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Temperament and adolescent problematic Internet use: The mediating role of deviant peer affiliation[☆]Xian Li^a, Joan Newman^a, Dongping Li^{b,*}, Haiyan Zhang^c^a Department of Educational and Counseling Psychology, University at Albany, SUNY, Albany, NY 12222, USA^b School of Psychology, Central China Normal University, Wuhan, Hubei 430079, China^c Department of Psychology, Siena College, Albany, NY 12211, USA

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ABSTRACT

Problematic Internet use (PIU) creates psychological, social, school and/or work difficulties in a person's life. This study examined the unique roles of four dimensions of temperament (effortful control, sensation seeking, anger/frustration, and shyness) on adolescent PIU, as well as the mediating role of deviant peer affiliation (DPA) on these pathways. Participants were 2758 Chinese adolescents (46% male; mean age = 13.53 years, $SD = 1.06$) selected by stratified and random cluster sampling from 10 middle schools in southern China. After covariates were controlled, structural equation modeling (SEM) demonstrated that effortful control negatively predicted PIU, while sensation seeking, anger/frustration and shyness positively predicted PIU. SEM also identified that DPA partially mediated the pathway from all four temperament dimensions to PIU. These findings provide evidence for the relationship between specific temperament dimensions and adolescent PIU, and highlight DPA as one explanation for the prevalence of PIU.

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Problematic Internet use (PIU) refers to excessive internet usage which causes negative consequences such as psychological, social, occupational and/or academic difficulties (Beard & Wolf, 2001; Block, 2008). Research on PIU continues to document severe effects of Internet use, such as anxiety/depression, academic failure and social isolation (Gentile et al., 2011; Kim & Davis, 2009; Ko, Yen, Yen, Chen, & Chen, 2012). PIU may even alter an individual's brain structure and jeopardize the ability to evaluate risk, as suggested by preliminary neuroimaging analyses (Ko et al., 2014; Lin, Dong, Wang, & Du, 2015; Lin, Zhou, Dong, & Du, 2015; Zhou et al., 2011).

Adolescents are at high risk for PIU, given their immature self-control skills (Giedd, 2008; Steinberg et al., 2008) and availability of free time (Jiang, Hardy, Ding, Baur, & Shi, 2014). Indeed, adolescent PIU has been recognized worldwide, and has become a serious public health concern in some Asian countries like China, Singapore and South Korea (Minjikian, 2012). In China, legislation was enacted in 2005 to restrict adolescent access to Internet cafes as a means of mitigating the increasing prevalence of PIU. Given the

fact that the Internet is almost unavoidable nowadays, understanding the etiology of PIU will be of great public health significance. Increasing interest in PIU prevention and intervention programs has required attention to the multiple factors influencing adolescent PIU, such as intrapersonal attributes like temperament and interpersonal variables like peer influence.

1. Temperament and PIU

Although there are a number of studies that explore the links between temperament, character and PIU (Cho, Kim, Lee, & Kim, 2008; Dalbudak et al., 2013; Ha et al., 2007; Kim, Lee, Han, Suh, & Kee, 2006; Lee et al., 2008; Lee & Jung, 2012; Li, Zhang, Li, Zhen, & Wang, 2010), there are few studies that investigate the roles of specific dimensions of temperament. Temperament is defined as biologically-based individual differences in reactivity and self-regulation (Rothbart & Bates, 2006). Recent literature has identified temperament as a diathesis for the development of problem behaviors such as depression, delinquency, substance abuse, and gambling (DePauw & Mervielde, 2010; Nigg, 2006; Rothbart & Bates, 2006). Given the maladaptive nature of PIU, temperament is likely to have a role in the etiology of PIU.

Despite the conceptual links, empirical studies of the

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relationship between particular components of temperament and PIU are scarce. In the few studies that have been located, either only a single temperament dimension was investigated (Shi, Chen, & Tian, 2011; Velezmore, Lacefield, & Roberti, 2010), or an imprecise measurement tool (the Temperament and Character Inventory or TCI) was utilized (Cho et al., 2008; Dalbudak et al., 2013; Ha et al., 2007; Kim et al., 2006; Lee et al., 2008; Lee & Jung, 2012). The impact of a range of temperament dimensions on PIU has yet to be examined in detail, ideally with a more accurate instrument.

Although there are disagreements about how temperament should be conceptualized, the temperament model developed by Rothbart and Bates (2006) is a representative and well-established one. It has been found to be particularly appropriate for Asian adolescents (Xu, Farver, Yu, & Zhang, 2009; Zhou, Main, & Wang, 2010). In recent studies (e.g., Ko, Yen, Yen, Chen, & Wang, 2008; Li et al., 2010; Odaci & Çelik, 2013), several specific dimensions of temperament, such as effortful control, sensation seeking, anger/frustration, and shyness, have been found to be associated with the occurrence of PIU.

The first dimension of temperament in the model—effortful control—is known as a core aspect of self-regulation. Rothbart and Bates (2006) defined it as “an individual's ability to regulate attention in response to situational needs”. Previous research has established its beneficial role in fostering children's desirable behaviors and inhibiting children's maladaptive behaviors (see review by Eisenberg, Hofer, & Vaughan, 2007). There is also some recent research evidence suggesting that effortful control correlates negatively with problem behaviors such as game addiction (Kim, Namkoong, Ku, & Kim, 2008) and PIU (LaRose & Eastin, 2004; LaRose, Lin, & Eastin, 2003; Li, Li, & Newman, 2013).

