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Problematic Internet Use:
Relationship with Stress and Loneliness

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Chapter I

Review of the Literature

The Internet has been rapidly increasing in popularity since the 1990s. Internet use is prevalent among adults, with 85% of American adults 18 years and older accessing the Internet (Pew Internet and American Life Project, 2012). In a group of 18-29 year-olds, 96% reported using the Internet (Pew Internet and American Life Project, 2012). College students, who generally fall into this age range, reported using the Internet for many tasks, including communicating, researching information, attaining driving directions, accessing the news and weather, and maintaining social networks (Pew Internet and American Life Project, 2009). Thus, Internet usage is integrated into the lives of many individuals and is particularly important to the college student population.

Problematic Internet Use

The Internet can be a valuable tool, with numerous benefits to using it (Laouris, 2011). It is a vast source of information, with new information being added daily. The Internet offers many services such as shopping, banking, planning and organizational tools, and entertainment. The Internet also offers a free and available method of communication and information distribution. Despite the potential benefits associated with Internet access, its usage is relatively new such that researchers do not fully understand the implications for the users of this technology.

Recent research has shown that some individuals use the Internet in a way that is problematic, which has become known in the literature as Problematic Internet Use (PIU). PIU has been defined by Czincz and Hechanova (2009) as “an individual’s inability to control his or her use of the Internet, which eventually causes significant difficulties in the areas of mental health, interpersonal relationships, school, and/or employment” (p. 258). They further described PIU as “a psychological dependence on the Internet characterized by an increasing investment of resources in Internet-related activities, unpleasant feelings when offline, an increasing tolerance to the effects of being online, and denial of the problematic behavior” (p. 258). Czincz and Hechanova indicated that in order for an individual to be problematically using the Internet, there must be difficulties that extend into everyday life that cause some amount of distress. Beard and Wolf (2001) agreed with Czinc and Hechanova and defined PIU as the “use of the Internet that creates psychological, social, school and/or work difficulties in a person’s life” (p. 378). Some researchers have compared Internet addiction to other impulse control disorders, but not all are in agreement regarding the existence of PIU (Cao, Su, Liu, & Gao, 2007). According to Czincz and Hechanova, one of the main questions in PIU research is whether PIU is a unique disorder, or whether it represents preexisting difficulties manifesting in a different way. Czincz and Hechanova called for theory-driven models to be tested longitudinally in order to gain a better understanding of this potential problem.

Incidence rates of PIU vary across studies, with estimates in convenience samples ranging up to 18.3% (Morahan-Martin, 2008). In a U.S. randomized telephone sample, prevalence rates for PIU were estimated to range from .3 - .7%, with 3.7-13% endorsing

one or more markers of PIU (Aboujaoude, Koran, Gamel, Large, & Serpe, 2006). Some differences in rates of PIU may be related to the varying sampling methods used. Other contributing variables suggested are culture and age (Morahan-Martin, 2008). According to Czincz and Hechanova (2009), PIU has been reported across all ages, genders, and ethnicities; however, some groups, such as adolescents, have been shown to be at an increased risk for engaging in PIU. According to Yang and Tung (2007), there are several risk factors associated with adolescents that could increase their likelihood to develop PIU. These include (1) a desire to develop meaningful relationships and a sense of identity, (2) free and accessible Internet usage, and (3) encouragement to use the Internet at home and school. Additionally, Czincz and Hechanova indicated that explanations about culture as related to PIU are inconclusive; however there is some evidence to suggest that individuals in collectivistic cultures are at higher risk for developing PIU as compared to individuals in individualistic cultures (Choi & Ross, 2006; Young, 2004). Related to nationality, the amount and content of Internet usage have been shown to differ among countries. For example, in Japan, individuals are more likely to use the Internet for information and entertainment, whereas in Korea, individuals are more likely to use the Internet for communication (Young, 2004). In Turkey, there is a gender gap related to Internet use, with 54.9% of males accessing the Internet, whereas only 35.3% of females access the Internet (TUIK, 2011). This discrepancy in Internet access is thought to be one explanation for the increased PIU in Turkish males compared to females (Gencer & Koc, 2012). One of the limitations of the previous literature on diversity factors is that clear correlations and causal pathways have not been identified as related to PIU (Czincz & Hechanova, 2009). Further research regarding PIU as related to

diversity factors, specifically culture and nationality, is needed as Internet use becomes more widespread internationally.

Research has found inconsistent results regarding the relationship between PIU and gender. Some studies have suggested that being male is a risk factor for developing PIU (Bakken, Wenzel, Götestam, Johansson, & Oren, 2009; Chou, Condrón, & Belland, 2005; Çuhadar, 2012; Frangos, Frangos, & Sotiropoulos, 2011; Kormas, Critselis, Janikian, Kafetzis, & Tsitsika, 2011; Morahan-Martin & Schumacher, 2000; Mottram, & Fleming, 2009; Odaci & Kalkan, 2010; Tekinarslan & Gürer, 2011; Yang & Tung, 2007). In one study, a small gender difference was found, with males scoring higher; however, the researchers cautioned that, because there was a small effect size, the true effect of gender might be considered weak (Gencer & Koc, 2012). Other studies suggested that females are at higher risk for developing PIU (Jelenchick, Christakis, & Moreno, 2011; Leung, 2004). Still, a number of studies have found that there are no differences in PIU based on gender (Amichai-Hamburger & Ben-Artzi, 2003; Ferraro, Caci, D'amico, & Blasi, 2007; Hardie & Yi-Tee, 2007; Kim et al., 2006; Lee et al., 2007; Li, Wang, & Wang, 2009; Smahel, Brown, & Blinka, 2012; Soule, Shall, & Kleen, 2003). Thus there is no conclusive support for gender differences in PIU and further research is indicated.

Davis (2001) differentiated specific PIU from generalized PIU. Specific PIU involves problematically using the Internet for one purpose, for example, online shopping or online stock trading. Davis characterized this use of the Internet as content-specific, stating that it is likely these dependencies would exist even in the absence of the Internet. Generalized PIU, on the other hand, involves spending unusual amounts of time on the Internet, doing activities such as participating in chat room discussions or browsing the

Internet with no purpose. Generalized PIU is thought to be separate from any specific use of the Internet; it is a pathological use that goes beyond use of specific applications (Morahan-Martin, 2008). Although Davis suggested a difference between specific and generalized PIU, there is overlap among the classifications. For example, using the Internet primarily for online gambling does not rule out the possibility for an overarching generalized PIU in which an individual also spends excessive time on the Internet in chat rooms or playing games. Caplan (2002) stated that generalized PIU focuses on the problems individuals experience as a result of Internet use, including psychological, social, and behavioral problems, a definition consistent with that proposed by Beard and Wolf (2001).

Mitchell, Becker-Blease, and Finkelhor (2005) studied PIU from a clinical perspective involving 1,504 clinicians. The researchers suggested that clients may demonstrate different types of PIU which can be classified into the following 11 categories: overuse, pornography, infidelity, sexual exploitation and abuse, gaming/gambling/role-playing, harassment, isolative-avoidant use, fraud/stealing/deception, failed online relationships, harmful influence websites, and risky or inappropriate use not otherwise specified. The most common type of problem found was overuse of the Internet, which was present in over 926 PIU cases (61%). Based on the sample, 56% presented with issues related to pornography use. Concerns about gambling/gaming/role-playing were present in 15% of the sample. The researchers concluded that five dimensions should be considered when evaluating clients with PIU: the persons involved, a possible sexual component, a possible criminal component, the

centrality of the Internet issue to treatment, and the Internet contribution to the client's presenting problem.

Byun et al. (2009) studied PIU through a meta-analysis of empirical studies published from 1996 to 2006 that studied correlates of PIU. A total of 61 articles were found to meet criteria for empirically based research (defined by the researchers as a full-length article in a peer reviewed journal that utilized human participants and a quantitative measure of PIU). However, 22 of the articles were excluded because they were focused on factors such as social and economic costs of PIU, treatment problems, or employee termination due to PIU, as opposed to correlates of PIU. Byun et al. found that researchers have primarily examined PIU in relation to personality characteristics, interpersonal skills, and intelligence. The authors indicated that many of the studies call for additional research to determine whether characteristics associated with Internet use are due to a predisposition to Internet addiction. Byun et al. called for more research in the area of PIU, specifically regarding improving the measurement of PIU, testing causal relationships and utilizing representative samples to reduce bias.

Additional researchers have examined personality factors associated with PIU and have established a correlation between PIU and factors such as low self-esteem (Armstrong, Phillips, & Saling, 2000; Amiel & Sargent, 2004; Niemz, Griffiths, & Banyard, 2005; Yang & Tung, 2007) and social anxiety or shyness (Caplan, 2002; Chak & Leung, 2004; Wei, Zijie, & Daxi, 2004; Yang & Tung, 2007). One study found that individuals with PIU are more likely to be dependent, shy, and neurotic (Yang & Tung, 2007). Individuals low in extraversion were found to be more likely to experience PIU (Mottram, & Fleming, 2009). Other studies have demonstrated a relationship between

PIU and loneliness (Amichai-Hamburger & Ben-Artzi, 2003; Caplan, 2003; Chak & Leung, 2004; Ghassemzadeh, Shahraray, & Moradi, 2008; Kim, LaRose, & Peng, 2009; Kubey, Lavin, & Barrows, 2001; Morahan-Martin & Schumacher, 2000; Nalwa & Anand, 2003; Whang, Lee, & Chang, 2003).

Although PIU is a relatively new area of research, there are some studies which have investigated the relationship of PIU to psychological disorders. There is some evidence to suggest that individuals with PIU are more likely to have anxiety and mood disorders, such as depression or bipolar disorder (Black, Belsare & Schlosser, 1999; Haung et al., 2009; Kim & Chun, 2005; Kim et al., 2006; LaRose, Lin, & Eastin, 2003; Shapira, Goldsmith, Keck, Khosla, & McElroy, 2000; Thatcher & Goolam, 2005; Wei et al., 2004; Whang et al., 2003; Yang & Tung, 2007; Young & Rogers, 1998). Some studies have also shown a relationship between PIU and social anxiety (Lee & Stapinski, 2012). Other studies have suggested that individuals with PIU are more likely to overuse substances (Bai, Lin, & Chen, 2001; Frangos et al., 2011; Greenberg, Lewis, & Dodd, 1999).

PIU can be viewed as a maladaptive coping strategy. Milani, Osualdella, and Di Blasio (2009) studied PIU in a sample of 98 adolescents ranging in age from 14 to 19 years. The purpose of their research was to evaluate the relationship between PIU, quality of interpersonal relationships, and methods of dealing with daily problems, to gain a better understanding of how PIU develops in adolescents. Each participant completed four measures, including the Italian version of the Internet Addiction Test (IAT; Young, 1998), the Test of Interpersonal Relationships (Italian version; Bracken, 1996), the Children's Coping Strategies Checklist (Ayers & Sandler, 1999) and the Questionnaire

for Recording of Internet Use Habits, which the authors created for their research to measure participants' web navigation habits. Parents of the participants were asked to complete the Child Behavior Checklist (CBCL; Achenbach, 1991) to measure the child's internalization and externalization of psychological problems. The researchers found that 36.7% of adolescent participants showed signs of PIU based on the IAT cutoff score of 50. These adolescents spent significantly more hours per week on the Internet than those who did not meet criteria for PIU (PIU: 21.05 hours vs. Non-PIU: 8.89 hours). Also, they had significantly lower scores on the total index score of the Test of Interpersonal Relationships (PIU: 90.31 vs. Non-PIU: 94.80) and significantly higher scores on the Children's Coping Strategies Checklist for avoidant coping (PIU: 2.44 vs. Non-PIU: 2.20). Based upon the Questionnaire for Recording Internet, individuals with PIU were more likely to use the Internet for social reasons (PIU: 97.2% vs. Non-PIU: 77.4%) and less likely to use the Internet for information gathering or learning (PIU: 25.0% vs. Non-PIU: 50.9%). The results of this study indicated that adolescents with PIU have a lower quality of interpersonal relationships and are more likely to use avoidant coping mechanisms.

