affirms an elementary principle in developmental psychology and sociology: social institutions such as school and peer contexts are interdependent, and the functioning of one has important implications for the operation of others (Zhang

and Messner 1996). To our knowledge, our study is one of the first that apply the above theories to adolescent PIU research.

As noted, two studies (Wang et al. 2011; Yen et al. 2009) explicitly examined the influences of both school connectedness and deviant peer affiliation on adolescent PIU. However, they assumed that the two variables operated independently. Unlike these studies, the present study examined the impact of school connectedness on deviant peer affiliation, which some argue as an important mechanism that schools may protect students from problematic behaviors (Hawkins and Weis 1985; Oetting and Donnermeyer 1998). Accordingly, we found that strong school connectedness decreased the likelihood of adolescents' deviant peer affiliation, which in turn decreased the likelihood of PIU. Therefore, the protective effects of school connectedness on adolescent PIU were probably underestimated as a result of controlling for deviant peer affiliation (the mediator in this study). Indeed, Newcombe (2003) pointed out that "some controls control too much" when she commented on such inappropriate use of statistical control.

Second, our results offered support for the moderating role of adolescent self-control on the indirect link between school connectedness and adolescent PIU. In line with the protective-attenuating hypothesis, we found self-control attenuating the relationship between school connectedness, deviant peer affiliation, and PIU through the link between school connectedness and deviant peer affiliation. This protective-attenuating moderation effect has also been reported in previous research. For instance, the negative association between school connectedness and problematic behaviors such as alcohol use, antisocial behavior, and delinquency was substantially weaker among children with higher self-control (Baker 2010; Loukas et al. 2010; Wright et al. 2001). If this pattern of moderation effect could be successfully replicated in future studies, we are able to propose the following argument: for adolescents with poor self-control, social control such as school connectedness will be critical for their development; however, for adolescents with good self-control, the beneficial effect of social control may not be very significant. Of course, these predictions are still preliminary and should be tested in future studies. It is worth noting that self-control "attenuates" the relationship between school connectedness and adolescent PIU, this moderation effect still suggests that self-control is a protective rather than a risk factor for adolescent PIU, because high self-control adolescents had significantly lower levels of deviant peer affiliation than those low in self-control (see Table 3 and Fig. 3).

Contrary to our expectations, we did not find evidence that the relationship between deviant peer affiliation and PIU was moderated by self-control. This finding indicates that, to some extent, self-control can protect low school-

connected adolescent from affiliating with deviant peers. However, once they affiliate with deviant peers, self-control does not attenuate the relationship between deviant peer affiliation and PIU. Although some previous studies have found self-control attenuating the relationship between deviant peer affiliation and adolescent development (Baker 2010; Loukas et al. 2010; Wright et al. 2001), their outcome variables were externalizing behaviors or antisocial behaviors rather than PIU. Given that this is a negative result with other possible explanations, we should not draw strong conclusions at this stage.

Nonetheless, our findings suggest that the impact of school connectedness may not be constant across all levels of self-control. When we are interested in the effect of school connectedness on PIU, we should not ignore adolescent self-control and vice versa. The two control processes perhaps should not be viewed as separate but rather interdependent with each other. Therefore, this study makes important contributions to the social development model. By incorporating self-control into the meditation process of PIU, we discovered effects that would have been neglected without the moderation effect analysis. The moderated mediation model in this study can offer greater predictive power and conceptual fruitfulness than the original social development model alone. In fact, this theoretical integration has been highly valued by researchers and policy makers during the past decade for its power in offering insights that cannot be obtained by separating these theories.

#### Limitation and Future Direction

Several limitations must also be considered when interpreting the results of the present study. First, we are not able to make any causal inferences from this cross-sectional data. Future studies should use longitudinal designs to seek evidence for the causal assumptions that are made in this study. Second, the data were based on adolescent self-reported measures. Although previous research has shown that adolescent self-report of risk behavior does not contain strong bias under conditions of anonymity and confidentiality (Chan 2009; Tourangeau and Yan 2007), as was the case in our study, future studies should simultaneously employ multiple informants and multiple methods to collect data. Third, given that tests of moderating effects in observational studies typically require large sample size to provide enough statistical power, we did not stratify the analyses by gender or other background variables. Such research is important for understanding whether these results can be applied to different subgroups. Finally, the model was tested based on a population sample of Chinese adolescent. Therefore, we should not generalize the current conclusion to other cultural and/or geographical settings.

Despite these limitations, this research has important practical implications. First, our results suggest that promoting school connectedness could be helpful in reducing the risk of PIU. Given the fact that satisfying students' socioemotional needs such as school connectedness is still an underemphasized aspect in school reform (Shochet et al. 2006), this finding is critical. Second, our findings can help practitioners understand pathways by which school connectedness is associated with adolescent PIU, suggesting a possible venue for targeted interventions. For example, reducing deviant peer affiliation may ameliorate some of the detrimental effects of poor school connectedness on adolescent PIU. This is important because many of the current PIU interventions were delivered in peer group settings (i.e., adolescents with PIU were aggregated into groups such as training camps), which under some circumstances may inadvertently increase adolescent interaction with deviant peers (Dishion and Tipsord 2011). Third, given that the protective effect of school connectedness on PIU through deviant peer affiliation is stronger for adolescents with poor self-control than for those with good self-control, we should develop and conduct targeted interventions, such as increasing students' connectedness to school, especially for those with low self-control.

In summary, although further replication and extension are needed, this study is an important step in investigating how school connectedness relates to adolescent PIU. It shows that deviant peer affiliation can serve as one potential mechanism by which school connectedness is associated with less PIU. Moreover, our finding suggests that this beneficial effect of school connectedness appears to be stronger for adolescents with poor self-control than for those with good self-control. These findings demonstrate the importance of moderated mediation models in understanding the mechanisms by which school connectedness is associated with adolescent PIU.

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