Sensation seeking, which is a common characteristic of adolescents (Cauffman et al., 2010; Steinberg et al., 2008), is the second dimension of temperament that has been associated with PIU. Individuals high in sensation seeking tend to seek out novel and highly stimulating experiences, and are willing to take associated risks. Sensation seeking has been identified as a partial determinant of high-risk and anti-social behaviors (Zuckerman, 2007). The Internet, due to its easy accessibility, provides adolescents many opportunities and resources for sensation and excitement seeking (e.g., sexual videos, violent games, online dating and social networking sites). There is some recent evidence suggesting that sensation seeking has a positive relationship with PIU. For example, a study of Taiwanese high school students identified a significant association between excessive Internet use and high sensation seeking tendency (Lin & Tsai, 2002). Similarly, two studies of Taiwanese high school adolescents, one a large-scale cross-sectional study, the other a one-year longitudinal study, identified high sensation seeking as a powerful predictor of Internet addiction (Ko et al., 2006; Ko, Yen, Yen, Lin, & Yang, 2007). Finally, a meta-analytical study aggregated results from 37 independent studies conducted in China, Taiwan, United States, and Iran to evaluate the relationship between sensation seeking and PIU (Wang, Chen, Yang, & Gao, 2013). A moderate and positive relationship was identified between the two variables.

Anger/frustration is the third dimension of temperament that has been associated with PIU. Rothbart and Bates (2006) defined this as “an individual's tendency to experience negative affect when interrupted on an on-going task or blocked from attaining specific goals.” Recent research has found that anger/frustration and similar traits of hostility are positively associated with PIU in East Asian adolescent samples. For instance, Ko et al. (2008) found that adolescents, especially boys, who were prone to frustration, were more likely to develop Internet addiction. Similarly, Yen et al. (2008) found that junior and senior high school adolescents who scored high on hostility were more likely to develop Internet addiction.

These results were significant even after controlling for other maladaptive symptoms.

Shyness is the fourth dimension of temperament that has been associated with PIU. Shyness has been defined as “an individual's discomfort and inhibition of normally expected social behavior when being with strangers” (Cheek & Buss, 1981). Shy people tend to be apprehensive and anxious about being evaluated or rejected in face-to-face social encounters. As the Internet offers an alternative way to satisfy unmet social and emotional needs through its secure virtual environment, online communication might be particularly appealing for shy adolescents. Past research investigating the relationship between shyness and Internet use has yielded inconsistent results (for a review, see Saunders & Chester, 2008). For example, some researchers found PIU to be positively associated with increased shyness (Caplan, 2002; Chak & Leung, 2004; Odaci & Çelik, 2013), whereas other researchers found few or no differences between shy and non-shy people in PIU (Henderson, Zimbardo, & Graham, 2002; Mandell & Muncer, 2006).

Most of the existing studies of temperament and PIU include only a limited number of temperament dimensions (Lee & Jung, 2012; Shi et al., 2011; Velezmore et al., 2010). Moreover, efforts to map out the differential contributions of the temperament dimensions to PIU have been hindered by lack of consistency in the construct of temperament employed. Therefore, previous research has not clarified which specific aspects of temperament are relevant for adolescents' susceptibility to PIU. One important goal of the current study is to identify the effects of specific temperament dimensions on PIU in adolescence, a developmental period during which peer influence is particularly prevalent (Steinberg & Monahan, 2007).

2. Deviant peer affiliation as a mediator

The main way temperament contributes to behavior problems is through its indirect influence on the individual's interaction with the social environment (Bates, Bayles, Bennett, Ridge, & Brown, 1991; Keenan & Shaw, 1997). Peers comprise an important component of this social environment. Social learning is one of the proposed mechanisms used to explain the association between peer influence and an individual's PIU; adolescents may acquire from peers certain norms and behaviors that are favorable to PIU (Li et al., 2013; Li et al., 2013; Zhang, Chen, Liu, Deng, & Fang, 2012). Also, peers might make Internet resources more readily available to their peers, and make Internet interactions (such as online gaming, chatting) more socially rewarding and stimulating. In these ways, peers increase the likelihood of addiction.

It is well documented that affiliating with deviant peers will increase the chance of aggressive behaviors, delinquency, and substance use (Monahan, Steinberg, & Cauffman, 2009; Mrug, Hoza, & Bukowski, 2004). Various studies have also confirmed the significant risk posed by deviant peer affiliation (DPA) in shaping adolescent PIU (Wang et al., 2011; Yang, Cheng, Wang, & Wang, 2008; Yen, Ko, Yen, Chang, & Cheng, 2009). However, an individual's tendency towards peer affiliation is largely driven by personal characteristics such as temperament. For example, Wills, Sandy, and Yaeger (2000) found that some temperaments (e.g., negative emotionality and low self-control) contribute to more substance use behaviors through increased affiliation with peer substance users.

For the joint role of temperament and peer influence on the development of problematic behaviors, DPA may serve as one pathway linking specific aspects of temperament with a behavioral outcome. Indeed, a number of investigations have demonstrated that DPA mediates the link between temperament and adolescent substance abuse (Creemers et al., 2010; Giancola & Parker, 2001;

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