Whang et al. (2003) studied the psychological consequences of overusing the Internet. Participants were recruited with a banner on a popular Internet website in Korea. A total of 13,588 participants completed the Survey on Internet Use (Kim, Kim, & Lee, 2001) which measures demographics, Internet dependence, Internet use, and psychological well-being (specifically loneliness, depressive mood, and compulsiveness). The participants included 7,878 males and 5,710 females, with an average age of 26.74 years ($SD = 7.27$). Based on the Internet dependence score on the Survey, individuals

were divided into three groups: Internet addicts who obtained a score of higher than 60 (rated all 20 questions a 3 or 4 on the 4-point Likert type scale), possible Internet addicts who obtained a score between 50 and 60, and non-addicts who obtained a score of less than 40 (they disagreed with most criteria). Additionally, 31.8% of the participants were excluded from the analysis because they did not fall into any group (i.e., obtained a score between 40 and 49). A major finding was that the groups did not utilize the Internet for the same purposes. The Internet addict group participated in online games, shopping, and community activities at a higher rate than the other groups. The non-addict group used the Internet for email, chatting, and searching for information at a higher rate than the other groups. When stressed by others, Internet addicts used the Internet more than possible addicts, who used the Internet more than non-addicts (21.2%, 14.3%, and 8.6% respectively). Alternatively, the non-addict group reported responding to stress by meeting people (6.2%) more than the possible addict group (5.2%) and the addict group (2.8%). When stressed by work, similar results were found, with the Internet addict group using the Internet most often (20.4%) as compared to the possible addicts (16.6%) and the non-addicts (5.0%). Internet use was the most common behavior when participants reported they were sad, with Internet addicts reporting the highest rate (23.4%) followed by possible addicts (18.7%) and non-addicts (5.6%). Similarly, when individuals were depressed, Internet addicts showed the highest rate of Internet use (52%) followed by possible addicts (40.7%) and non-addicts (20.4%). In regards to psychological well-being, researchers found significant differences among the groups in loneliness, depressive moods, and compulsiveness, with post-hoc analyses revealing that the Internet addict group reported the highest levels on all three factors.

Stress and PIU

According to Cohen, Kessler, and Gordon (1995), stress has been conceptualized and measured in inconsistent ways in the research, with three broad traditions emerging. First, biological stress refers to the activation of physiological systems, including the sympathetic-adrenal medullary system and the hypothalamic-pituitary-adrenocortical axis (Cohen et al., 1995). Biological stress is measured by the responses of these bodily systems to stress. For example, the galvanic skin response is used to measure skin conductance based on the amount of sweat on the skin, as controlled by the sympathetic nervous system. There are no known studies examining the relationship between biological stress and PIU. Psychological stress focuses on an individual's evaluation of his or her ability to cope with the demands of specific events or experiences. Psychological stress requires that individuals perceive an event as stressful, rather than merely being exposed to a stressful event. Individuals evaluate both the event and the adequacy of their resources to cope with the event. Psychological stress can be measured by self-report measures, such as the Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983). During adolescence, individuals can perceive and experience stress in many life areas, including family, school, and peer relationships (Li, Zhang, Li, Zhen, & Wang, 2010). According to Li et al. (2009), psychological stress of college students has been shown to be related to depression and many maladaptive behaviors, including overeating, problematic drinking, smoking, and drug abuse. Li et al. indicated that PIU is also considered a maladaptive behavior, and suggested that excess stress may be a risk factor for the development of PIU. Some further research has supported a relationship between PIU and psychological (or perceived) stress (Chao, 2011; Velezmoro, Lacefield,

& Roberti, 2010); however, there are overall very few studies which have looked at this relationship. Finally, environmental stress is concerned with events and experiences that are “normatively associated with substantial adaptive demands” (Cohen et al., 1995, p. 3). Environmental stress includes events that happen in one’s daily life that lead to a greater amount of stress experienced. Research on environmental stress has typically utilized measures of stressful life events such as the Holmes and Rahe Social Readjustment Rating Scale (SRRS; 1967). Some research has suggested that the amount of cumulative life stress one has experienced may significantly increase the risk for engaging in PIU (Li et al., 2009).

Much of the prior research has focused on individual vulnerability factors to PIU, such as personality, but has not closely examined the role of environmental factors, such as stressful life events, as related to PIU. Increasingly, researchers have been examining the role of environmental stress as related to PIU. In a study with 717 Hong Kong adolescents, Leung (2007) found that stressful life events, as measured by a list of 21 stressful life events compiled from previous research, correlated with the use of the Internet for mood management (arousal-oriented motives such as seeking information or for entertainment or diversion) and social compensation (attempts to gain recognition or maintain relationships). Leung did not consider the use of the Internet to be problematic, but rather adaptive in children’s coping (such as increasing social support).

In a further study, environmental stress was related to PIU (Li et al., 2009). Using a sample of 654 Chinese college students, the researchers found that stressful life events (as measured by the Chinese College Student Stress Questionnaire; Chi & Lin, 2005) accounted for a significant portion of PIU. More specifically, PIU was significantly

correlated with academic stress, daily hassles, job-related stress, and social-communication. Major life event stressors, such as losing a family member, were included as potential stressors, but were infrequently reported in this study, and consequently no conclusions could be made about their relationship with PIU. Using scores from the Chinese version of the Coping Style Questionnaire, PIU was found to be significantly positively correlated with self-blame, fantasy, withdrawal, and rationalization, and significantly negatively correlated with problem-solving. The researchers found that the standardized path coefficients from stressful life events to avoidant coping style and from avoidant coping style to PIU were significant. There was also evidence of a direct path from stressful life events to PIU; however, this coefficient was much lower than the coefficient of the path that included avoidant coping style as a mediator. The results suggested that the relationship between stressful life events and PIU is mediated through avoidant coping style.

In a further study conducted in China, Li et al. (2010) studied PIU as related to environmental stress, specifically stressful life events, in 660 adolescents ages 12-17 years. Li et al. included both environmental and personal factors in this study through the use of a mediated moderation model. The authors suggested that the relationship between stressful life events and PIU is mediated by maladaptive cognitions. The relationship between stressful life events and maladaptive cognitions was thought to be moderated by temperament. Accordingly, when adolescents experienced stressful life events, their maladaptive cognitions were hypothesized to lead to PIU. The moderating variable of temperament was thought to affect the strength of this relationship. Temperament was measured on two domains: effortful control and sensation seeking. Effortful control was

proposed as a protective factor in stressful life events, whereas sensation seeking was proposed as a risk factor in the relationship between stressful life events and PIU. For example, maladaptive cognitions were hypothesized to not be as likely to develop in someone who exhibits effortful control, whereas they are predicted to be likely to develop in someone who exhibits sensation seeking behaviors. The authors demonstrated support for females' mediated moderation model; however, although effortful control did moderate the relationship between stressful life events and PIU, sensation seeking did not. Those women with low effortful control were more likely to engage in PIU than those high in effortful control; however, those high in sensation seeking behavior did not differ from those low in sensation seeking behavior as related to PIU (Li et al., 2010). For males, there was an interaction effect between maladaptive cognitions and effortful control in relation to PIU. Effortful control can protect an adolescent male from PIU even if he develops maladaptive cognitions about the Internet. When the mediating variable of maladaptive cognitions was included in the model, it accounted for the interaction between effortful control and PIU, thus mediating the relationship. Based on their results, the authors suggested that a moderation or mediated moderation model may be most appropriate to study PIU and stress. Currently, two such models have been reported (Li et al, 2010; Li et al, 2009).

Loneliness and PIU

Baumeister and Leary (1995) indicated that humans have an innate need to belong which can be a motivating factor for our thoughts, emotions, and behaviors. Loneliness is a desire to form and maintain positive interpersonal relationships that are lasting and significant (Baumeister & Leary, 1995). Loneliness can be experienced throughout one's

lifetime, but prior research has suggested that loneliness often peaks during adolescence (Heinrich & Gullone, 2006). Further research has supported that adolescents and young adults seem to be the most vulnerable to loneliness (Ponzetti, 1990). Some research indicated that loneliness is common among young adults in college (Cutrona, 1982; Shaver, Furman, & Buhrmester, 1985). College students who experience loneliness have reported less happiness and fewer positive emotional experiences (Ponzetti, 1990). Lonely college students might also report more anxiety, hopelessness, and social alienation (Ponzetti, 1990).

In one study, 462 university students participated in a study in which the authors were researching the effects of gender and loneliness on coping strategies (Cecen, 2008). Two measures were used: the UCLA Loneliness Scale- Revised (Russell, Peplau, & Cutrona, 1980) and the Brief Ways of Coping Inventory (Folkman & Lazarus, 1988). The coping strategies used by individuals who were high in loneliness included hopeless and submissive coping styles. For those low in loneliness, coping strategies were more likely to include self-confident, optimistic, and support seeking styles. The results suggested individuals who are low in loneliness are more likely to use adaptive coping strategies.

Previous research has demonstrated that PIU and loneliness are correlated (Amichai-Hamburger & Ben-Artzi, 2003; Chak & Leung, 2004; Ghassemzadeh, et al., 2008; Kim et al., 2009; Morahan-Martin & Schumacher, 2000). Ceyhan and Ceyhan (2008) investigated whether loneliness, depression, and computer self-efficacy were predictors of PIU. The researchers conducted this study with 559 students from a university in Turkey. Each participant was given four measures: the Problematic Internet Usage Scale (PIUS; Ceyhan, Ceyhan, & Gürcan, 2007), the UCLA Loneliness Scale-

Revised (Russell et al., 1980), the Beck Depression Inventory (BDI; Beck, Ward, Mock, & Erbaugh, 1961), and the Computer Self-Efficacy Scale (Gürçan, 2005). Loneliness significantly predicted PIU, $p < .001$. Although depression and computer self-efficacy were also positive predictors of PIU, loneliness contributed the greatest variance (21.8%), with depression (3.3%) and computer self-efficacy (2.8%) predicting less. The authors concluded that there is a positive relationship between PIU and loneliness, with increased feelings of loneliness predicting greater engagement in PIU.

Previous research demonstrated that Internet use tends to have a negative influence on social integration and well-being, even when the Internet is being used for social interaction (Moody, 2001; Weiser, 2001). Engelberg and Sjöberg (2004) studied the relationship between PIU and interpersonal skills, personality, and emotional intelligence. In their study, 41 Swedish university students were recruited and each participant completed a test battery including two measures of emotional intelligence similar to those on the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT; Mayer, Caruso, & Salovey, 2000), the UCLA Loneliness Scale (version 3; Russell, 1996), the Work/Leisure Balance Scale (Sjöberg, 2001), the Internet Addiction Scale (Young, 1998), the Schwartz Value Scale (Schwartz, 1992), and the Big Five Inventory (Wiggins & Trapnell, 1997). Scores on the Internet Addiction scale were included as the dependent variable in a regression analysis with three social adaptation variables (Value Deviance, Work/Leisure Balance, and Loneliness) included as the independent variables. Results yielded a significant equation, and the standard regression coefficients included Value Deviance accounting for the most variance, Work/Leisure Balance accounting for a moderate amount of variance, and Loneliness accounting for a non-significant portion

of variance. Additionally, responses regarding time spent online were used to divide participants into two groups (high and low frequency users). Higher scores on the Internet Addiction Scale were correlated with higher scores on the UCLA Loneliness Scale, higher scores on the Value Deviance index of the Schwartz Value Scale, and lower scores on two measures of social adeptness from the MSCEIT: identifying emotions in facial expressions and identifying emotions in social episodes.

Nalwa and Anand (2003) conducted a study to explore features of Internet addiction in a sample of students in India 16 to 18 years old. Three instruments were used in this study: the Davis Online Cognition Scale (Davis, Flett, & Besser, 2002), the UCLA Loneliness Scale (version 3; Russell, 1996), and a Semi-Structured Questionnaire regarding Internet use. One hundred students were randomly selected and, from that sample, 18 “dependents” and 21 “non-dependents” (based on their scores from the Davis Online Cognition Scale) were included in the data analysis. In comparison to non-dependents, dependents often lost sleep because of Internet use, reported being lonelier, felt upset when unable to log on at a certain time, reported that life would be boring without the Internet, and delayed work to spend time online.

