

## ORIGINAL ARTICLE

**An Evaluation of Two Characterizations of the Relationships Between Problematic Internet Use, Time Spent Using the Internet, and Psychosocial Problems**

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*This article reports tests of the relationships between problematic Internet use (PIU), time spent using the Internet, and psychosocial problems from the two perspectives. Ten individual meta-analyses were first conducted to identify weighted mean correlations among the five variables included within the models. The correlations derived from the meta-analyses were subsequently used in path analysis to test the alternative characterizations. The results offer some support for the deficient self-regulation model but provide relatively little evidence consistent with the pathology perspective of PIU.*

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The Internet has become an integral part of life for many people around the world. Estimates suggest there are over 1.7 billion Internet users worldwide spending an average of 7.8 hours per week online (Nielsen Online, 2009). The Internet and the technologies it supports (e.g., World Wide Web, e-mail, instant messaging, etc.) are used for purposes ranging from entertainment (Whitty & McLaughlin, 2007) and searching for information (Rice, 2006) to networking (Ellison, Steinfield, & Lampe, 2007; Valkenburg & Peter, 2007) and commerce (Metzger, 2007). Despite the numerous benefits associated with Internet use (Birnie & Horvath, 2002; Rodgers & Chen, 2005; Wellman, Haase, Witte, & Hampton, 2001), various negative outcomes have been reported. One issue that has received a fair amount of attention in news media and scholarly literature is problematic Internet use (PIU; Caplan, 2002, 2005; Davis, 2001; Griffiths, 1998; Kershaw, 2005; Payne, 2006; Young, 1998b).

PIU, sometimes termed Internet addiction, Internet abuse, Internet dependency, or compulsive Internet use, refers to an unhealthy attachment to Internet-based technologies. Despite varied labels, PIU has been operationalized fairly consistently as a multidimensional construct. The key dimensions include an inability to control the amount of time spent using the Internet, feelings of withdrawal when the Internet is

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unavailable, and the desire to forego offline socializing in favor of online interactions (Caplan, 2002; Davis, Flett, & Besser, 2002; Griffiths, 1998; Morahan-Martin, 2008; Nichols & Nicki, 2004; Young, 1996, 1998b). There is, however, some controversy about how PIU should be best characterized within this body of research (for a review, see Morahan-Martin, 2008). PIU is discussed as a clinical pathology akin to gambling addiction (Young, 1996, 1998b) or a nonclinical artifact of deficient self-regulation (LaRose, Lin, & Eastin, 2003). From the pathology perspective, PIU is described as “an individual’s inability to control his or her use of the Internet, causing marked distress and/or functional impairment” (Shapira, Goldsmith, Keck, Khosla, & McElroy, 2000, p. 267). As an indicator of deficient self-regulation, PIU is discussed as a “benign problem . . . that compensates for a lack of satisfaction in other areas of life, and that [PIU] behaviors lie within the scope of the ordinary person to correct” (Hall & Parsons, 2001, p. 314).

One central issue that distinguishes the two characterizations of PIU is the proposed relationships between PIU, time spent using the Internet, and psychosocial problems. Scholars who characterize PIU as a clinical pathology assert that psychosocial problems contribute to the amount of time one spends using the Internet, which eventually evolves into PIU (Chou & Hsiao, 2000; Chou, Chou, & Tyan, 1998; Hur, 2006; Morahan-Martin, 1999; Young, 1998b). In contrast, time spent using the Internet is viewed as an outcome of PIU under the deficient self-regulation perspective. Psychosocial problems make individuals susceptible to the development of PIU, which results in greater time spent using the Internet (LaRose et al., 2003).

To advance PIU research and theorizing, it is essential to develop a better understanding of the relationships between PIU, time spent using the Internet, and psychosocial problems. Further, examining the relationships between these three variables offers an avenue to evaluate the two broader characterizations of PIU articulated within the body of literature on this topic. In the reported study, a meta-analysis was conducted and two models of PIU were tested. The models, which will be referred to as the *pathology model* and *deficient self-regulation model*, represent two characterizations of the relationships between PIU, time spent using the Internet, and psychosocial problems. Meta-analysis (Hedges & Olkin, 1985; Hunter, Schmidt, & Jackson, 1982) makes it possible to summarize the findings from a body of research and, thus, creates the conditions for a relatively robust test of the two perspectives. Meta-analyses were first conducted to identify the aggregate zero-order correlations between the variables in the two models, and the results of the meta-analysis were then used to formally evaluate the models using path analysis.

### **Defining and prior theorizing about PIU**

Prior research regarding PIU provides a foundation for discussing the two perspectives of this phenomenon. PIU has been operationalized consistently within previous research as a multidimensional construct consisting of three key elements: Failure to control Internet use, withdrawal symptoms, and substitution of face-to-face social

interactions with Internet-based communication (Caplan, 2002; Ceyhan, Ceyhan, & Gurcan, 2007; Davis et al., 2002; Lin & Tsai, 2002).<sup>1</sup> The failure to control time spent on the Internet relates to an individual's perceived (in)ability to successfully regulate his or her Internet use (Brenner, 1997; Caplan, 2002; Davis et al., 2002; LaRose et al., 2003). Withdrawal symptoms are feelings of irritability and discomfort when away or restricted from Internet use (Young, 1996, 1998b). The final dimension of PIU includes feelings of security and confidence while online, which lead to a preference for online socializing (Caplan, 2002; Davis et al., 2002; Morahan-Martin & Schumacher, 2000).

There is also a fair amount of continuity among the constructs related to PIU. Three psychosocial problems—social anxiety, loneliness, and depression—are commonly studied within several models developed to explain the antecedents and/or outcomes of PIU (e.g., Caplan, 2003, 2005; Davis, 2001; Kim & Davis, 2009; LaRose et al., 2003; Pratarelli, Browne, & Johnson, 1999).<sup>2</sup> These three factors, which will be incorporated into the models tested in this project, are described in the following paragraphs. The two perspectives of the relationships between PIU, time spent using the Internet and psychosocial problems, are then discussed.

### *Social anxiety*

Social anxiety refers to an apprehension of being negatively evaluated by others in social interactions (Schlenker & Leary, 1982). Segrin (2001) explains that, as a general concept, “social anxiety may be manifested as a clinical disorder (e.g., social phobia), as an enduring trait (e.g., shyness), or as a momentary state (e.g., state social anxiety)” (p. 44). Social anxiety may lead individuals to deliberately isolate themselves or otherwise avoid social interactions (Cappella, 1985; Spitzberg & Cupach, 1984).

Technologies supported by the Internet may be an attractive resource for individuals with social anxiety (Caplan, 2007; Chak & Leung, 2004; Shepherd & Edelman, 2005). The reduced social cues (e.g., visual and vocal cues) and greater control over interactions are two features that may lead socially anxious individuals to prefer Internet-based communication over face-to-face encounters (Erwin, Turk, Heimberg, Fresco, & Hantula, 2003; King & Poulos, 1998; Morahan-Martin & Schumacher, 2003). Reduced cues lower the perceived risk of encountering negative evaluations. In addition, the asynchronous nature of some forms of Internet-based communication technologies makes it possible for individuals to have more control over their self-presentation and, presumably, the manner in which they are perceived by others (O'Sullivan, 2000; Walther, 1996). The Internet also offers ways to create online identities and take risks without experiencing offline consequences (Joinson, 2001; Kiesler, Siegel, & McGuire, 1984; Morahan-Martin & Schumacher, 2000; Suler, 2004). Finally, the various technologies made available through the Internet may offer opportunities to avoid face-to-face interactions altogether and may serve as a means of escaping or avoiding dysphoric moods associated with social anxiety (Morahan-Martin & Schumacher, 2000; Rotunda, Kass, Sutton, & Leon, 2003).

### *Loneliness*

Loneliness is the perception that one's social network is inadequate (Hays & DiMatteo, 1987; Russell, Peplau, & Cutrona, 1980) and is most often precipitated by unmet companionate needs (Segrin & Flora, 2000). Weiss (1973, 1974) suggests that loneliness can be emotional, such as lacking closeness or intimacy with others, and/or social, such as being excluded from a group of peers. For lonely individuals, Internet-based communication technologies may be an appealing way to increase their social network and ease feelings of social isolation (Matsuba, 2006; Morahan-Martin, 1999; Morahan-Martin & Schumacher, 2003). The Internet provides access to countless others, independent of geographic boundaries, through technologies such as Web-based discussion forums, interactive gaming environments, and social networking Websites. Beyond simply providing access to others, the Internet allows people to connect specifically with those who share common interests or hobbies. McKenna, Green, and Gleason (2002) propose that lonely individuals may feel they are better able to express themselves through the Internet than in face-to-face settings.

### *Depression*

Depression is characterized by changes in mood, a depreciated sense of self-worth, declining mental and physical well-being, and/or altered levels of physical activity (Beck & Alford, 2009). Depression and insufficient interpersonal skills are closely linked (for review, see Segrin, 1990, 2001); inadequate interpersonal communication skills may lead to and be caused by depression. Internet-based communication offers greater control in interactions, greater anonymity, and less social risk in comparison to face-to-face communication (Caplan, 2003, 2005). The reduced risk of communication failures when interacting online, in particular, may make the use of Internet-supported communication technologies to meet others an attractive choice for those who are depressed. Additionally, noncommunicative uses of the Internet, such as visiting auction Websites or some online games, may be used to alleviate dysphoria associated with depression (Morahan-Martin & Schumacher, 2000; Rotunda et al., 2003).

### **Testing two characterizations of PIU**

Researchers studying PIU have characterized this phenomenon in two distinct ways. PIU is regarded as a clinical pathology analogous to gambling addiction (Young, 1996, 1998b; Young & Rodgers, 1998) or as a fairly benign artifact of deficient self-regulation (LaRose et al., 2003). An important distinction between the two perspectives of PIU is how the relationships between PIU, time spent using the Internet, and psychosocial problems are characterized. In the following sections, the two characterizations are discussed and two models are presented.

#### *Characterizing PIU as a pathology*

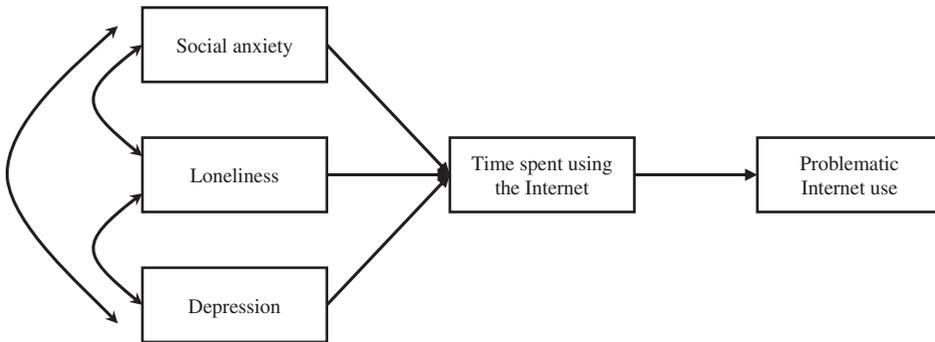
In considering PIU as a form of pathology, scholars conceptualize PIU as a psychological dependence marked by an increased investment in Internet-based activities,

and maladaptive cognitions and behaviors (Chou & Hsiao, 2000; Chou, Chou, & Tyan, 1999; Hur, 2006; Kandell, 1998; Young, 1998b). Although PIU is not currently included in the *Diagnostic and Statistical Manual of Mental Disorders (DSM; American Psychiatric Association, 2000)*,<sup>3</sup> researchers who characterize PIU as a form of pathology have developed diagnostic criteria to identify and treat those with the condition (e.g., Nichols & Nicki, 2004; Scherer, 1997; Young, 1996, 1998b). The criteria, adapted from measures used to diagnose addictions such as substance abuse and pathological gambling, include whether individuals have an unhealthy preoccupation with the Internet, use the Internet to relieve or escape real-life problems, are unsuccessful at curtailing Internet use, and find it challenging to be away from the Internet. From this perspective, PIU may require clinical or professional intervention to remedy the problem (Young, 1999).

Consistent with the perspective of PIU as a form of pathology, increased Internet use in response to psychosocial problems (i.e., social anxiety, loneliness, and depression) is predicted to result in PIU. Loneliness, depression, and social anxiety are likely to foster increased amounts of time spent using the Internet as individuals attempt to mitigate or cope with the ill effects of their psychosocial problems (Morahan-Martin, 1999; Young & Rodgers, 1998). Pratarelli and Browne (2002) suggest that “having addictive characteristics [e.g., psychosocial problems] [is] the first stage in the overuse of the Internet” (p. 59). To the extent that Internet use is effective in relieving dysphoric moods related to psychosocial problems or building gratifying communication experiences, increased time spent using the Internet may develop into PIU. The cognitive association generated between Internet use and needs fulfillment may become self-perpetuating, thus encouraging the development of PIU. For example, the desire to make friends and increased perceptions of self-efficacy to communicate successfully with others (surfacing from the use of Internet-based technologies) represent two reasons why individuals may spend increased amounts of time using the Internet, which develops into PIU (Lin & Tsai, 2002). Leung (2004) summarizes the relationship between time spent online and PIU by stating that “some psychologists believe spending too much time online can lead to a clinically diagnosable disorder called Internet addiction” (p. 344). Figure 1 depicts the hypothesized pathology model. According to the model, social anxiety, loneliness, and depression contribute to the time spent using the Internet, which, in turn, results in PIU.

#### *Characterizing PIU as an indicator of deficient self-regulation*

Critics of PIU have questioned the legitimacy of claims that Internet use results in psychological dependence and whether it should be considered a pathological disorder (LaRose et al., 2003; Shaffer, Hall, & Vander Bilt, 2000). Hall and Parsons (2001) level several criticisms of the characterization of PIU as a pathology. They argue that studies evaluating PIU from a pathological disorder etiology do not discount comorbidity—including mood and anxiety disorders—as a causal agent, are largely atheoretical, and do not separate the medium (i.e., Internet-based technologies) from the message (i.e., specific uses of the technology such as gaming). Additionally,



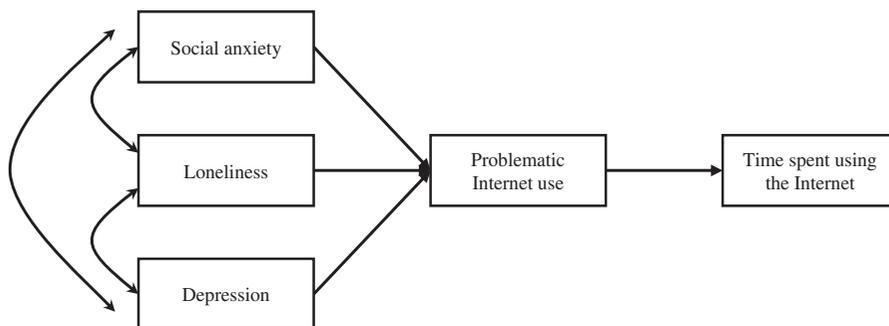
**Figure 1** Hypothesized model from the pathology characterization of problematic Internet use (PIU).

scholars arguing for the pathology perspective are unable to explain how certain sufferers can remedy PIU without the assistance of clinical or professional interventions (LaRose et al., 2003). To overcome the conceptual shortcomings found in characterizing PIU as a form of pathology, PIU is, instead, proposed as a marker of deficient self-regulation (LaRose et al., 2003).

In the deficient self-regulation perspective, PIU is not considered to be a serious disorder or disease that requires professional treatment (LaRose et al., 2003). According to LaRose et al., conceptualizations of PIU in research adopting the pathology perspective may be “reinterpreted as markers of deficient self-regulation and the process of addiction as the struggle to maintain effective self-regulation over problematic media behavior” (p. 233). Deficient self-regulation is recognized by both habitual and impulsive behaviors, in concert with a perceived loss of control (Marlatt, Baer, Donovan, & Kivlahan, 1988). In the case of PIU, the loss of self-control or insufficient self-regulation results in increased time spent using the Internet.