PIU, Stress, and Loneliness

Prior research has indicated that environmental stress is likely related to PIU; however, researchers have proposed that the relationship between stress and PIU is likely more complex and best explained by a mediated or moderated model (Li et al., 2010; Li et al., 2009). Chao (2011) conducted a study with 459 college students in the United States examining psychological stress, social support, and coping. Participants completed a demographic questionnaire and four other instruments: the Perceived Stress Scale

(Cohen et al., 1983), the Social Support Inventory (Brown, Brady, Lent, Wolfert, & Hall, 1987), the COPE Inventory (Carver, Scheier, & Weintraub, 1989), and the Mental Health Inventory (Veit & Ware, 1983). The researcher found that having high social support served as a buffer against stress and allowed the student to maintain positive well-being. However, low social support did not provide a buffer against stress. Avoidant coping strategies accelerated the association between stress and well-being in a negative direction. Therefore, when utilizing avoidant coping strategies, stress increased as well-being decreased. The use of avoidant coping strategies accelerated the association between stress and loneliness at both low and high levels of social support; however, individuals were found to be most vulnerable during times of stress when they have low social support and utilize avoidant coping strategies (Chao, 2011).

Velezmoro et al. (2010) studied problematic Internet use in 104 United States college students. Participants completed a demographic questionnaire, the IAT (Young, 1998), the Cybersex Addiction Test (Young, 1998), the Sensation Seeking Scale Form V (Zuckerman, 1994), and the Perceived Stress Scale (Cohen & Williamson, 1988). The researchers found that the hopelessness scale on the Perceived Stress Scale and the boredom susceptibility scale on the Sensation Seeking Scale predicted Internet abuse for non-sexual purposes. Also, they found that total scores on the Perceived Stress Scale and the disinhibition scale of the Sensation Seeking Scale predicted Internet abuse for sexual purposes. The authors suggested that, although directionality cannot be determined, loneliness and social problems might be related to PIU and stress. The authors called for further research to be conducted in this area.

Summary

Research regarding PIU has mainly focused on examining possible determinants and correlates related to PIU. Prior research has indicated that PIU is associated with stressful life events (Leung, 2007; Li et al., 2010; Li et al., 2009). Research has also suggested evidence for a mediating and/or moderating variable (e.g., coping style, temperament, maladaptive cognitions) to better account for the differences found in the relationship between PIU and environmental events (Li et al., 2010; Li et al., 2009). One variable, loneliness, stands out as a potential moderator of the relationship between environmental stress and PIU (Velezmoro et al., 2010).

Chapter II

Rationale and Hypotheses

Since the early 1990s, Internet use has been increasing, with individuals utilizing this resource to find information, communicate, and complete daily tasks. Although some individuals use the Internet in a safe and healthy manner, other individuals use the Internet problematically. According to Li et al. (2010), further research is needed to better understand the factors that put individuals at higher risk for engaging in PIU and to facilitate intervention.

The goal of the current study is to further previous research by evaluating a potential moderation model of problematic Internet use. Prior research suggested a positive correlation between environmental stress and PIU (Li et al., 2010); however, the experience of stressful life events does not lead to the same level of PIU for all individuals (Li et al., 2010). Thus researchers have suggested that the relationship is more complex and that a mediating and/or moderating variable likely accounts for the differences in PIU noted among individuals experiencing stress (Li et al., 2010; Li et al., 2009). Increasingly, studies have shown that individuals who engage in PIU are more likely to be lonelier than those who do not (Ceyhan & Ceyhan, 2008; Engelberg & Sjöberg, 2004; Nalwa & Anand, 2003; Whang et al., 2003). During times of stress, individuals are most vulnerable when they have low social support (Chao, 2011). Velezmoro et al. (2010) suggested that loneliness might be related to stress and PIU, but indicated that additional research is needed to understand this relationship. Stressed

individuals who engage in PIU may be doing so because they have low social support (are lonely) and are less likely to cope in a social support seeking way. Thus, loneliness is hypothesized to moderate the relationship between PIU and stress.

This study will examine how the relationship between environmental stress, as measured by the Undergraduate Stress Questionnaire, and PIU, as measured by the Internet Addiction Test, changes as a function of loneliness, as measured by the UCLA Loneliness Scale. Baron and Kenny (1986) described moderation as the causal relationship between the independent and dependent variables that changes as a function of an additional variable (i.e., the moderator; see Figure 1). For the current study, the relationship between stress and PIU is hypothesized to change as a function of loneliness. In order to test the moderation model, an additional variable, the product variable, must be created by finding the interaction, or product, of stress and loneliness (the hypothetical moderator). Baron and Kenny indicated that the moderation model will be supported if there is a significant effect of the product variable when controlling for the effects of the independent (stress) and moderator (loneliness) variables. Baron and Kenny indicated that it is not necessary for the independent and moderator variables to be correlated with the dependent variable; however, in the current study, both stress and loneliness are hypothesized to be positively significantly correlated with PIU. The following are the study hypotheses:

Figure 1. Model of stress, loneliness, and the moderation of stress by loneliness as it predicts Problematic Internet Use (on the basis of Baron & Kenny, 1986).

H₁. Stress, as measured by the Undergraduate Stress Questionnaire, is significantly positively correlated with PIU, as measured by the Internet Addiction Test.

H₂. Loneliness, as measured by the UCLA Loneliness Scale, is significantly positively correlated with PIU, as measured by the Internet Addiction Test.

H₃. The product of stress, as measured by the Undergraduate Stress Questionnaire, and loneliness, as measured by the ULCA Loneliness Scale, is significantly positively correlated with PIU, as measured by the Internet Addiction Test. Thus, loneliness moderates the relationship between stress and PIU.

Exploratory Hypothesis

In order to contribute further to the minimal available literature on PIU, an exploratory analysis will be conducted in which the impact of the study variables will serve as predictors of PIU. Predictor variables will include stress, as measured by the Undergraduate Stress Questionnaire, loneliness, as measured by the UCLA Loneliness Scale, and gender, as measured by the Demographic Questionnaire. Other variables may be included in the analysis based on the study data. The null hypothesis will be tested at the .05 level of significance:

H₀: There is no variable or combination of variables which significantly predicts PIU, as measured by the Internet Addiction Test.

Chapter III

Method

Participants

Participants will be recruited from a Midwest, medium-sized, private university that has an undergraduate student population of approximately 4,000. Students between the ages of 18 and 25 who are enrolled in an undergraduate psychology course will have the opportunity to participate in this study. Because the purpose of this study is to examine PIU in college students, this sampling procedure is considered a convenience sample because it is not a random sampling of all college students.

According to Cohen (1992), at least 85 participants will be needed to detect a medium effect size with an alpha of .05. Demographic data, including age, gender, race, ethnicity, nationality, college major, year in college, time spent on the Internet over a 7-day period, and information about types of usage of the Internet, will be collected from each participant. Analyses will be run to determine the need for covariates as part of the statistical design.

Potential participants without Internet access for the past week or without access to a computer to complete the study will be excluded.

Design

Baron and Kenny's (1986) moderation model will be used to test the hypotheses. The criterion variable is PIU, with environmental stress as the independent variable and

loneliness as the moderator variable. The moderation model will be tested using a hierarchical regression analysis. Also, a logistic regression will be completed with PIU as the criterion variable as an exploratory analysis to add to the minimal literature available on PIU.

Measures

All measures will be completed by participants through an online survey hosting website.

Demographic questionnaire. A Demographic Questionnaire was constructed for the purposes of this study and includes items of age, gender, ethnicity, race, nationality, college major, year in college, six questions regarding amount of time spent online during the past seven days, and a list in which participants rank categories for which they use the Internet (see Appendix A). Categories were adapted from previous research, including the Pew Internet and American Life Project (2012).

Internet Addiction Test. The Internet Addiction Test (IAT; Young, 1998) is a 20-item measure on which participants rate how often they engage in each item using a 5-point Likert-type scale ranging from 1 = *Rarely* to 5 = *Always*, or indicate that the item is not applicable (see Appendix B). A total score between 0 and 100 is calculated by summing the scores for each item, with a higher score indicating greater Internet addiction. Widyanto and McMurrin (2004) reported that the IAT is a reliable and valid measure of Internet addiction. They found that the IAT is comprised of six factors, including salience, excessive use, neglecting work, anticipation, lack of control, and neglecting social life. These six factors accounted for 68.16% of the variance. Internal consistency within the items on each factor was calculated and found to be moderate to

highly reliable (alpha coefficients ranging from .54 - .82) All six factors significantly correlated with each other ranging from $r = .23$ to $r = .62$.

Additionally, the researchers were interested in whether time spent using the Internet personally or professionally was correlated with IAT scores. Research demonstrated that the total IAT score was positively correlated with overall Internet use, $r = .22, p < .05$, and personal Internet use, $r = .30, p < .01$; however, there was not a significant correlation between total IAT score and professional Internet use (Widyanto & McMurran, 2004).

Undergraduate Stress Questionnaire. The Undergraduate Stress Questionnaire (USQ; Crandall, Preisler, & Aussprung, 1992) is a checklist of 83 stressful life events specific to the college student population (see Appendix C). For the current study, participants will rate each item as either 0 = *did not occur* or 1 = *did occur*. Scores can range from 0 to 83, with higher scores indicating more stressors present. The items were developed during a discussion-based health psychology class at a United States public university consisting of 30 students. Eighty-three items were generated during this discussion. In the original study, each discussion participant rated on a 4-point Likert-type severity scale (with 1 = *none*, 2 = *a little*, 3 = *some*, 4 = *a lot*) how stressful each event would be if they experienced it, and the researchers organized the questionnaire in descending order such that the item with the highest stress-rating was listed first. Next, the researchers recruited 30 additional students and asked them to rate how often they perceived each item to occur on a 5-point Likert-type scale. Then, the researchers determined the actual frequency of the items by recruiting 86 undergraduate students and asking them to check each item they had experienced personally in the past week.

Researchers utilized two methods to determine if a weighted scale would produce different results than an unweighted scale. First, measures were scored using the item severity (1 = *minor stressor* [items scored below a 3 on the severity scale] and 2 = *major stressor* [items scored a 3 or above on the severity scale]) and these scores were significantly correlated with the unweighted version of the scale, $r = .99$. Measures were also scored using their raw severity score ranging from 1 to 4 and these scores were found to be to be significantly correlated with the unweighted version of the scale, $r = .998$. For the purposes of the current study, the unweighted version of the scale will be used and participants will only indicate whether or not the event has occurred recently.

Criterion-related validity was measured using the Brief Mood Introspection Scale (BMIS; Mayer & Gaschke, 1988) and the Pennebaker Inventory of Limbic Languidness (PILL; Pennebaker, 1980). The USQ score was negatively correlated with the BMIS score, $r = -.26$, $p < .05$, and positively correlated with physical symptoms, $r = .53$, $p < .001$. However, when examining the results for males and females separately, the BMIS score was not significantly correlated for males, $r = .11$, but was for females, $r = -.44$, $p < .005$. The split-half reliability was $r = .71$ and the internal consistency was satisfactory (.80). Using the Spearman-Brown formula, the estimated reliability was .83. In a study with 59 students, test-retest reliability was found to be $r = .59$, $p < .0001$.

Twenty-three participants completed the USQ and the SRRS (Holmes & Rahe, 1967), the Student SRRS (S-SRSS; Marx, Garrity, & Bowers, 1975), and the Daily Stress Inventory (Brantley, Waggoner, Jones, & Rappaport, 1987). After completing the measures, participants rated the scales for completeness and accuracy. The authors found participants rated the measures differently, $F(3,66) = 13.19$, $p < .0005$, on both accuracy,

$F(3,66) = 13.99, p < .001$, and completeness, $F(3,66) = 9.616, p < .001$, with the USQ scoring highest on both. The USQ was rated significantly higher than the SRSS and the S-SRSS (both $p < .01$), but was not significantly higher than the Daily Stress Inventory. In debriefing interviews, participants were asked about strengths and weaknesses of the USQ and the Daily Stress Inventory, and they reported that the USQ had a good representation of stressful events and the Daily Stress Inventory offered participants an opportunity to rate the subjective stressfulness of each event. The researchers took this feedback into consideration in a later study with 216 undergraduates, in which they had participants use a 6-point Likert-type scale with 0 = *did not happen* and 5 = *happened and was extremely stressful*. Their scores were found to be highly correlated with the objective (0 = *did not happen*, 1 = *happened*) scoring of the scale, $r = .92, p < .001$. Therefore, the researchers ultimately concluded that using a subjective scoring method was not necessary.