The dysphoria experienced by individuals with psychosocial problems fosters deficient self-regulation by interfering with cognitions that serve as a safeguard for successful self-regulation (LaRose et al., 2003). Individuals with psychosocial problems such as social anxiety, depression, and loneliness may use Internet-based technologies to escape dysphoric moods and/or personal problems (Song, LaRose, Eastin, & Lin, 2004). PIU develops when these technologies become “an important or exclusive mechanism to relieve stress, loneliness, depression, or anxiety” (LaRose et al., 2003, p. 230). A negative cognitive bias, discussed by others as maladaptive cognitions (Davis, 2001), impairs successful self-regulation associated with healthy Internet use. Accordingly, there is a strong relationship between PIU and social anxiety, loneliness, and depression.

Unlike in the pathology model, the increased amount of time people spend using the Internet is argued to be an outcome of PIU in the deficient self-regulation model because individuals are unable to control their Internet use. The failure to regulate Internet behaviors, in the context of PIU, results in greater amounts of time spent



**Figure 2** Hypothesized model from the deficient self-regulation characterization of problematic Internet use (PIU).

using the Internet through the formation of habits and impulses. An illustration of the hypothesized model is provided in Figure 2. In the deficient self-regulation model, psychosocial problems directly result in PIU, which, in turn, predicts time spent using the Internet.

## Method

The two models of the relationships between PIU, time spent using the Internet, and psychosocial problems were tested as follows: 10 fixed-effects model meta-analyses (Hedges & Vevea, 1998) were first conducted to compute weighted mean zero-order correlations between the five variables in the two hypothesized models. The five variables include PIU, time spent using the Internet, social anxiety, loneliness, and depression. Meta-analysis is a procedure for aggregating the results from a body of research (Hedges & Olkin, 1985; Hunter et al., 1982; Lipsey & Wilson, 2001). Meta-analysis makes it possible to calculate a sample-weighted mean effect size from a collection of studies. The effect size used in this study,  $r$ , represents the Pearson product-moment correlation between two variables. The correlations were then used to conduct path analyses testing the two models. It is noteworthy that, given the aims of this project, tests for moderators were not conducted. The following sections describe the procedure used to conduct the meta-analyses; tests of the path models are discussed in the following section.

### Literature search and inclusion criteria

A literature search was conducted to identify research reports relevant to PIU and Internet use completed prior to 2009. Three procedures were used to locate the reports. First, six electronic databases were searched. EbscoHost's *Academic Search Premier*, *Business Source Premier*, *Computer Source*, *Communication and Mass Media Premier*, *ERIC*, *Medline*, *Psychology and Behavioral Sciences Collection*, and *PsychInfo* databases were searched for journal articles and conference papers. In addition, the WorldCat, JSTOR, and LexisNexis databases were used to search for relevant research

reports. ProQuest was used to obtain doctoral dissertations and master's theses, and the All Academic database was searched for conference papers. The following search terms were used: "problematic Internet use," "pathological Internet use," "PIU," "Internet addiction," "Internet overuse," "excessive Internet use," and "Internet dependency." Second, reference sections from review articles focusing on PIU (e.g., Chou, Chondron, & Belland, 2005; Morahan-Martin, 2005; Widyanto & Griffiths, 2006) were consulted to identify additional research reports. Third, correspondence was sent to researchers in the field soliciting any unpublished articles investigating PIU.<sup>4</sup> The literature search resulted in more than 350 unique citations.

Two criteria were used to include cases in the sample for this project. First, all cases in the sample must have been about PIU or, more generally, Internet use. Accordingly, all cases must have included a measure of PIU or Internet use. Second, cases must have reported an *r* value or data making it possible to compute an *r* value (e.g., means and standard deviations, a *t*-value). A total of 100 cases met the preceding criteria for inclusion in the meta-analysis. The cases included 75 journal publications, 23 master's theses and doctoral dissertations, and 2 conference papers. A summary of all research reports included in the meta-analysis is given in Table 1.

A small number of cases met the two inclusion criteria but were excluded for other reasons. One case (Young, 1998b) was excluded from the meta-analysis of the relationship between PIU and time spent using the Internet after the zero-order correlation was determined to be an outlier; the reported correlation was more than three standard deviations greater than the unweighted mean correlation for all other cases that examined these two variables. Lipsey and Wilson (2001) recommend excluding such "extreme effect size values that are notably discrepant from the preponderance of those found in the research of interest" (p. 107). Other cases were excluded because the same data were presented in multiple reports (e.g., Caplan, 2003; LaRose, Eastin, & Gregg, 2001); in these instances, the report with the most information about the data was used for this project.

### **Operationalizing study variables**

The five variables included in the models were operationalized as follows: PIU was operationalized using measures that address both generalized (e.g., Caplan, 2002, 2005, 2007; Ceyhan & Ceyhan, 2008; Chak & Leung, 2004; Davis et al., 2002) and specific (e.g., Charlton & Danforth, 2007; Kim, Namkoong, Ku, & Kim, 2008; Lee et al., 2007) forms of PIU. Time spent using the Internet was operationalized using measures that evaluate the actual time individuals spent using the Internet (e.g., Armstrong et al., 2000) and the amount of time they perceived being online (e.g., LaRose et al., 2003). Consistent with Segrin's (2001) work, social anxiety was operationalized as shyness (e.g., Chak & Leung, 2004), perceived social anxiety (e.g., Caplan, 2007), and social phobia (e.g., Yen et al., 2008). In seven instances, social anxiety was operationalized as extraversion (and assigned the opposite sign); high levels of extraversion imply that an individual is not anxious in social situations. Loneliness was operationalized in most instances using the UCLA loneliness scale

**Table 1** Description of Studies Included in the Meta-Analysis

Author(s)	N	Sample Type	Age (M)	% Male	PIU Measure	Offline/Online	Nation
Altman (2000) <sup>a</sup>	52	Precollege students	15.4	44.2	NA	Offline	United States
Amichai-Hamburger and Ben-Artzi (2000)	72	College students	24.5	62.5	NA	NA	Israel
Amichai-Hamburger and Ben-Artzi (2003)	85	College students	26.6	48.2	NA	Offline	Israel
Andrade (2003) <sup>a</sup>	82	Precollege students	12.6	41.5	NA	Offline	United States
Armstrong, Phillips, and Saling (2000)	52	Nonstudent adults	NA	55.8	IRABI & IRPS	Online	NA
Butler (2000) <sup>a</sup>	220	College students	20.3	67.0	NA	NA	United States
Campbell, Cummings, and Hughes (2006)	215	College students	28.7	32.1	IUQ	Offline/online	Australia
Cao and Su (2007)	2620	Precollege students	12–18	50.2	Modified YDQ	Offline	China
Caplan (2002)	386	College students	20	30.1	GPIUS	Offline	United States
Caplan (2007)	343	College students	19.4	69.7	NA	Offline	United States
Ceyhan and Ceyhan (2008)	559	College students	NA	41.9	PIUS	Offline	Turkey
Ceyhan et al. (2007)	1658	College students	NA	NA	PIUS	NA	Turkey
Chak and Leung (2004)	722	Precollege students and other	NA	36.0	YDQ	Offline/online	Hong Kong
Chang and Man Law (2008)	410	College students	NA	45.6	IAT	Offline	Hong Kong
Charlton and Danforth (2007)	442	Other	28.8	85.7	AEQ	Online	NA
Chen and Peng (2008)	42719	College students	NA	43.8	NA	Online	Taiwan
Choi (2001) <sup>a</sup>	355	Nonstudent adults	NA	57.5	Modified YDQ	Online	Korea
Chou, Chou, and Tyan (1998) <sup>b</sup>	104	College students	22.3	66.7	IRABI (Chinese)	Online	Taiwan
Chou and Hsiao (2000)	910	College students	21.1	60.0	IRABI (Chinese) & YDQ	Offline	Taiwan
Cooper (2003) <sup>a</sup>	52	Precollege students	13.8	50.0	NA	Offline	United States