Validity was demonstrated in a study with 444 undergraduates who completed one of four stress measures: the USQ, SSRS, S-SRSS, or the Daily Stress Inventory. The USQ had the highest correlation with physical symptoms (measured by the PILL; Pennebaker, 1980), $r = .44, p < .001$, significantly higher than each of the other three measures of stress including the next closest correlation, the Daily Stress Inventory, $z = 2.96, p < .01$ (Daily Stress Inventory, $r = .35, p < .001$; SRSS, $r = .23, p < .05$; and S-SRSS, $r = .24, p < .05$).

UCLA Loneliness Scale. The UCLA Loneliness Scale Version 3 (Russell, 1996) is a 20-item measure on which participants respond using a 4-point Likert-type scale (see Appendix D). Eleven items are worded in the negative direction (1 = *Never* and 4 =

Always) and nine items are worded in the positive direction and are reverse scored (Russell, 1996). Scores can range from 20 to 80, with higher scores representing higher degrees of loneliness. The UCLA Loneliness Scale Version 3 is considered very reliable, with coefficient alphas ranging from .89 to .94 across various samples (Russell, 1996). Validity of the scale has been studied using a variety of populations; however, the validity of this measure as related to college students will be reported here. Convergent validity was found with the NYU Loneliness Scale, $r = .65, p < .001$, and the Differential Loneliness Scale, $r = .72, p < .001$ (Russell, 1996). Loneliness scores were also found to be negatively associated with measures of social support, including the Social Provisions Scale, $r = -.68, p < .001$ (Russell, 1996). Strong correlations were also found between this measure of loneliness and a measure of depression, $r = .52, p < .001$. Because this correlation is less than the correlations between measures of loneliness, Russell concluded sufficient support for discriminant validity. Similarly, loneliness was negatively correlated with self-esteem, $r = -.60, p < .001$, but this correlation was not as strong as the correlations between loneliness measures, thus supporting the discriminant validity of the UCLA Loneliness Scale (Russell, 1996). Additionally, the correlation between loneliness and social desirability was significant, $r = -.21, p < .001$; however, the magnitude is relatively low, suggesting that loneliness is not largely affected by concerns related to social desirability of the respondent (Russell, 1996).

Procedure

Approval from the Xavier University Institutional Review Board (IRB) will be sought before collecting data for this study.

Participants will be recruited through the participant pool guidelines established by the Psychology Department (see Appendix E). Accordingly, a short description of the study will be included on the sign-in sheet for potential participants to read before agreeing to take part in the study. Participants will write their name and e-mail address on the sign-in sheet to indicate their interest in participating in this study.

Within one week of signing up for the study, participants will be sent an email (see Appendix F) that includes a link to the online survey. Participants will be instructed to click on the link to begin the survey. The survey will begin with the Informed Consent Form, in which participants will be informed that they can discontinue the study at any time without repercussions. After agreeing to participate in the study, the participants will be directed to the demographic questionnaire. Then, the four study measures, the IAT, USQ, and the ULCA Loneliness Scale, will be presented in random order. The study should take approximately 25 mins to complete. After completing or discontinuing the study, participants will be directed to a separate link to provide their name, email address, and instructor in order to receive course credit and debriefing information. Identifying information will not be stored in the same database with survey responses. Internet IP addresses will not be collected. Data will be collected from all students who sign up through the participant pool and consent to participate in this study until at least 85 participants have completed the study.

Chapter IV

Proposed Analyses

The purpose of this study is to examine the possible moderating effect of loneliness, as measured by the UCLA Loneliness Scale, on the relationship between stress, as measured by the USQ, and PIU, as measured by the IAT. First, descriptive analyses, including means and standard deviations for each of the variables, will be calculated. Second, correlations between the variables will be completed. Next, the moderated model will be tested utilizing a hierarchical regression analysis. Finally, all variables (including gender, the study variables, and other possible covariates) will be included in a logistic regression analysis. All analyses will be computed with a one-tailed alpha of .05 indicating significance. The study hypotheses are:

H₁. Stress, as measured by the Undergraduate Stress Questionnaire, is significantly positively correlated with PIU, as measured by the Internet Addiction Test.

H₂. Loneliness, as measured by the UCLA Loneliness Scale, is significantly positively correlated with PIU, as measured by the Internet Addiction Test.

H₃. The product of stress, as measured by the Undergraduate Stress Questionnaire, and loneliness, as measured by the ULCA Loneliness Scale, is significantly positively correlated with PIU, as measured by the Internet Addiction Test. Thus, loneliness moderates the relationship between stress and PIU.

In order to test the hypotheses, a moderational model using a hierarchical linear regression consistent with Baron and Kenny (1986) will be utilized. The predictor

variables will be stress (independent variable), loneliness (moderator variable), and the product of stress and loneliness (hypothesized moderator). The criterion variable will be PIU as measured by the Internet Addiction Test. Although it is not necessary for the predictor variables of stress and loneliness to be correlated with the criterion variable in order to have a significant moderation model, it is hypothesized that both stress and loneliness will be positively significantly correlated with PIU (Hypotheses 1 & 2). The moderation model will be supported if there is a significant effect of the product variable when controlling for the effects of the independent (stress) and moderator (loneliness) variables (Hypothesis 3; Baron & Kenny, 1986).

Exploratory Analysis

The exploratory hypothesis states that there is no variable or combination of variables which significantly predicts PIU. In order to test this hypothesis, a logistic regression analysis will be completed to allow inclusion of the categorical variable of gender. The predictor variables will include stress as measured by the Undergraduate Stress Questionnaire, loneliness, as measured by the UCLA Loneliness Scale, and gender, as measured by the Demographic Questionnaire, with other possible predictors added based on the sample. The criterion variable will be PIU, as measured by the Internet Addiction Test.

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Appendix A

Demographic Questionnaire

Age (in years) _____

Nationality _____

Gender

____ Male

____ Female

____ Other

Ethnicity

____ Hispanic or Latino

____ Non Hispanic or Latino

Year in College

____ First Year

____ Sophomore

____ Junior

____ Senior

Race

____ American Indian or Alaska Native

____ Black or African-American

____ Arab or Arab-American

____ Asian or Asian-American

____ Native Hawaiian or Other Pacific

Islander

____ White or Caucasian

____ Biracial or Multiracial

College Major _____

*Indicate if undecided

Has Internet access been available to you for the past 7 days, such as at home, in public or school computer labs, or at work? ____ yes ____ no

Total number of hours spent online within the past 7 days _____

How many of these hours spent online were doing school-related activities? _____

How many of these hours spent online were doing work-related activities? _____

How many of these hours spent online were doing social activities? _____

How many of these hours spent online were doing activities not listed above? _____

Is this total representative of a typical week for you? ____ yes ____ no

If no, how many hours each week do you normally spend on the internet? _____

Please rank the primary purposes for which you use the Internet. Rank you most important purpose for using the Internet "1". Rank the second most important purpose for your use of the Internet "2", etc. For any that are Not Applicable, rank "0".

____ Emailing

____ Social networking

____ Playing games

____ Gambling

____ Downloading music, videos, or images

____ Online dating

____ Shopping

____ Business/Employment

____ Education

____ Sexual Content/Pornography

____ Other: _____

____ Other: _____

Appendix B

Internet Addiction Test

This measure was utilized with permission of the author, Dr. Kimberly Young. Please visit <http://netaddiction.com/internet-addiction-test/> to view the questions on this measure and to contact the author for permission to use.

Appendix C

Undergraduate Stress Questionnaire

This measure was utilized with permission of the author, Dr. Chris Crandall. Please refer to the following article for more information.

Crandall, C.S., Preisler, J.J., & Aussprung, J. (1992). Measuring life event stress in the lives of college students: The Undergraduate Stress Questionnaire (USQ). *Journal of Behavioral Medicine*, 16(6), 627-662. doi:10.1007/BF00844860

Appendix D

UCLA Loneliness Scale (Version 3)

This measure was utilized with permission of the author, Dr. Daniel Russell. Please refer to the following article for more information.

Russell, D. (1996). The UCLA Loneliness Scale (version 3): Reliability, validity, and factor structure. *Journal of Personality Assessment*, 66, 20–40.
doi:10.1207/s15327752jpa6601_2

Appendix E

Participant Pool Flyer

Investigator: Julie E. Meade, M.A.

Advisor: Christine M. Dacey, Ph.D., ABPP

Purpose of Study: This study is investigating Internet use and related factors in college students.

Requirements: Participants must be college students between the ages of 18 and 25 who have had access to the Internet in the past week, such as at home, in public or school computer labs, or at work. Participants must also have access to a computer to complete this study.

Date/Time of Project: Participants will take a slip with the study URL and complete the study online.

Location: Participants must have access to a computer to complete this study from a location of their choice.

Approximate Time for Completion: 30 minutes

[Study URL]
Password: Xavier

[Study URL]
Password: Xavier

[Study URL]
Password: Xavier

[Study URL]
Password: Xavier

[Study URL]
Password: Xavier

[Study URL]
Password: Xavier

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Password: Xavier

Appendix F

Informed Consent Form

You are being given the opportunity to volunteer to participate in a project conducted through Xavier University.

The purpose of this study is to examine internet use and related factors in college students ages 18 to 25. You have been selected because you indicated you were interested in participating in this study and indicated that you met the study criteria. This study will involve completing one brief demographic questionnaire and three measures regarding your Internet use and related factors. The study will take approximately 30 minutes to complete. There are no known risks to completing this survey. There are no direct benefits to you for participating in this study. After completing the survey in its entirety, you will be directed to a second link, where you will input your name, your professors name, and course. This information will be submitted for participant pool credit. No identifying information will be linked to your survey responses or to the database containing these responses. Your responses are and will remain anonymous. Your Internet IP address will not be collected. Data will be stored in a locked file cabinet for five years following the completion of this study and will then be destroyed. You may receive course credit as compensation for your participation. Refusal to participate in this study will have no effect on any future services you may be entitled to from the University. You are free to withdraw from the study at any time without penalty. If you decide to participate in this project, please indicate your consent by checking the box below, next to the option stating your agreement.

If you have any questions at any time during the study, you may contact Julie Meade at adcockj@xavier.edu or Dr. Christine Dacey at (513) 745-1033. Questions about your rights as a research participant should be directed to Xavier University's Institutional Review Board at (513) 745-2870.

_____ I have been given information about this research study and its risks and benefits. I freely give my consent to participate in this research project.

_____ I do not give my consent to participate in this study and choose to discontinue at this time with no penalty.

Chapter V

Dissertation

Abstract

Although the Internet provides a number of benefits to users, some individuals use the Internet in a problematic way, known as problematic Internet use (PIU). Prior research indicated a positive correlation between environmental stress and PIU (Li et al., 2010); as well as a relationship between loneliness and PIU (Ceyhan & Ceyhan, 2008; Engelberg & Sjöberg, 2004; Nalwa & Anand, 2003; Whang et al., 2003). The current study explored a moderation model to further examine the relationship between stress and PIU. Ninety-five college students completed measures of stress, loneliness, and PIU. Results indicated that both stress and loneliness were significantly positively correlated with PIU. Support was found for the moderation model, indicating that the interaction between stress and loneliness may best explain the relationship between stress and PIU. Those students low in loneliness did not experience a significant increase in PIU as stress increased, whereas those high in both stress and loneliness were the most vulnerable to PIU. The effect size was $f^2 = .06$. Exploratory analyses indicated that gender was not significantly correlated with PIU, nor was it a significant predictor in the regression equation. Additionally, this sample reported using the Internet most frequently for emailing, social networking, and education. Future research should continue to explore more complex models of PIU.