**Table 1** *Continued*

Author(s)	N	Sample Type	Age (M)	% Male	PIU Measure	Offline/Online	Nation
Davis et al. (2002)	211	College students	21.7	49.3	OCS	Offline	Canada
DiNicola (2004) <sup>a</sup>	731	College students	NA	31.1	CBC	Online	United States
Dittman (2003) <sup>a</sup>	466	College students	NA	47.6	NA	NA	United States
Donohoe (2007) <sup>a</sup>	91	College students	18.7	46.2	Short IUS	Offline	United States
Eastin and LaRose (2000)	171	College students	21	60.0	NA	Offline	United States
Ebeling-Witte, Frank, and Lester (2007)	88	College students	19.2	38.6	OCS	NA	United States
Engelberg and Sjöberg (2004)	41	College students	21.1	51.2	IAT	Offline	Sweden
Farran (2004) <sup>a</sup>	186	College students	19.3	24.7	NA	Offline	United States
Forston et al. (2007)	411	College students	20.4	44.0	DSM-IV	NA	United States
Gordon, Juang, and Syed (2007)	312	College students	21.3	33.0	NA	Offline	United States
Goulet (2002) <sup>a</sup>	525 <sup>c</sup> 430 <sup>d</sup>	College students	18.7 <sup>c</sup>	49.7 <sup>c</sup> 47.7 <sup>d</sup>	IUS <sup>v</sup>	Offline	United States
Gross (2004)	229	Precollege students	NA	38.3	NA	Offline	United States
Gross, Juvonen, and Gable (2002)	130	Precollege students	12.1	37.8	NA	Offline	United States
Ha et al. (2007)	452	Precollege students	15.8	53.7	IAT	Offline	South Korea
Hardie and Tee (2007)	96	Nonstudent adults	26.9	45.8	IAT	Online	NA
Huang (2004) <sup>a</sup>	1119	Precollege and college students	19.0	49.2	IAT	Offline	Taiwan
Hughes (1999) <sup>a</sup>	295	College students	20.6	30.5	IRABI	Offline	United States
Hwang (2007) <sup>a</sup>	6341	Precollege students	15.5	50.0	NA	NA	Taiwan
Jang, Hwang, and Choi (2008)	912	Precollege students	13.9	26.7	IAT (Korean)	Offline	South Korea
Jenaro et al. (2007)	337	College students	21.6	24.0	IOS	Online	Spain

**Table 1** *Continued*

Author(s)	N	Sample Type	Age (M)	% Male	PIU Measure	Offline/Online	Nation
Johansson and Gotesam (2004)	3237	Other	14.9	51.0	YDQ	NA	Norway
Khazaal et al. (2008)	246	College students and nonstudent adults	24.1	32.9	IAT (French)	NA	Switzerland
Kheirkhah, Ghabeli Juibary, Gouran, and Hashemi (2008)	1856	Nonstudent adults	NA	NA	YDQ (Farsi)	Online	Iran
Kim et al. (2006)	1575	Precollege students	NA	35.0	IAT (Korean)	NA	South Korea
Kraut et al. (1998)	256	Nonstudent adults	NA	46.0	NA	NA	United States
Landers and Lounsbury (2006)	117	College students	NA	41.0	NA	Offline	United States
LaRose et al. (2003)	465	College students	NA	61.0	DISR	NA	United States
Lee et al. (2007)	627	Precollege students	15.9	77.8	KIAT	Offline	South Korea
Lin, Ko, and Wu (2008)	4456	Precollege students	19.9	46.7	CIAS-Revised	Offline	Taiwan
Lin and Tsai (2002)	752	Precollege students	NA	67.4	IAT	NA	Taiwan
Liu and Kuo (2007)	555	College students	NA	46.0	YDQ	NA	Taiwan
Liu and Peng (2008)	115	College students	26.0	62.0	CIAS-Revised	Online	China
Lo, Wang, and Fang (2005)	174	College students	19.1	48.9	NA	NA	Taiwan
Matanda, Jenvey, and Phillips (2006)	158	College students and nonstudent adults	38.8	44.9	NA	Offline	Australia
Matsuba (2006)	203	College students	20.5	28.0	IUSc	Offline	Canada
Meerkerk, van den Eijnden, Vermulst, and Garretsen (2006)	447 <sup>c</sup> 229 <sup>d</sup>	Nonstudent adults	NA	NA	CIUS	Online	Netherlands
Mitchell (1999) <sup>a</sup>	167	Nonstudent adults	32.1	56.3	NA	Online	United States
Mittal, Tessner, and Walker (2007)	69	Precollege students	14.4	49.2	NA	Offline	United States

**Table 1** *Continued*

Author(s)	N	Sample Type	Age (M)	% Male	PIU Measure	Offline/Online	Nation
Moody (2001)	166	College students	19.2	28.3	NA	NA	United States
Morahan-Martin and Schumacher (2000)	277	College students	20.7	54.2	IUSc	NA	United States
Morahan-Martin and Schumacher (2003)	277	College students	20.7	54.2	NA	NA	United States
Morgan and Cotten (2003)	256	College students	18.0	54.0	NA	Online	United States
Nalwa and Anand (2003)	39	Precollege students	NA	NA	OCS	NA	India
Ngai (2007)	988	Precollege students	NA	NA	IAT	Offline	Hong Kong
Nichols and Nicki (2004)	207	College students	NA	58.0	IAS	NA	Canada
Nithya and Julius (2007)	200	NA	NA	NA	NA	Online	NA
Ofosu (1999) <sup>a</sup>	211	College students	NA	49.3	YDQ	Offline	Canada
Oh (2003)	450	Precollege students	NA	53.3	IAT	NA	South Korea
Okeke (2007) <sup>a</sup>	117	College students	20.6	38.5	IUSc	Offline	United States
Orzan and Buzlu (2007)	730	College students	20.8	47.1	OCS	NA	Turkey
Parsons (2005) <sup>a</sup>	507	Nonstudent adults	26.8	83.4	YDQ	Online	NA
Peters and Malesky (2008)	196	Nonstudent adults	24.3	88.3	EAS	Online	NA
Prezza, Pacilla, and Dinelli (2004)	331	Precollege students	17.3	80.6	NA	NA	Italy
Ramnath (2004) <sup>a</sup>	203	College students	30.0	29.6	OUI	Offline	United States
Rotunda et al. (2003)	393	College students	27.6	46.4	IUS	Online	United States
Sanders, Field, Diego, and Kaplan (2000)	89	Precollege students	NA	58.4	NA	Offline	United States
Scherer (1997)	385	College students	24.0	51.5	DSM-IV	Offline	United States
Seay and Kraut (2007)	2600	Nonstudent adults	28.0	88.0	EAS	Online	NA
Shelesky (2003) <sup>a</sup>	181	College students	26.5	100.0	NA	Offline	United States

**Table 1** *Continued*

Author(s)	N	Sample Type	Age (M)	% Male	PIU Measure	Offline/Online	Nation
Shepherd and Edelmann (2005)	169	College students	26.0	26.6	RIU	Offline	United Kingdom
Shim (2004) <sup>a</sup>	405	Precollege students	NA	48.6	NA	Offline	United States
Smahel, Blinka, and Ledabył (2008)	584	Nonstudent adults	25.0	84.6	MMORPGA	Online	NA
Spada, Langston, Nikcevic, and Moneta (2008)	97	College students	23.3	57.7	IAT	Offline	United Kingdom
Sum, Mathews, Hughes, and Campbell (2008)	222	Nonstudent adults	NA	38.0	NA	Online	Australia
Tahiroglu, Celik, Uzel, Ozcan, and Avci (2008)	3975	Precollege students	14.8	50.7	OCS	NA	Turkey
Thatcher and Goolam (2005a)	279	Nonstudent adults	NA	71.0	PIUQ	Online	South Africa
Thatcher and Goolam (2005b)	1791	Nonstudent adults	NA	75.3	PIUQ	Online	South Africa
Thatcher, Wretschko, and Fisher (2008)	1399	Nonstudent adults	NA	76.1	OCS & PIUQ	Online	South Africa
van den Eijnden, Meerkerk, Vermulst, Spijkerman, and Engels (2008)	633	Precollege students	13.4	48.0	NA	Offline	Netherlands
Wang (2006) <sup>a</sup>	268	College students	29.2	48.1	NA	Online	United States
Ward (2000) <sup>a</sup>	114	College students	21.9	31.0	IUQW	Offline	United States
Wastlund, Norlander, and Archer (2001)	329	College students	35.3	35.3	NA	Offline	Sweden
Weiser (2000) <sup>a</sup>	435	College students and nonstudent adults	NA	32.2	NA	Online	United States
Widyanto and McMurrin (2004)	86	Nonstudent adults	29.4	33.7	IAT	Online	NA