Problematic Internet Use: Relationship with Stress and Loneliness

The Internet has been rapidly increasing in popularity since the 1990s. Internet use is prevalent among adults, with 85% of American adults 18 years and older accessing the Internet (Pew Internet and American Life Project, 2013). In a group of 18-29 year-olds, 98% reported using the Internet (Pew Internet and American Life Project, 2013). College students, who generally fall into this age range, reported using the Internet for many tasks, including communicating, researching information, attaining driving directions, accessing the news and weather, and maintaining social networks (Pew Internet and American Life Project, 2009). Thus, Internet usage is integrated into the lives of many individuals and is particularly important to the college student population.

Problematic Internet Use

The Internet can be a valuable tool, providing numerous benefits to those who use it (Laouris, 2011). The Internet offers a free and available method of communication and information distribution. Despite the potential benefits associated with Internet access, its usage is relatively new such that researchers do not fully understand the implications for the users of this technology.

Recent research has shown that some individuals use the Internet in a way that is problematic, which has become known in the literature as Problematic Internet Use (PIU). PIU has been defined by Czincz and Hechanova (2009) as “an individual’s inability to control his or her use of the Internet, which eventually causes significant difficulties in the areas of mental health, interpersonal relationships, school, and/or employment” (p. 258). They further described PIU as “a psychological dependence on the Internet characterized by an increasing investment of resources in Internet-related

activities, unpleasant feelings when offline, an increasing tolerance to the effects of being online, and denial of the problematic behavior” (p. 258). Czincz and Hechanova indicated that in order for an individual to be demonstrating PIU, he or she must experience difficulties that extend into everyday life and cause some amount of distress. Some researchers have compared PIU, also referred to as Internet addiction, to other impulse control disorders, but not all are in agreement regarding the existence of PIU (Cao, Su, Liu, & Gao, 2007). According to Czincz and Hechanova, one of the main questions in PIU research is whether PIU is a unique disorder, or whether it represents preexisting difficulties manifesting in a different way. Czincz and Hechanova called for theory-driven models to be tested longitudinally in order to gain a better understanding of this potential problem.

Incidence rates of PIU vary across studies, with estimates in convenience samples ranging up to 18.3% (Morahan-Martin, 2008). In a U.S. randomized telephone sample, prevalence rates for PIU were estimated to range from .3% - .7%, with 3.7-13% of respondents endorsing one or more markers of PIU (Aboujaoude, Koran, Gamel, Large, & Serpe, 2006). Some of the differences reported in rates of PIU may be related to the varying sampling methods used (e.g., convenience vs. representative). Other contributing variables suggested are culture and age (Morahan-Martin, 2008). According to Czincz and Hechanova (2009), PIU has been reported across all ages, genders, and ethnicities; however, some groups, such as adolescents, have been shown to be at an increased risk for engaging in PIU. Additionally, Czincz and Hechanova indicated that explanations about culture as related to PIU are inconclusive; however there is some evidence to suggest that individuals in collectivistic cultures are at higher risk for developing PIU as

compared to individuals in individualistic cultures (Choi & Ross, 2006; Young, 2004). One of the limitations of the previous literature on diversity factors is that clear correlations and causal pathways to PIU were not identified (Czincz & Hechanova, 2009). Further research regarding PIU as related to diversity factors, specifically culture and nationality, is needed as Internet use becomes more widespread internationally.

Inconsistent results have been found in the literature regarding the relationship between PIU and gender. Some studies have suggested that being male is a risk factor for developing PIU (Bakken, Wenzel, Götestam, Johansson, & Oren, 2009; Chou, Condon, & Belland, 2005; Çuhadar, 2012; Frangos, Frangos, & Sotiropoulos, 2011; Kormas, Critselis, Janikian, Kafetzis, & Tsitsika, 2011; Morahan-Martin & Schumacher, 2000; Mottram, & Fleming, 2009; Odaci & Kalkan, 2010; Tekinarslan & Gürer, 2011; Yang & Tung, 2007). In one study, a small gender difference was found, with males scoring higher; however, the researchers cautioned that, because there was a small effect size, the true effect of gender might be considered weak (Gencer & Koc, 2012). Other studies suggested that females are at higher risk for developing PIU (Jelenchick, Christakis, & Moreno, 2011; Leung, 2004). Still, a number of studies have found that there are no differences in PIU based on gender (Amichai-Hamburger & Ben-Artzi, 2003; Ferraro, Caci, D'amico, & Blasi, 2007; Hardie & Yi-Tee, 2007; Kim et al., 2006; Lee et al., 2007; Li, Wang, & Wang, 2009; Smahel, Brown, & Blinka, 2012; Soule, Shall, & Kleen, 2003). Thus there is no conclusive support for gender differences in PIU and further research is indicated.

Byun et al. (2009) studied correlates of PIU through a meta-analysis of empirical studies published from 1996 to 2006. A total of 61 initial articles were found to meet

criteria for empirically based research (defined by the researchers as a full-length article in a peer reviewed journal that utilized human participants and a quantitative measure of PIU). However, 22 of the articles were excluded because they were focused on factors other than correlates of PIU, such as social and economic costs of PIU, treatment problems, or employee termination due to PIU. Byun et al. found that researchers have primarily examined PIU in relation to personality characteristics, interpersonal skills, and intelligence. The authors indicated that many of the studies call for additional research to determine whether characteristics associated with Internet use are due to a predisposition to Internet addiction. Byun et al. called for more research in the area of PIU, specifically regarding improving the measurement of PIU, testing causal relationships and utilizing representative samples to reduce bias.

Additional researchers have examined personality factors associated with PIU and have established a correlation between PIU and factors such as low self-esteem (Amiel & Sargent, 2004; Armstrong, Phillips, & Saling, 2000; Niemz, Griffiths, & Banyard, 2005; Yang & Tung, 2007) and social anxiety or shyness (Caplan, 2002; Chak & Leung, 2004; Wei, Zijie, & Daxi, 2004; Yang & Tung, 2007). One study found that individuals with PIU are more likely to be dependent, shy, and neurotic (Yang & Tung, 2007). Individuals low in extraversion were found to more likely experience PIU (Mottram, & Fleming, 2009). Other studies have demonstrated a relationship between PIU and loneliness (Amichai-Hamburger & Ben-Artzi, 2003; Caplan, 2003; Chak & Leung, 2004; Ghassemzadeh, Shahraray, & Moradi, 2008; Kim, LaRose, & Peng, 2009; Kubey, Lavin, & Barrows, 2001; Morahan-Martin & Schumacher, 2000; Nalwa & Anand, 2003; Whang, Lee, & Chang, 2003).

PIU has been viewed as a maladaptive coping strategy. Milani, Osualdella, and Di Blasio (2009) studied PIU in a sample of 98 adolescents ranging in age from 14 to 19 years. The purpose of their research was to evaluate the relationship between PIU, quality of interpersonal relationships, and methods of dealing with daily problems, to gain a better understanding of how PIU develops in adolescents. Each participant completed four measures, including the Italian version of the Internet Addiction Test (IAT; Young, 1998), the Test of Interpersonal Relationships (Italian version; Bracken, 1996), the Children's Coping Strategies Checklist (Ayers & Sandler, 1999) and the Questionnaire for Recording of Internet Use Habits, which the authors created for their research to measure participants' web navigation habits. They found that adolescents with PIU have a lower quality of interpersonal relationships and are more likely to use avoidant coping mechanisms. Other research has demonstrated that when stressed by others and work, individuals with higher scores on an Internet addiction measure used the Internet more often (Whang et al., 2003). Additionally, researchers found significant differences among Internet addicts versus non-addicts in levels of loneliness, depressive moods, and compulsiveness, with post-hoc analyses revealing that the Internet addict group reported the highest levels on all three factors (Whang et al., 2003).

Stress and PIU

Initial but minimal research has shown a relationship between stress and PIU (Chao, 2011; Li, Zhang, Li, Zhen, & Wang, 2010; Li et al., 2009; Velezmoro, Lacefield, & Roberti, 2010). According to Cohen, Kessler, and Gordon (1995), stress has been conceptualized and measured in inconsistent ways in the research, with three broad traditions emerging: biological stress, psychological stress, and environmental stress. The

current study is concerned with environmental stress, which involves the impact of events and experiences that are “normatively associated with substantial adaptive demands” (Cohen et al., 1995, p. 3). Environmental stress includes events that happen in one’s daily life that lead to a greater amount of stress experienced. Research on environmental stress has typically utilized measures of stressful life events such as the Holmes and Rahe Social Readjustment Rating Scale (SRRS; 1967). Some research has suggested that the amount of cumulative life stress one has experienced may significantly increase the risk for engaging in PIU (Li et al., 2009).

Prior research has not closely examined the role of environmental factors, such as stressful life events, on PIU, although recent researchers have shown more interest in the relationship between environmental stress and PIU. In a study with 717 Hong Kong adolescents, Leung (2007) found that stressful life events, as measured by a list of 21 stressful life events compiled from previous research, correlated with the use of the Internet for mood management (arousal-oriented motives such as seeking information or for entertainment or diversion) and social compensation (attempts to gain recognition or maintain relationships). Leung did not consider the use of the Internet to be problematic, but rather adaptive in children’s coping (i.e., increasing social support).

Li and colleagues (2009) studied a sample of 654 Chinese college students and found that stressful life events, as measured by the Chinese College Student Stress Questionnaire (Chi & Lin, 2005), accounted for a significant portion of PIU. More specifically, PIU was significantly correlated with academic stress, daily hassles, job-related stress, and social-communication. Major life event stressors, such as losing a family member, were included as potential stressors, but were infrequently reported in

this study, and consequently no conclusions could be made about their relationship with PIU. Using scores from the Chinese version of the Coping Style Questionnaire, PIU was found to be significantly positively correlated with self-blame, fantasy, withdrawal, and rationalization, and significantly negatively correlated with problem-solving. The researchers found that the standardized path coefficients from stressful life events to avoidant coping style and from avoidant coping style to PIU were significant. There was also evidence of a direct path from stressful life events to PIU; however, this coefficient was much lower than the coefficient of the path that included avoidant coping style as a mediator. The results suggested that the relationship between stressful life events and PIU is mediated through avoidant coping style.

In a further study conducted in China, Li et al. (2010) studied PIU as related to environmental stress, specifically stressful life events, in 660 adolescents ages 12-17 years. Li et al. included both environmental and personal factors in this study through the use of a mediated moderation model. The authors suggested that the relationship between stressful life events and PIU is mediated by maladaptive cognitions. The relationship between stressful life events and maladaptive cognitions was thought to be moderated by temperament. Accordingly, when adolescents experienced stressful life events, their maladaptive cognitions were hypothesized to be related to PIU. The moderating variable of temperament was thought to affect the strength of this relationship. Temperament was measured on two domains: effortful control and sensation seeking. Effortful control was proposed as a protective factor in stressful life events, whereas sensation seeking was proposed as a risk factor in the relationship between stressful life events and PIU. Thus maladaptive cognitions were hypothesized to not be as likely to develop in someone who

exhibits effortful control, whereas they are predicted to be likely to develop in someone who exhibits sensation seeking behaviors. The authors studied their mediation moderation model with males and females separately. For females, they demonstrated support for the model; however, although effortful control did moderate the relationship between stressful life events and PIU, sensation seeking did not. Those women with low effortful control were more likely to engage in PIU than those high in effortful control; however, those high in sensation seeking behavior did not differ from those low in sensation seeking behavior as related to PIU (Li et al., 2010). For males, there was an interaction effect between maladaptive cognitions and effortful control in relation to PIU. The authors described that effortful control may protect an adolescent male from PIU even if he develops maladaptive cognitions about the Internet. When the mediating variable of maladaptive cognitions was included in the model, it accounted for the interaction between effortful control and PIU, thus mediating the relationship. Based on their results, the authors suggested that a moderation or mediated moderation model may be most appropriate to study PIU and stress. Currently, two such models have been reported (Li et al, 2010; Li et al, 2009).