**Table 1** *Continued*

Author(s)	N	Sample Type	Age (M)	% Male	PIU Measure	Offline/Online	Nation
Williams (2007)	884	Nonstudent adults	NA	86.5	NA	Online	NA
Yang, Choe, Baity, Lee, and Cho (2005)	328	College students	16.2	50.0	IAT	NA	South Korea
Yang and Tung (2007)	1708	College students	NA	56.0	YDQ	Offline	Taiwan
Yen, Ko, Yen, Wu, and Yang (2007)	1890	Precollege students	16.3	56.3	CIAS	NA	Taiwan
Yen et al. (2008)	3517	Precollege students	15.5	63.1	CIAS	NA	Taiwan
Yuen and Lavin (2004)	283	College students	NA	27.9	IDS	Online	United States

*Note:* NA: Data not available or not applicable. Offline/online refers to whether data for a study were collected using an Internet-based questionnaire (online) or a paper-and-pencil questionnaire (offline). Nation refers to country from which participants were drawn. The following measures of PIU were used among research reports in the data set: AEQ = Addiction-engagement questionnaire (Charlton, 2002); CBC = Cognitive-behavioral checklist (DiNicola, 2004); CIAS = Chen Internet addiction scale (Chen, Weng, Su, Wu, & Yang, 2003); CIUS = Compulsive Internet use scale (Meerkerk, van den Eijnden, Vermulst, & Garretsen, 2005); CSID = Clinical symptoms of Internet dependency (Scherer, 1997); DISR = Deficient Internet self-regulation (LaRose et al., 2003); DSM-IV = Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 1994); EAS = Engagement/addiction scale (Danforth, 2004); GPIUS = Generalized problematic Internet use scale (Caplan, 2002); IAS = Internet addiction scale (Nichols & Nicki, 2000); IAST = Internet addiction scale for Taiwanese (Lin & Tsai, 1999); IAT = Internet addiction test (Young, 1998a); IDS = Internet dependency scale (Yuen & Lavin, 2004); IOS = Internet overuse scale (Jenaro et al., 2007); IRABI = Internet-related addictive behavior inventory (Brenner, 1997); IRPS = Internet-related problem scale (Armstrong et al., 2000); IUQ = Internet use questionnaire (Campbell et al., 2006); IUQW = Internet use questionnaire (Ward, 2000); IUS = Internet use survey (Rotunda et al., 2003); IUSv = Internet use survey (Brenner, 1997); IUSc = Internet usage scale (Morahan-Martin & Schumacher, 2000); KIAT = Korean Internet addiction test (Kim & Lee, 2004); MMORPGA = Massively multiplayer online role playing game addiction (Smahel et al., 2008); OCS = Online cognition scale (Davis et al., 2003); OUI = Online usage inventory (Ramnath, 2004); PIUQ = Problematic Internet use questionnaire (Thatcher & Goolam, 2005); PIUS = Problematic Internet use scale (Ceyhan & Ceyhan, 2007); RIU = Reasons for Internet use (Shepherd & Edelmann, 2005); YDQ = Young's diagnostic questionnaire (Young, 1996).

<sup>a</sup>Master's thesis or doctoral dissertation. <sup>b</sup>Conference paper. <sup>c</sup>Time 1. <sup>d</sup>Time 2.

(e.g., Caplan, 2003) and the social and emotional loneliness scale (e.g., Nichols & Nicki, 2004). Depression was operationalized by most cases in the sample using the Center for Epidemiological Studies Depression Scale; in some instances (e.g., Caplan, 2002; Jenaro, Flores, Gomez-Vela, Gonzalez-Gil, & Caballo, 2007), other checklists and inventories were used to assess depression.

### **Effect size extraction, bias correction, and computation of weighted mean effects**

The meta-analysis was conducted following three general steps (Hedges & Olkin, 1985; Hunter et al., 1982). First, each of the cases in the sample were reviewed to identify the zero-order correlations and corresponding sample sizes for the five variables included in the proposed models of PIU. In most cases, it was possible to identify a correlation between at least two variables. In some cases, an  $r$  value was computed from means and standard deviations or transformed from a  $t$ -value. It is noteworthy that the sample size reported in one case (i.e., Chen & Peng, 2008) was an extreme outlier ( $N > 45,000$ ). To mitigate the disproportionate influence of this case, the sample size was reassigned a value of  $N = 3,733$  for all zero-order correlations reported by Chen and Peng. This value is three standard deviations (plus 1) greater than the mean sample size for all cases in this project.

Second, where possible and appropriate, effect estimates (and weights) were corrected for biases stemming from measurement error and/or dichotomization of the PIU variable. These two sources of bias attenuate effect estimates and were thus corrected (Hunter & Schmidt, 1990, 2004). Using formulas specified by Hunter and Schmidt (2004), the reliability coefficient for each variable in a zero-order correlation was used to correct for measurement error. In instances where the reliability of a measure was not reported, the Spearman–Brown formula was used to compute the reliability coefficient based on the number of items included in a measure. If the number of items in a measure was not reported, then the average number of items used in measures of that variable (across the sample) was used as an estimate. The mean number of items and reliability of a single item for each variable were as follows: PIU ( $\alpha_{\text{single-item}} = .32$ ;  $M_{\text{items}} = 20$ ), time spent using the Internet ( $\alpha_{\text{single-item}} = .40$ ;  $M_{\text{items}} = 3$ ), social anxiety ( $\alpha_{\text{single-item}} = .42$ ;  $M_{\text{items}} = 17$ ), loneliness ( $\alpha_{\text{single-item}} = .32$ ;  $M_{\text{items}} = 18$ ), and depression ( $\alpha_{\text{single-item}} = .28$ ;  $M_{\text{items}} = 16$ ). Time was assessed with a single item in all but 13 cases in the data set. Given that the time one spends using the Internet is an observed variable (as opposed to a latent construct), all single-item measures of time were assumed to possess a reliability of  $\alpha = 1.0$ . Additionally, because PIU was dichotomized in several studies, corrections for attenuation due to dichotomization were made using formulas provided by Hunter and Schmidt (1990). The proportion of the sample dichotomized into the two groups was identified and used to compute the correction factor.

Third, the corrected effect estimates and weights were used to conduct separate fixed-effects meta-analyses (Hedges & Vevea, 1998). Ten individual meta-analyses were conducted using formulas specified by Hedges and Olkin (1985) for computing weighted mean effects. Again, because the purpose of the meta-analysis is to identify

the zero-order relationships between the variables in the proposed models of PIU, tests for moderators were not conducted. The tests for homogeneity of effects are not reported in this article but are available from the first author.

## Results

### Meta-analyses of the relationships between variables in the PIU models

The results of the meta-analyses for the 10 relationships corresponding to the five variables in the PIU models are reported in Table 2. In the lower portion of Table 2, the corrected effect estimates, number of studies included in the analysis ( $K$ ), and median sample size ( $N$ ) for each relationship are reported. The corrected, weighted mean correlations between PIU and the four other variables ranged from  $r = .27$  to  $r = .39$ . The uncorrected, weighted mean correlations are reported in the upper portion of Table 2.

### Path analysis of the deficient self-regulation and pathology models

Path analysis makes it possible to simultaneously test the interrelationships among several variables (Bollen, 1989; Kline, 1998). Path models test whether a predicted model fits a given data set, which, in this project, refers to the corrected, weighted mean effect estimates derived from the meta-analyses and reported in the lower portion of Table 2. Given that the sample sizes among the cases in the data set ranged from as few as 39 to as many as 6,341, the median sample size from the 100 cases ( $Mdn = 320$ ) was used in conducting the path analysis. The median is preferable in this instance because it is less sensitive to extreme values than the mean.

The hypothesized models developed from the two characterizations of PIU are depicted in Figures 1 and 2. In the pathology model (depicted in Figure 1), social anxiety, loneliness, and depression were modeled as predictors of time spent using

**Table 2** Zero-Order Correlation Matrix of Variables in the Hypothesized Model

	1	2	3	4	5
1. PIU		$r = .34$	$r = .18$	$r = .28$	$r = .27$
2. Time	$r = .39$		$r = .03$	$r = .06$	$r = .03$
	$K = 46; N = 411$				
3. Social anxiety	$r = .27$	$r = .03$		$r = .50$	$r = .44$
	$K = 13; N = 169$	$K = 15; N = 200$			
4. Loneliness	$r = .33$	$r = .07$	$r = .56$		$r = .51$
	$K = 19; N = 295$	$K = 22; N = 321$	$K = 12; N = 271$		
5. Depression	$r = .37$	$r = .04$	$r = .47$	$r = .62$	
	$K = 23; N = 452$	$K = 24; N = 216$	$K = 10; N = 225$	$K = 13; N = 329$	

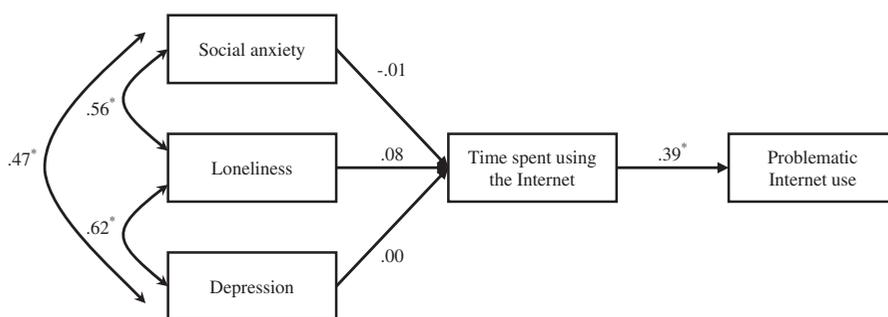
*Note:*  $K$  = number of cases in the analysis;  $N$  = median number of participants per case; PIU = problematic Internet use. The lower portion of the matrix consists of the corrected, weighted mean  $r$  values; the upper portion of the matrix displays the uncorrected, weighted mean  $r$  values.

the Internet, which, in turn, was modeled as a predictor of PIU. In the deficient self-regulation model (depicted Figure 2), social anxiety, loneliness, and depression were modeled as antecedents of PIU, which predicted time spent using the Internet. In both models, covariances were included among the exogenous variables (i.e., social anxiety, loneliness, depression); prior research suggests these three constructs are correlated (e.g., Segrin, 2001).

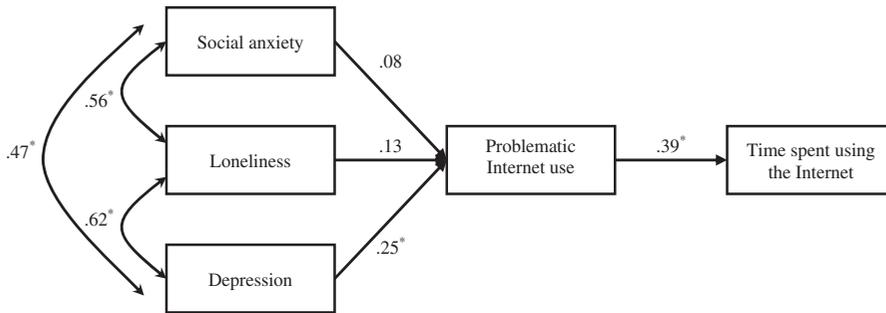
Model fit was evaluated using Hu and Bentler's (1999) dual criteria of a comparative fit index (CFI) value greater than or equal to .96 and a standardized root mean square residual (SRMR) value less than or equal to .10. The results of the path analysis, conducted using Equations 6.1 (EQS; Bentler, 1995), indicate that the hypothesized model developed from the characterization of PIU as a form of pathology does not adequately fit the data. The chi-square test was significant and the additional fit indices did not meet the criteria established by Hu and Bentler,  $\chi^2(df = 3) = 58.39, p < .01, CFI = .86, SRMR = .14$ . The results of the path analysis testing the deficient self-regulation perspective indicate that the model fits the data. The model chi-square test was nonsignificant and the other fit indices met the established criteria,  $\chi^2(df = 3) = 5.34, p = .15, CFI = .99, SRMR = .04$ . Given that the objective of the study was to test the alternative characterizations of the relationships between PIU, time spent using the Internet, and psychosocial problems, and not model development or refinement, modification indices (e.g., Lagrange multiplier test, Wald test, residual covariances) were not consulted. The results of the models developed from the pathology and deficient self-regulation characterizations of PIU, including standardized path estimates, are shown in Figures 3 and 4, respectively.

### Posthoc analyses of indirect effects

Tests of the indirect effects in the pathology and deficient self-regulation models were conducted using the path coefficients and standard errors from each respective model.<sup>5</sup> Asymmetric distribution of products tests (MacKinnon, Lockwood,



**Figure 3** Path model from the pathology characterization of problematic Internet use (PIU). *Note:* The parameter estimates provided in the model are standardized coefficients. The median sample size ( $N = 320$ ) for all cases in the project was used in testing the path model. \* $p < .05$ .



**Figure 4** Path model from the deficient self-regulation characterization of problematic Internet use (PIU).

*Note:* The parameter estimates provided in the model are standardized coefficients. The median sample size ( $N = 320$ ) for all cases in the project was used in testing the path model. \* $p < .05$ .

Hoffman, West, & Sheets, 2002; MacKinnon, Lockwood, & Williams, 2004) were performed to evaluate the indirect effects.<sup>6</sup> This test uses asymmetric confidence intervals (CIs) and can be considered a “products of coefficients” approach for testing indirect effects (see MacKinnon et al., 2002, 2004). To summarize, z-statistics were computed for the two paths in the indirect effect (e.g., depression-PIU and PIU-time spent using the Internet). The z-values were used to find upper and lower critical values in Meeker, Cornwell, and Aroian’s (1981) table of critical values for the product of two random variables. These critical values were then used to construct the 95% CI around the indirect effect.<sup>7</sup> An indirect effect is significant when the CI does not include zero.

Three indirect effects were tested for the pathology model. The results indicate that the indirect effects for depression-time spent using the Internet-PIU (.001, 95% CI [−.05, .06]), social anxiety-time spent using the Internet-PIU (−.004, 95% CI [−.06, .05]), and loneliness-time spent using the Internet-PIU (.03, 95% CI [−.03, .10]) are not different from zero. Three indirect effects were also tested for the deficient self-regulation model. The results indicate that the indirect effect for depression-PIU-time spent using the Internet (.10, 95% CI [.04, .16]) is different from zero, but the indirect effects for social anxiety-PIU-time spent using the Internet (.03, 95% CI [−.01, .08]) and loneliness-PIU-time spent using the Internet (.05, 95% CI [.00, .11]) are not different from zero.

## Discussion

The aim of this project was to evaluate the nature of the relationships between PIU, time spent using the Internet, and psychosocial problems. The models tested were developed from broader characterizations of PIU as a form of pathology (Chou & Hsiao, 2000; Hur, 2006; Morahan-Martin, 1999; Young, 1998b) and as an indicator of deficient self-regulation (LaRose et al., 2003). To test the two models, meta-analyses

were first conducted to identify sample-weighted Pearson  $r$  correlations for the relationships between the five variables included within the models—social anxiety, loneliness, depression, time spent using the Internet, and PIU. Path analysis was then used to formally test the fit of the two models.<sup>8</sup> This approach offers a fairly robust test of the relationships between PIU, time spent using the Internet, and psychosocial problems, and consequently provides insights into the two broader characterizations of PIU. In the following sections, the results of the analyses are discussed, the implications of the findings for research and theory are examined, and the limitations and directions for future research are addressed.

### **Evaluating the pathology and deficient self-regulation models**

PIU has been discussed fairly inconsistently by researchers. In the characterization of PIU as a form of pathology, individuals with psychosocial vulnerabilities (e.g., depression) are argued to spend longer time using the Internet, presumably to assuage dysphoric moods and/or seek comforting communication (Morahan-Martin & Schumacher, 2000), which ultimately leads to PIU. From the perspective of deficient self-regulation, PIU develops as psychosocial problems hinder the capacity to closely regulate Internet-related behaviors, which, in turn, results in greater time spent using the Internet.

The results of the path analyses provide some support for the deficient self-regulation model, but do not validate the model developed from the characterization of PIU as a form of pathology. It is impossible to draw any definitive conclusions about the causal nature of the relationships between psychosocial problems, PIU, and time spent using the Internet because the data used to conduct the meta-analyses and test the path models were almost exclusively from cross-sectional studies. Nonetheless, it is noteworthy that only the deficient self-regulation model adequately fit the sample data. Such a result offers evidence that the deficient self-regulation characterization provides a tenable explanation for the relationships between psychosocial problems, PIU, and time spent using the Internet, whereas the pathology characterization does not.