Loneliness and PIU

Baumeister and Leary (1995) indicated that humans have an innate need to belong which can be a motivating factor for our thoughts, emotions, and behaviors. Loneliness is a desire to form and maintain positive interpersonal relationships that are lasting and significant (Baumeister & Leary, 1995). Loneliness can be experienced throughout one's lifetime, but prior research has suggested that loneliness often peaks during adolescence (Heinrich & Gullone, 2006). Further research has supported that adolescents and young

adults seem to be the most vulnerable to loneliness (Ponzetti, 1990). Some research indicated that loneliness is common among young adults in college (Cutrona, 1982; Shaver, Furman, & Buhrmester, 1985). College students who experience loneliness have reported less happiness and fewer positive emotional experiences (Ponzetti, 1990). Lonely college students report more anxiety, hopelessness, and social alienation (Ponzetti, 1990).

In one study, researchers examined the effects of gender and loneliness on coping strategies in 462 university students (Cecen, 2008). Two measures were used: the UCLA Loneliness Scale- Revised (Russell, Peplau, & Cutrona, 1980) and the Brief Ways of Coping Inventory (Folkman & Lazarus, 1988). The coping strategies used by individuals who were high in loneliness included hopeless and submissive coping styles. For those low in loneliness, coping strategies were more likely to include self-confident, optimistic, and support seeking styles. The results suggested individuals who are low in loneliness are more likely to use adaptive coping strategies.

Previous research has demonstrated that PIU and loneliness are correlated (Amichai-Hamburger & Ben-Artzi, 2003; Chak & Leung, 2004; Ghassemzadeh, et al., 2008; Kim et al., 2009; Morahan-Martin & Schumacher, 2000). Ceyhan and Ceyhan (2008) investigated whether loneliness, depression, and computer self-efficacy were predictors of PIU. Loneliness significantly predicted PIU. Although depression and computer self-efficacy were also positive predictors of PIU, loneliness contributed the greatest variance (21.8%), with depression (3.3%) and computer self-efficacy (2.8%) predicting less. The authors concluded that there is a positive relationship between PIU

and loneliness, with increased feelings of loneliness predicting greater engagement in PIU.

Previous research demonstrated that Internet use tends to have a negative influence on social integration and well-being, even when the Internet is being used for social interaction (Engelberg & Sjöberg, 2004; Moody, 2001; Weiser, 2001).

Other researchers have found that, in comparison to Internet non-dependents, Internet dependents often lost sleep because of Internet use, reported being lonelier, felt upset when unable to log on at a certain time, reported that life would be boring without the Internet, and delayed work to spend time online (Nalwa & Anand, 2003).

PIU, Stress, and Loneliness

Prior research has indicated that environmental stress is likely related to PIU; however, researchers have proposed that the relationship between stress and PIU is likely more complex and best explained by a mediated or moderated model (Li et al., 2010; Li et al., 2009). Chao (2011) conducted a study with 459 college students in the United States examining psychological stress, social support, and coping. Participants completed a demographic questionnaire and four other instruments: the Perceived Stress Scale (Cohen et al., 1983), the Social Support Inventory (Brown, Brady, Lent, Wolfert, & Hall, 1987), the COPE Inventory (Carver, Scheier, & Weintraub, 1989), and the Mental Health Inventory (Veit & Ware, 1983). The researcher found that having high social support served as a buffer against stress and allowed the student to maintain positive well-being. However, low social support did not provide a buffer against stress. Avoidant coping strategies accelerated the association between stress and well-being in a negative direction. Therefore, when utilizing avoidant coping strategies, stress increased as well-

being decreased. The use of avoidant coping strategies accelerated the association between stress and loneliness at both low and high levels of social support; however, individuals were found to be most vulnerable during times of stress when they had low social support and utilized avoidant coping strategies (Chao, 2011).

Velezmoro et al. (2010) studied problematic Internet use in 104 United States college students. Participants completed a demographic questionnaire, the Internet Addiction Test (Young, 1998), the Cybersex Addiction Test (Young, 1998), the Sensation Seeking Scale Form V (Zuckerman, 1994), and the Perceived Stress Scale (Cohen & Williamson, 1988). The researchers found that the hopelessness scale on the Perceived Stress Scale and the boredom susceptibility scale on the Sensation Seeking Scale predicted Internet abuse for non-sexual purposes. Also, they found that total scores on the Perceived Stress Scale and the disinhibition scale of the Sensation Seeking Scale predicted Internet abuse for sexual purposes. The authors suggested that, although directionality cannot be determined, loneliness and social problems might be related to PIU and stress. The authors called for further research to be conducted in this area.

The goal of the current study was to further previous research by evaluating a moderation model of problematic Internet use. Prior research suggested a positive correlation between environmental stress and PIU (Li et al., 2010); however, the experience of stressful life events does not lead to the same level of PIU for all individuals (Li et al., 2010). Thus researchers have suggested that the relationship is more complex and that a mediating and/or moderating variable likely accounts for the differences in PIU noted among individuals experiencing stress (Li et al., 2010; Li et al., 2009). Increasingly, studies have shown that individuals who engage in PIU are likely to

be lonelier than those who do not (Ceyhan & Ceyhan, 2008; Engelberg & Sjöberg, 2004; Nalwa & Anand, 2003; Whang et al., 2003). During times of stress, individuals are most vulnerable when they have low social support (Chao, 2011). Velezmoro et al. (2010) suggested that loneliness might be related to stress and PIU, but indicated that additional research is needed to understand this relationship. Stressed individuals who engage in PIU may be doing so because they have low social support (are lonely) and are less likely to cope in a social support seeking way. Thus, loneliness was hypothesized to moderate the relationship between PIU and stress (see Figure 1).

More specifically, the present study investigated how the relationship between environmental stress, as measured by the Undergraduate Stress Questionnaire, and PIU, as measured by the Internet Addiction Test, changed as a function of loneliness, as measured by the UCLA Loneliness Scale. The following were the study hypotheses:

H₁. Stress, as measured by the Undergraduate Stress Questionnaire, is significantly positively correlated with PIU, as measured by the Internet Addiction Test.

H₂. Loneliness, as measured by the UCLA Loneliness Scale, is significantly positively correlated with PIU, as measured by the Internet Addiction Test.

H₃. The product of stress, as measured by the Undergraduate Stress Questionnaire, and loneliness, as measured by the ULCA Loneliness Scale, is significantly positively correlated with PIU, as measured by the Internet Addiction Test. Thus, loneliness moderates the relationship between stress and PIU.

The alpha level was set at .05.

Exploratory Hypothesis

In order to contribute further to the minimal available literature on PIU, an exploratory analysis was conducted in which the impact of the study variables and gender served as predictors of PIU. Predictor variables included stress, as measured by the Undergraduate Stress Questionnaire, loneliness, as measured by the UCLA Loneliness Scale, and gender, as measured by the Demographic Questionnaire. The null hypothesis was tested at the .05 level of significance:

H₀: There is no variable or combination of variables which significantly predicts PIU, as measured by the Internet Addiction Test.

Method

Participants

The participants in this study were college students, ages 18 to 25, who were recruited through the university's psychology department's participant pool. A total of 109 participants consented to participate in the study; however, only 100 participants completed the study in its entirety. Of the 100 participants, four were excluded from analyses as they indicated their Internet use over the past week was atypical, and one was excluded due to not being within the age range of the study. Thus, the final number of participants was 95, which is 87% of the total number of individuals who consented to participate.

The mean age of the participants was 20.29 years ($SD = 1.20$) and the modal age was 20 years. Forty-four participants reported being male (46.3%) whereas 51 reported being female (53.7%). The majority reported their race as White or Caucasian (81 participants or 85.3%); 5 reported their race as Black or African-American (5.3%); 4 as

Asian or Asian-American (4.2%); 1 as Arab or Arab-American (1%); 1 as Native Hawaiian or Other Pacific Islander (1%); and 3 as bi- or multiracial (3.2%). Regarding ethnicity, 87 participants identified as non-Hispanic or Latino (91.6%), whereas 8 participants identified as Hispanic or Latino (8.4%). Information about participants' nationality was collected; however, it was evident through the responses that many participants misunderstood this question and responded with their race or cultural heritage. Consequently, these data could not be utilized.

The majority of the participants were in their junior year of college (54 participants; 56.8%); 9 participants were in their first year (9.5%), 8 in their sophomore year (8.4%), and 24 in their senior year (25.3%). Thirty different college majors were represented in the sample and three individuals reported an undecided major.

Measures

Demographic Questionnaire. A Demographic Questionnaire was constructed for the purposes of this study and included items of age, gender, ethnicity, race, nationality, college major, year in college, six questions regarding amount of time spent online during the past seven days, and a list in which participants ranked categories for which they use the Internet. Categories were adapted from previous research, including the Pew Internet and American Life Project (2013).

Internet Addiction Test. The Internet Addiction Test (IAT; Young, 1998) is a 20-item measure on which participants rate how often they engage in each item using a 5-point Likert-type scale ranging from 1 = *Rarely* to 5 = *Always*, or indicate that the item is not applicable, which is scored 0. A total score between 0 and 100 is calculated by summing the scores for each item, with a higher score indicating greater Internet

addiction. Adequate reliability and validity have been reported (Widyanto & McMurren, 2004). According to the IAT Manual, a score of 0 to 30 is considered normal, while scores 31 to 49 indicate mild Internet addiction, scores 50 to 79 indicate moderate Internet addiction, and scores 80 to 100 indicate severe Internet addiction (Young, 2010).

Undergraduate Stress Questionnaire. The Undergraduate Stress Questionnaire (USQ; Crandall, Preisler, & Aussprung, 1992) is a checklist of 83 stressful life events specific to the college student population. Participants rate each item as either 0 = *did not occur* or 1 = *did occur*, based on whether the stressor is currently affecting them. Scores can range from 0 to 83, with higher scores indicating more stressors present. The USQ has adequate reliability and validity (Crandall et al., 1992). When developing the measure, Crandall and colleagues (1992) found the mean score for a sample of college students was 17.63 ($SD = 7.93$).

UCLA Loneliness Scale. The UCLA Loneliness Scale Version 3 (Russell, 1996) is a 20-item measure on which participants respond using a 4-point Likert-type scale. Eleven items are worded in the negative direction (1 = *Never* and 4 = *Always*) and nine items are worded in the positive direction and are reverse scored (Russell, 1996). Scores can range from 20 to 80, with higher scores representing higher degrees of loneliness. The UCLA Loneliness Scale Version 3 is very reliable, and validity has been demonstrated in a number of populations, including college students (Russell, 1996). Research has demonstrated that the approximate mean score is 40 ($SD =$ approximately 10).

Procedure

Approval was obtained through Xavier University's Institutional Review Board (see Appendix). Participants were recruited through a research participant pool at a Midwest, medium-sized, private university with an undergraduate population of approximately 4,000. Students between the ages of 18 and 25 who were enrolled in an undergraduate psychology course were eligible to participate in this study.

Individuals recruited via the participant pool were given a link and password to the online survey. After consenting to participate, individuals completed the demographic questionnaire, followed by the three study measures: the IAT, USQ, and UCLA in random order. No identifying information was collected. After completing the measures, individuals were directed to contact the researcher if they would like additional information about the study; however, no participants to this date have made contact.

Results

The purpose of the present study was to investigate the role of loneliness in the relationship between stress and PIU. In order to test the hypotheses, a moderation model consisting of a multiple linear regression was utilized. The analyses were computed using an alpha level of .05.

The means and standard deviations were calculated for each of the study measures for the total sample, and by gender (see Table 1). No statistically significant gender differences were found on any of the study measures. The mean scores on the study measures of the current sample of college students were similar to the normative data provided for each of the respective measures. More specifically, on the USQ, a mean score of 17.63 ($SD = 7.93$) was reported for the normative sample and the current study

sample had a mean score of 17.64 ($SD = 8.30$). The UCLA Loneliness Scale normative mean score was reported to be approximately 40 ($SD =$ approximately 10), and the current sample had a mean score of 39.08 ($SD = 10.97$). Although a mean score was not specified for the normative sample on the IAT, “normal” Internet use is classified as a score between 0 and 30, and the current sample had a mean score of 29.72 ($SD = 10.40$), with 51 participants in the “normal” range, 41 in the “mild” range, 3 in the “moderate” range, and 0 in the “severe” range. A correlation matrix for the study variables is presented in Table 2.