The model developed from the deficient self-regulation characterization of PIU demonstrates that social anxiety, loneliness, and depression contribute, in varying degrees of magnitude, to the development of PIU. Depression, which is theorized to cause a negative cognitive bias hindering successful self-regulation of Internet use (LaRose et al., 2003), is the strongest predictor of PIU. Further, the indirect effect from depression to time spent using the Internet through PIU was also significant. Depression may encourage individuals to selectively expose themselves to media that mitigate dysphoric moods (Zillmann, 2000; Zillmann & Bryant, 1985). The deficient self-regulation of media use develops when individuals come to rely on media to relieve the ill effects of depression (LaRose et al., 2003). The path coefficients for the relationship between PIU and loneliness and social anxiety were also in the expected direction in the deficient self-regulation model. Although neither was statistically significant, nor were the indirect effects associated with these relationships, the point

estimates for the path coefficients are important to consider. The correlation matrix used in testing the path models and estimating the path coefficients was constructed from the results of several meta-analyses. Further, the significance test for the path coefficients is substantially influenced by sample size, which, for the two models tested in this project, was fairly conservative (see endnote 8). The point estimates for the relationships between PIU and loneliness and social anxiety suggest that, controlling for other psychosocial problems, both loneliness and social anxiety play a small, but potentially important role, in PIU. Finally, consistent with the deficient self-regulation perspective, time spent using the Internet was positively associated with PIU.

The findings provide relatively little support for the model developed from the characterization of PIU as a form of pathology. The fit indices demonstrate that the pathology model does not adequately fit the data. Further, although time spent using the Internet predicts PIU, the path estimates for the relationships between two of the three psychosocial problems and time spent using the Internet nears zero. An explanation for the poor fit of the model developed from the pathology characterization of PIU may lie in the sample characteristics of the individual studies included in the meta-analyses. The characterization of PIU as a form of pathology is based on evidence from case studies and other research involving self-identified problematic Internet users (e.g., Young, 1998b). This research involves asking participants to complete a measure containing set cut-off points to identify individuals with PIU. Participants who exceed a specific threshold are assumed to have “clinical” levels of PIU. LaRose et al. (2003), however, argue that most of the research on PIU is conducted using participants who do not report “clinical” levels. Indeed, very few cases of “clinical” levels of PIU were included among the studies in the present project. Using the criteria for identifying “clinical” levels of PIU established within each study, percentages of individuals with PIU ranged between 1.6 and 18.3%. Accordingly, it could be argued that there is a disconnect between the model developed from the characterization of PIU as a pathology and the nature of the samples included in the meta-analyses. The pathology characterization of PIU assumes “clinical” levels of PIU; yet, most participants studied did not report “clinical” levels. The model developed from the characterization of PIU as a form of pathology may hold in a sample of strictly problematic Internet users.

### **Implications for conceptualizing and theorizing about PIU**

There are several implications of this project for understanding and conceptualizing PIU. First, the findings are fairly consistent with the characterization of PIU as a marker of deficient self-regulation; PIU can be understood as an indicator of one’s inability to successfully regulate his or her Internet use. Internet use that stems directly from deficient self-regulation is interpreted as a set of impulsive behaviors (LaRose et al., 2003). The deficient self-regulation perspective describes PIU as lapses in effective self-regulation and moves away from the idea of PIU as patterns of media consumption consistent with an addiction or disease.

Second, it is worthwhile to consider PIU in view of the tradition of scholarship on other forms of media dependency such as television addiction. In media dependence research, television addiction is described as “dependence to the television medium itself, regardless of whatever content happens to be on” (McIlwraith, Jacobvitz, Kubey, & Alexander, 1991, p. 104). Television addiction is discussed as a serious affliction marked by many hours spent watching television each day (Horvath, 2004). Past research on media addiction, however, has been criticized for its conceptual shortcomings. Livingstone (1999) explains that it is never made clear whether media dependency such as television addiction should be interpreted as “a pattern of media use, a psychological condition, [or] the outcome of social deprivation” (p. 67). Scholarship on television addiction suggests at least two lessons that might inform research and theorizing about PIU. First, time spent using the Internet should not be confounded with PIU. One may spend substantial time using the Internet but not experience PIU. Second, despite early work discussing a “generalized” form of PIU involving a “general, multidimensional overuse of the Internet” (Davis, 2001, p. 188), it seems more likely that PIU involves a specific use of a technology supported by the Internet (e.g., gaming). The transition to PIU in the deficient self-regulation perspective begins with an individual’s reliance on specific technologies such as e-mail or chat to relieve stress or cope with psychosocial problems (LaRose et al., 2003). The notion of a generalized form of PIU overlooks the potentially important role played by the uses of specific Internet-supported technologies in the development of PIU.

### **Limitations and directions for future research**

Although the findings from this investigation offer important insights into the relationships between PIU, time spent using the Internet, and psychosocial problems, several limitations warrant consideration. First, as previously noted, most of the cases included in the meta-analyses were cross-sectional studies. Although the use of cross-sectional data limits causal claims, it is noteworthy that the zero-order correlations forming the foundation for the two models tested in this project were derived from meta-analyses. Meta-analysis makes it possible to identify relatively robust zero-order correlations that serve as stable estimates of the relationships between the variables in the models. Given the importance of understanding the relationships between PIU, time spent using the Internet, and psychosocial problems, it would be worthwhile for future investigations to replicate the findings of the present research using longitudinal data. A panel study, while challenging to conduct, would make it possible to infer causality for the hypothesized relationships with greater confidence. The nature of the samples used within the individual studies of the meta-analyses should also be noted. Convenience samples were used in a majority of the cases; however, as detailed in Table 1, the samples are reasonably diverse in terms of mean age, percentage of male and female participants, and nationality. The diversity in the samples improves the external validity of the findings from this project.

Second, although the models tested in this project provide a better understanding of the relationships between PIU, time spent using the Internet, and psychosocial problems, they are relatively limited in scope. Certain variables important to PIU could not be included in the two models. Habit strength, for example, is a notable component of the deficient self-regulation perspective absent from the two models tested in this project. Further, Caplan's (2003, 2005) work suggests that an important variable in the development of psychosocial problems in PIU models is deficient social skills. In general, it was not possible to include variables in this project unless they had been measured and tested in a sufficient number of studies. It would be worthwhile to incorporate these constructs in future efforts summarizing research on PIU.

Third, the models tested in this project offer a cross-section or snapshot of the PIU process; in essence, PIU is presented as a process with a clear beginning and end. There is, however, some argument and evidence to suggest that PIU may be a cyclical process (e.g., Caplan, 2003, 2005). Kim, LaRose, and Peng (2009), for instance, demonstrate that loneliness is both an antecedent and outcome of PIU. Future PIU theorizing should include the possibility of viewing PIU as a cyclical process. For example, one possible explanation of this process is that psychosocial problems result in PIU, and indirectly, the time one spends using the Internet, which then leads to further psychosocial problems aggravated by offline social isolation and increasingly impoverished relationships.

Finally, Internet use was most commonly assessed in past studies using hours per day or week online as a single-item measure. In addition to the psychometric limitations of single-item measures (Spector, 1991), collapsing the time spent using the Internet for different functions into a single construct may be problematic. Evidence suggests that the time spent using Internet-supported technologies for specific activities (e.g., social vs. nonsocial) may moderate the relationship between overall Internet use and PIU (Huang, 2010; Li & Chung, 2006; Morgan & Cotten, 2003). Future investigations should consider time spent using the Internet as a multidimensional construct and include items to assess specific uses of the Internet.

## Conclusion

In a relatively short period of time, a great deal of research has been conducted on PIU around the world. To underscore this point, 94 of the 100 articles included in the meta-analyses were published since the year 2000. Additionally, these studies were conducted by scholars in more than 20 different countries. This project represents one attempt to understand the relationships between PIU, time spent using the Internet, and psychosocial problems. The results lend support to the model conceptualizing PIU as a case of deficient self-regulation in which psychosocial problems foster PIU and, indirectly, time spent using specific Internet-based technologies. Continued research on PIU is essential to understand the role of PIU in the broader spectrum of Internet participation.