A hierarchical multiple linear regression was used to test the hypotheses, with the stress and loneliness scores entered in step 1 and the interaction variable included in step 2, with PIU as the criterion variable (see Table 3). First, the variables of stress and loneliness were centered at their means as recommended by Aiken and West (1991). The purpose of this is to reduce multicollinearity between the predictor variables and the interaction term. Then, the interaction term was created by multiplying the stress and loneliness scores together. Finally, the regression analysis was conducted.

Hypothesis 1 stated: Stress, as measured by the Undergraduate Stress Questionnaire, is significantly positively correlated with PIU, as measured by the Internet Addiction Test. With regards to the Hypothesis 1, stress was significantly positively correlated with PIU, $r = .45$, $p < .001$. Therefore, support was found for Hypothesis 1.

Hypothesis 2 stated: Loneliness, as measured by the UCLA Loneliness Scale, is significantly positively correlated with PIU, as measured by the Internet Addiction Test. Loneliness was significantly positively correlated with PIU, $r = .25$, $p < .01$, and therefore demonstrated support for Hypothesis 2.

Hypothesis 3 stated: The product of stress, as measured by the Undergraduate Stress Questionnaire, and loneliness, as measured by the ULCA Loneliness Scale, is significantly positively correlated with PIU, as measured by the Internet Addiction Test. Thus, a significant moderator effect was established. When controlling for the main effects of stress and loneliness, the product of stress and loneliness explained a significant increase in variance in PIU over the main effects, $\Delta R^2 = .05$, $F(1,91) = 6.43$, $p = .01$. The regression equation suggests that both stress, $B = .39$, $t(91) = 3.12$, $p < .01$, and the interaction term, $B = .03$, $t(91) = 2.54$, $p = .01$, significantly predicted PIU, while loneliness did not, $B = .14$, $t(91) = 1.59$, $p = .12$. According to Baron and Kenny (1986), it is not necessary for the main effects of stress and loneliness to be significant in order to have a significant moderation model; thus, Hypothesis 3 was supported and there was evidence of a significant moderator effect. The effect size was $f^2 = .06$; an effect size of .02 is considered small, whereas an effect size of .15 is considered medium.

In order to better understand the relationship of these variables, post-hoc probing of the interaction was necessary. For the current study, the relationship of stress and PIU was thought to be moderated by loneliness, based on previous research suggesting that the relationship between stress and PIU is likely best explained by a mediating or moderating variable. In order to explore this interaction, simple slopes were calculated at two additional levels of loneliness, using centered variables as recommended by Aiken and West (1991). The purpose of the simple slope analysis was to test the significance of the regression lines at two single values of loneliness. In order to do this, new loneliness variables were created at low and high levels of loneliness by adding or subtracting the value of one standard deviation of loneliness. Then, using the new loneliness values, new

interaction terms were created and a regression analysis was conducted for low and high loneliness. For low loneliness, the first unstandardized simple slope was calculated at 1 standard deviation below the mean of loneliness, $B = .12$, $t = .63$, $p = .53$, which is not significantly different from 0. This indicates that as stress increases, the amount of PIU reported does not change at low levels of loneliness. The unstandardized simple slope for high loneliness was calculated at 1 standard deviation above the mean of loneliness, $B = .66$, $t = 5.09$, $p < .001$ (see Figure 2). This means that as stress increases, the amount of PIU reported significantly increases at high levels of loneliness. The third line, at the mean level of loneliness, was calculated in the original analysis and is represented by the slope of the multiple regression. The effect of stress on PIU is related to the amount of loneliness that the individual is reporting. At high levels of loneliness, PIU increases as stress increases. However, at low levels of loneliness, PIU does not change significantly as stress increases.

An exploratory analysis was conducted to determine if gender and the study variables of stress and loneliness significantly predicted PIU. The null hypothesis stated: There is no variable or combination of variables which significantly predicts PIU, as measured by the Internet Addiction Test. In order to test this hypothesis, a standard linear regression analysis was conducted (see Table 4). The results of the analysis indicated that stress was a significant predictor in the regression equation, $B = .51$, $t(91) = 4.19$, $p < .001$, accounting for 14.9% of the variance, whereas loneliness was not a significant predictor, $B = .12$, $t(91) = 1.35$, $p = .18$, accounting for 1.56% of the variance. Gender was not significantly correlated with PIU, $r = -.15$, $p = .08$, and was not a significant predictor of PIU, $B = -1.37$, $t(91) = -.70$, $p = .48$, accounting for 0.42% of the variance.

Further exploratory analyses were completed in order to learn more about this sample of 95 college students and their use of the Internet. The mean number of hours students reported they spent online in the past seven days was 24.45 ($SD = 15.65$). Participants were asked to further classify their time spent online into four categories with the following mean hours reported: (1) school-related activities: $M = 9.49$, ($SD = 5.85$); (2) work-related activities: $M = 2.40$ ($SD = 3.93$); (3) social activities: $M = 9.13$ ($SD = 9.42$); and activities not elsewhere classified: $M = 3.42$, ($SD = 4.40$). Interestingly, PIU scores were significantly correlated with total hours spent online, $r = .33$, $p < .001$ and activities not elsewhere classified, $r = .25$, $p = .01$, but not with school-related activities, $r = .17$, $p = .11$, work-related activities, $r = .21$, $p = .04$; or social activities, $r = .24$, $p = .02$, using a p value of .01 due to multiple comparisons.

In order to learn more about the participants' use of the Internet, they were asked to rank the purposes for which they use the Internet (see Table 5). Education was ranked as the #1 ("most important") use of the Internet by the most participants (45.3%), followed by Emailing (35.8%), and Social Networking (32.6%).

After exploring the rank ordered lists, a new variable was calculated based on whether the participant ranked the use of the Internet or not (see Table 6). The uses of the Internet that were ranked by the most participants included: Emailing (reported by 96.8% of sample), Social Networking (95.8%), and Education (89.5%). Other research findings have indicated that of U.S. adults, 88% use the Internet to send or read email and 67% use a social networking site (Pew Internet and American Life Project, 2013). Chi-squared analyses were performed to determine whether any gender differences were present based on whether the participant ranked the item or not for specific types of uses of the Internet.

While five categories could not be analyzed due to violating the assumption that at least 80% of the cells must have an expected frequency count greater than 5, chi square analyses were conducted on the other 5 variables. Using an alpha level of .01 due to multiple comparisons, men were significantly more likely than women to use the Internet for Playing Games and Sexual Content/Pornography. No gender differences were found in usage of the Internet for Downloading Music, Shopping, or Business/Employment.

Discussion

Just before the turn of the century, Internet use was on the rise, with 46% of people using the Internet in 2000 (Pew Internet and American Life Project, 2009). Currently, 85% of American adults 18 years and older access the Internet, with 98% of individuals 18-29 accessing the Internet (Pew Internet and American Life Project, 2013). As technological advances are made, it is essential that researchers explore the implications of using such technology. As the Internet is a relatively new system of telecommunication, researchers are only beginning to develop tools to measure its impact, including the psychological benefits and detriments to users worldwide. In particular, researchers have begun to explore PIU, particularly with adolescents and college students, who use the Internet at higher rates than other age groups.

Prior research had suggested a positive correlation between stress and PIU (Chao, 2011; Li et al., 2010; Li et al., 2009; Velezmoro et al., 2010); however, the experience of stressful life events (i.e., environmental stress) has not led to the same level of PIU for all individuals (Li et al., 2010). It has been suggested that the relationship between stress and PIU is likely best explained with a mediating and/or moderating variable. Thus, the current study employed a moderation model to gain a better understanding of the

relationship between stress and PIU, with loneliness serving as the moderating variable. The model was constructed based upon previous literature which suggested a potential relationship of loneliness in the relationship between stress and PIU (Velezmoro et al., 2010).

The results of the current study support the previous findings indicating that stress is related to PIU. Based on a hierarchical multiple regression analysis, environmental stress was shown to be positively related to PIU and the main effect of stress was a significant variable in the prediction of PIU. Prior research had also indicated a relationship between PIU and loneliness (Amichai-Hamburger & Ben-Artzi, 2003; Ceyhan & Ceyhan, 2008, Chak & Leung, 2004; Ghassemzadeh, et al., 2008; Kim et al., 2009; Morahan-Martin & Schumacher, 2000; Nalwa & Anand, 2003), which was consistent with the findings in the current study. Loneliness was positively correlated with PIU; however, it was not found to be a significant predictor of PIU in the regression equation. The relationship between stress and PIU was better explained in the current study by exploring the interaction between stress and loneliness. The results of this study indicated that loneliness moderates the relationship between stress and PIU. Specifically, at lower levels of loneliness, the amount of PIU reported did not significantly increase as stress increased. However, at higher levels of loneliness, PIU increased as stress increased. Thus the current findings suggest that individuals most vulnerable to PIU are those who report both high stress and high loneliness.

Milani and colleagues (2009) suggested that PIU may be associated with avoidant, maladaptive coping. Using this hypothesis, a possible explanation for the current findings is that individuals who are experiencing stress, but are not lonely, may

utilize other coping mechanisms such as reaching out to friends, rather than overusing the Internet. However, individuals who are both stressed and lonely might turn to solitary activities, such as using the Internet, to cope with their high levels of stress. Even at high levels of stress, being low in loneliness seems to buffer the individual from PIU. However, at high levels of loneliness when the buffering effects of social support are not present, individuals are more likely to report PIU as stress increases.

As with most newly developing areas of research, many earlier studies explored the relationship between PIU and individual variables. However, the results of this study demonstrate that the relationship between stress and PIU is not easily explained by any one factor. As more recent research has called for an examination of multifaceted models, this study explored one such model and found support for this method of studying PIU. Further studies should build on this literature by continuing to explore more sophisticated models of PIU in order to gain a more complete understanding of this problem.

According to Tao and colleagues (2010), “considerable effort” was made to have PIU, or Internet addiction, included in the recently published *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM-5*; American Psychiatric Association [APA], 2013). Although Internet addiction did not appear in the revised diagnostic manual, a related diagnosis of “Internet Gaming Disorder” was included in the section on *Conditions for Further Study*. Internet Gaming Disorder is defined as the “persistent and recurrent use of the Internet to engage in games, often with other players, leading to clinically significant impairment or distress” (p. 795). In further defining this disorder, the *DSM-5* continues, “excessive use of the Internet not involving playing of online games is not considered analogous to Internet gaming disorder, and future research on

other excessive uses of the Internet would need to follow similar guidelines as suggested herein” (APA, 2013; p. 797-798). While Internet addiction was not included as a diagnostic category in the *DSM-5*, Block wrote an editorial article in 2008 that stated “Internet addiction appears to be a common disorder that merits inclusion in the *DSM-V*” (p.306). He further described four components central to this issue: excessive use, withdraw, tolerance, and negative repercussions. He also stated that in the United States, Internet problems often go undetected, whereas in Asia, therapists are taught to screen for Internet addiction (Block, 2008). Increasing our understanding of this condition, as well as the cultural factors involved, could help therapists recognize and provide more comprehensive treatment for PIU symptoms.

Previous research has found inconsistent results regarding the relationship between PIU and gender, with some studies suggesting that being male is a risk factor for developing PIU (Bakken et al., 2009; Chou et al., 2005; Çuhadar, 2012; Frangos et al., 2011; Kormas et al., 2011; Morahan-Martin & Schumacher, 2000; Mottram, & Fleming, 2009; Odaci & Kalkan, 2010; Tekinarslan & Gürer, 2011; Yang & Tung, 2007), other studies suggesting that females are at higher risk for developing PIU (Jelenchick et al., 2011; Leung, 2004), and still others finding no differences in PIU based on gender (Amichai-Hamburger & Ben-Artzi, 2003; Ferraro et al., 2007; Hardie & Yi-Tee, 2007; Kim et al., 2006; Lee et al., 2007; Li et al., 2009; Smahel et al., 2012; Soule et al., 2003). In this study, no gender differences were found for PIU. Additionally, when including gender as a predictor variable of PIU in a multiple regression equation, gender alone was not predictive of PIU nor was it a significant contributor to the regression equation when examining the role of gender, loneliness, and stress.