## Notes

- 1 Some scholars have used the measures to establish diagnostic criteria (i.e., cut-off points) for determining clinical levels of PIU. Other research has treated PIU as a continuous variable.
- 2 As of March 2010, there has been discussion of including PIU (although the term “Internet addiction” is used in this literature) into the *DSM-5* as a nonsubstance addiction (American Psychiatric Association *DSM-5* Development, 2010; Block, 2008).
- 3 Previously hypothesized models are not discussed in great detail in this report because these models are not being tested for this study. The aim of this project is testing various characterizations of the relationships between PIU, time spent using the Internet, and psychosocial problems.
- 4 A concerted effort was made to identify and include unpublished works such as dissertations, theses, and conference papers in the sample to mitigate concerns associated with publication bias (Rothstein, Sutton, & Borenstein, 2005).
- 5 Although the zero-order correlations between time spent using the Internet and the three psychosocial problem variables are relatively small (suggesting the lack of direct effects in the pathology model), indirect effects involving these variables and PIU may nonetheless exist and should be assessed (Hayes, 2009).
- 6 Although a bootstrapping approach for testing indirect effects would be most desirable, the SPSS macros, created by Preacher, Rucker, and Hayes (2007), used to conduct such an analysis require raw data (Hayes, 2009, p. 418). Accordingly, we used the asymmetric distribution of products test to evaluate the indirect effects. This test for indirect effects results in lower Type I error rates than other tests in instances where the two paths’ coefficients involved in the indirect effect are of different magnitudes (e.g., large, zero; small, large; etc.) (MacKinnon et al., 2004).
- 7 Upper and lower confidence limits for the indirect effects were constructed using the following formulas provided by MacKinnon et al. (2004):

$$\text{Upper confidence limit} = \alpha * \beta + \text{Meeker upper limit} * \sigma_{\alpha\beta}$$

$$\text{Lower confidence limit} = \alpha * \beta + \text{Meeker lower limit} * \sigma_{\alpha\beta}$$

$\alpha$  and  $\beta$  refer to the two paths’ coefficients for the three variables in the indirect effect (e.g., depression-PIU and PIU-time spent using the Internet), and  $\sigma_{\alpha\beta} = \sqrt{\alpha^2\sigma_{\beta}^2 + \beta^2\sigma_{\alpha}^2}$ .

- 8 It is important to keep in mind two issues when interpreting the results. First, because the zero-order relationships between the variables were determined using meta-analysis, the point estimates reported in the path models are more robust than estimates derived from a single sample. In comparison with a study conducted using a single data set, the point estimates for the path coefficients should more closely approximate values for these relationships in the population. Second, the tests for statistical significance associated with the path coefficients and indirect effects should be interpreted in light of the fact that the median sample size for all cases in this project ( $Mdn = 320$ ) was used in testing the path models. For reference, we reran the two path models and tests of indirect effects using the mean total sample size for the 10 meta-analyses ( $M = 12,807$ ). Although the path coefficients did not change, the standard errors associated with the path, estimates and tests of statistical significance did change. All paths were statistically significant in the

deficient self-regulation model, and all of the indirect effects were different from zero. The relationship between loneliness and time spent using the Internet was significant in the pathology model, and the indirect effect involving loneliness was different from zero. Accordingly, the tests of statistical significance should not be used as the sole criterion to determine the (un)importance of a path coefficient or indirect effect.

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## 检验互联网不当使用、上网时间，以及心理疾病之间关系的两种描述

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### 【摘要】

本文从两个视角检验了互联网不当使用、上网时间，以及心理疾病之间的关系。首先进行了十个元分析以确定该模型中五个变量的加权平均值相关性。从元分析中所得出的相关性分析继而用于路径分析以测试其他关系描述。结果支持了不完善的自我管理模型，但相对较少地支持 PIU 的病理学角度的论断。

Une évaluation de deux caractérisations des relations entre l'utilisation problématique d'Internet, le temps consacré à Internet et les problèmes psychosociaux

Robert Shota Tokunaga & Stephen A. Rains

Cet article rend compte de tests des relations entre l'utilisation problématique d'Internet (UPI), le temps consacré à Internet et les problèmes psychologiques du point de vue de deux perspectives : celle de la pathologie et celle de l'auto-régulation déficiente. Dix méta-analyses individuelles ont d'abord été menées pour identifier des corrélations moyennes pondérées parmi les cinq variables incluses dans les modèles. Les corrélations tirées des méta-analyses ont ensuite été utilisées dans des analyses causales afin de tester les caractérisations alternatives. Les résultats appuient en partie le modèle de l'auto-régulation déficiente, mais offrent relativement peu de soutien à la perspective pathologique de l'UPI.

Zur Bewertung des Verhältnisses zwischen problematischem Internetgebrauch, Internetnutzungszeit und psychosozialen Problemen

Robert Shota Tokunaga & Stephen A. Rains

Dieser Artikel befasst sich mit der Überprüfung des Zusammenhangs zwischen problematischem Internetgebrauch, der Internetnutzungszeit und psychosozialen Problemen aus zwei Blickwinkeln. Wir führten zehn Meta-Analysen durch, um die gewichteten Mittelwertskorrelationen zwischen den fünf Variablen des Modells zu identifizieren. Die Korrelationen der Meta-Analysen wurden anschließend in eine Pfadanalyse überführt, um alternative Blickwinkel zu prüfen. Die Ergebnisse stützen zum Teil das defizitäre Selbstregulierungsmodell, bieten aber wenig Anhaltspunkte für eine pathologische Perspektive auf einen problematischen Internetgebrauch.

문제적인 인터넷 사용, 인터넷 사용시간, 그리고 심리사회적 문제들 사이의 관계에서

## 두가지 특징에 대한 평가

Robert Shota Tokunaga & Stephen A. Rains

### 요약

문제적 인터넷 사용 (PIU)은 인터넷 사용의 부정적인 사회적 함의로서 최근들어 많은 관심을 받았다. PIU는 관련 문헌내에서 여러 다양한 방법으로 개념화 되었는데, 도박 중독과 비슷한 병리적인 형태로 부터 불충분한 자기규제의 척도등에 이르기까지 다양하다. 이러한 두가지 특징들을 구별하는 하나의 주요한 요소는 PIU, 인터넷 사용 시간, 그리고 심리사회적 문제들 (예들들어 사회적 걱정, 외로움, 우울증) 사이의 관계들이다. PIU의 병리적 측면에서, 심리사회적 문제들은 인터넷 사용시간을 예측하고 있으며, 반대로 PIU를 이끌고 있다. 불충분한 자기규제측면을 논의하는 사람들은 심리사회적 문제들이 직접적으로 PIU를 예측할 수 있다고 제안하는데, 이는 결과적으로 인터넷 사용 시간을 증가시키는 것이라는 주장이다. 본 논문은 PIU, 인터넷 사용시간, 그리고 심리사회적 문제들사이의 연계를 두가지 측면에서 연구한 것이다. 이를 위해 열가지 개별적 메타분석들이 단행되었다. 이들 메타분석들로부터의 상관관계들은 대안적

특징들을 조사하기 위하여 통로분석에 연속적으로 사용되었다. 결과들은 불충분한 자기규제모델을 일정정도로 지지하고 있으나, PIU의 병리적 측면에서는 상대적으로 약한 증거들을 보여 주었다.

Evaluando Dos Caracterizaciones de las Relaciones entre el Uso Problemático del Internet, el Tiempo Dedicado al Uso del Internet, y los Problemas Sicológicos

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Resumen

Este artículo reporta las pruebas de las relaciones entre el uso problemático del Internet PIU, el tiempo empleado en el uso del Internet, y los problemas psico-sociales desde 2 perspectivas. 10 meta análisis individuales fueron conducidos primero para identificar el promedio medido de las correlaciones entre las 5 variables incluías dentro de los modelos. Las correlaciones derivadas de los meta-análisis fueron usados subsecuentemente en el análisis de trayectoria para poner a prueba las caracterizaciones alternativas. Los resultados ofrecen algo de apoyo al modelo de auto regulación deficiente, pero proveen de relativamente poca evidencia consistente con la perspectiva patológica del PIU.