In a previous study, researchers found PIU was associated with the number of hours spent online in adolescents (Milani et al., 2009). When using an IAT cutoff score of 50, indicating moderate to severe PIU, they found that adolescents with moderate to severe PIU spent significantly more hours per week on the Internet (21.05 hours) than those with normal use to mild PIU (8.89 hours). In the current sample, only three college students scored with moderate PIU ($M = 38.33$ hours; $SD = 18.93$) and none scored in the severe range, whereas 41 scored in the mild range ($M = 28.41$ hours; $SD = 17.94$) and 51 scored in the normal range ($M = 20.45$, $SD = 12.17$). Due to the low N 's in the moderate/severe range, differences between groups could not be calculated. However, the total number of hours spent online in the current study was significantly positively correlated with PIU, suggesting that as the number of hours spent on the Internet increases, PIU, as measured by the IAT, also increases. More specifically it was found that the hours students spent online engaged in activities other than school-, work- and social- related were positively correlated with PIU. These findings were somewhat consistent with a previous study which also found that total IAT scores were positively correlated with overall Internet use, and that there was not a significant correlation between IAT scores and professional Internet use (Widyanto & McMurrin, 2004). The previous study also found that PIU was correlated with hours of personal Internet use (Widyanto & McMurrin, 2004).

Limitations and Areas for Future Research

The results of this study are limited to the traditional college population and are not necessarily generalizable to other age groups. However, as the Internet is reported to be accessed by 98% of individuals in this age group (Pew Internet and American Life

Project, 2013), exploring PIU in the college population is important. Additional research should be conducted to determine if loneliness significantly moderates the relationship between stress and PIU in other age groups.

Additionally, caution should be taken in interpreting the results of this study. First, only 95 participants were included in the analysis and the results would need to be replicated with a larger sample to make generalizable statements about the results of this study. Additionally, although loneliness was shown to moderate the relationship between stress and PIU, this study was correlational in nature. Loneliness may be a proxy variable for another variable and additional research is needed to better understand this relationship. Researchers could explore other possible mediating and/or moderating variables, such as coping style, to better understand the relationship between stress, loneliness and PIU.

In order to gain a further understanding of PIU, additional research might explore whether an individual's level of PIU changes over time and, if so, what factors are related to such changes. In other words, it would be useful to learn whether PIU is more of a state or trait variable and/or whether there is a developmental quality to PIU (e.g., a coping mechanism related to adolescent and college years but something not as prevalent in adulthood).

As a follow-up to the survey research that has been conducted to date and consistent with the suggestion that PIU is a maladaptive coping mechanism, it seems important to explore PIU in clinical settings. Research in a clinical setting could provide diagnostic clarification as to how to better understand PIU and how to treat the symptoms of PIU. For example, clinical research might explore whether a reduction in stress or

loneliness, through therapeutic intervention, might impact a client's PIU. Researchers could also explore the impact of reducing a client's PIU on his or her level of stress and/or loneliness. Gaining an increased clinical understanding of PIU is particularly important because previous research has demonstrated that PIU is correlated with low self-esteem (Amiel & Sargent, 2004; Armstrong et al., 2000; Niemz et al., 2005; Yang & Tung, 2007), social anxiety or shyness (Caplan, 2002; Chak & Leung, 2004; Lee & Stapinski, 2012; Wei et al., 2004; Yang & Tung, 2007), and low extraversion (Mottram, & Fleming, 2009). Additionally, PIU has been shown to be related to anxiety and mood disorders, such as depression or bipolar disorder (Black, Belsare & Schlosser, 1999; Haung et al., 2009; Kim & Chun, 2005; Kim et al., 2006; LaRose, Lin, & Eastin, 2003; Shapira, Goldsmith, Keck, Khosla, & McElroy, 2000; Thatcher & Goolam, 2005; Wei et al., 2004; Whang et al., 2003; Yang & Tung, 2007; Young & Rogers, 1998) and substance abuse (Bai, Lin, & Chen, 2001; Frangos et al., 2011; Greenberg, Lewis, & Dodd, 1999).

The IAT is a 20-item scale, which measures PIU based on symptoms that develop with the overuse of the Internet (e.g., losing sleep due to Internet use or fear that life without the Internet would be boring, empty, and joyless). The current results provide some evidence that assessing increased time spent on the Internet, especially on activities not related to school, work or socializing, may provide a more time efficient way to screen for PIU in a clinical setting, which then may be followed up with the IAT or other similar measure of PIU, when indicated.

In summary, PIU is increasingly becoming a focus of research and clinical interest. The current study adds to the literature about PIU and stress by examining the

role of loneliness as a moderating variable. The moderation model was supported and the results indicated that, at low levels of loneliness, the amount of stress one reports is not related to an increase in PIU. However, at high levels of loneliness, an individual's increase in stress is significantly predictive of higher levels of PIU. These findings are important as the understanding of the relationship between stress and PIU is growing and can assist with diagnoses and treatment of individuals experiencing PIU.

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Table 1

Means, Standard Deviations, and t-values of Study Measures for Total Sample and by Gender

Measure	Total (<i>N</i> = 95)		Male (<i>n</i> = 44)		Female (<i>n</i> = 51)		<i>t</i> -values for gender	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>
IAT	29.72	10.40	28.09	10.17	31.12	10.49	-1.42	.16
USQ	17.64	8.30	16.34	7.14	18.76	9.12	-1.46	.16
UCLALS	39.08	10.97	37.23	9.67	40.69	11.83	-1.57	.13

Note: IAT = Internet Addiction Test; USQ = Undergraduate Stress Questionnaire; UCLALS = UCLA Loneliness Scale.

Table 2

Correlation Matrix for Study Variables

Measure	1	2	3
1. IAT	-	.45**	.25*
2. USQ		-	.27**
3. UCLALS			-

Note: * $p < .05$. ** $p < .01$.

Table 3

Hierarchical Multiple Regression Analyses Predicting Problematic Internet Use from Stress and Loneliness

Variable	Step 1			Step 2		
	<i>B</i>	<i>SE B</i>	<i>t</i>	<i>B</i>	<i>SE B</i>	<i>t</i>
Stress	.52	.12	4.30***	.39	.13	3.12**
Loneliness	.13	.09	1.46	.14	.09	1.59
Stress X Loneliness				.03	.01	2.54*
ΔR^2		.22			.05	
<i>F</i> for ΔR^2		12.96***			6.82*	

Note: Stress and Loneliness centered at their means.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 4

Multiple Regression Analyses Predicting Problematic Internet Use from Gender, Stress, and Loneliness

Variable	<i>B</i>	<i>SE B</i>	<i>t</i>	<i>sr</i> ²
Gender	-1.37	1.95	-.70	.004
Stress	.51	.12	4.19***	.016
Loneliness	.12	.09	1.35	.149
<i>R</i> ²		.22		
<i>F</i> for ΔR^2		8.76***		

Note: Stress and Loneliness centered at their means.

*** $p < .001$.

Table 5.

Number of Participants Ranking Each Type of Internet Use by Importance (Percentage in parentheses)

Use of Internet	1	2	3	4	5	6	7	8	9	10	11	12	NR
Emailing	34 (36)	21 (22)	19 (20)	10 (11)	6 (6)	2 (2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (3)
Social Networking	31 (33)	31 (33)	12 (13)	10 (11)	6 (6)	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	4 (4)
Playing Games	2 (2)	5 (5)	3 (3)	4 (4)	3 (3)	12 (13)	11 (12)	1 (1)	1 (1)	0 (0)	0 (0)	0 (0)	53 (56)
Gambling	0 (0)	2 (2)	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	3 (3)	1 (1)	1 (1)	0 (0)	0 (0)	87 (92)
Downloading music/ videos images	7 (7)	11 (12)	11 (12)	16 (17)	12 (13)	10 (11)	4 (4)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	24 (25)
Online dating	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)	1 (1)	3 (3)	1 (1)	0 (0)	0 (0)	89 (94)
Shopping	2 (2)	11 (12)	3 (3)	9 (10)	18 (19)	17 (18)	4 (4)	2 (2)	0 (0)	0 (0)	0 (0)	0 (0)	29 (31)
Business/ Employment	5 (5)	12 (13)	11 (12)	11 (12)	9 (10)	4 (4)	3 (3)	1 (1)	1 (1)	0 (0)	0 (0)	0 (0)	38 (40)
Education	43 (45)	21 (22)	8 (8)	8 (8)	3 (3)	1 (1)	0 (0)	0 (0)	0 (0)	1 (1)	0 (0)	0 (0)	10 (11)
Sexual Content/ Pornography	2 (2)	3 (3)	2 (2)	0 (0)	2 (2)	5 (5)	4 (4)	3 (3)	1 (1)	3 (3)	0 (0)	0 (0)	70 (74)
Other 1	3 (3)	5 (5)	1 (1)	1 (1)	1 (1)	1 (1)	0 (0)	1 (1)	0 (0)	1 (1)	1 (1)	0 (0)	80 (84)
Other 2	0 (0)	2 (2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)	0 (0)	92 (97)

Note: NR means not ranked. Some participants ranked multiple items "1" or "2" and participants were not required to use all available ranking numbers. Therefore, the percentages down the columns will not all add up to 100.

Table 6

Percentage of Individuals Reporting Types of Internet Usage

Use of Internet	Total		Male		Female		Gender Difference
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	χ^2
Emailing	92	96.8	41	93.2	51	100	-
Social Networking	91	95.8	41	93.2	50	98.0	-
Education	85	89.5	39	88.6	46	90.2	-
Downloading Music	71	74.7	34	77.3	37	72.5	.28
Shopping	66	69.5	29	65.9	37	72.5	.49
Business/ Employment	57	60.0	31	70.5	26	51.0	3.73
Playing Games	42	44.2	26	59.1	16	31.4	7.36*
Sexual Content/ Pornography	25	26.3	21	47.7	4	7.8	19.38**
Gambling	8	8.4	7	15.9	1	2.0	-
Online Dating	6	6.3	5	11.4	1	2.0	-

Note: A dash (-) indicates that the results cannot be calculated due to an insufficient *n*.

* $p < .01$. ** $p < .001$

Figure 1. Model of stress, loneliness, and the moderation of stress by loneliness as it predicts Problematic Internet Use (on the basis of Baron & Kenny, 1986).

Figure 2. Simple regression analysis from centered variables.

Appendix

IRB Approval Letter

October 3, 2012

Julie Meade
7991 Peaceful Way
Liberty Township, OH 45044

Re: Protocol #1225, *Problematic Internet Use: Impact of Stress and Loneliness*

Dear Ms. Meade:

The IRB has reviewed the materials regarding your study, referenced above, and has determined that it meets the criteria for the Exempt from Review category under Federal Regulation 45CFR46. Your protocol is approved as exempt research, and therefore requires no further oversight by the IRB. We appreciate your thorough treatment of the issues raised and your timely response.

If you wish to modify your study, including the addition of data collection sites, it will be necessary to obtain IRB approval prior to implementing the modification. If any adverse events occur, please notify the IRB immediately.

Please contact our office if you have any questions. We wish you success with your project!

Sincerely,

Morell E. Mullins, Jr., Ph.D.
Chair, Institutional Review Board
Xavier University

MEM/sb

C: Christine Dacey, Advisor

Summary

Title: Problematic Internet Use: Relationship with Stress and Loneliness

Problem: As a relatively new form of technology, the Internet provides many services and benefits to users. However, some individuals use the Internet in a problematic way, known as problematic Internet use (PIU). Prior research suggested a positive correlation between environmental stress and PIU (Li et al., 2010); however, the experience of stressful life events does not lead to the same level of PIU for all individuals and researchers have suggested that the relationship is more complex with a mediating and/or moderating variable likely accounting for the differences in PIU noted among individuals experiencing stress (Li et al., 2010; Li et al., 2009). Increasingly, studies have shown that individuals who engage in PIU are more likely to be lonelier than those who do not (Ceyhan & Ceyhan, 2008; Engelberg & Sjöberg, 2004; Nalwa & Anand, 2003; Whang et al., 2003). Velezmore et al. (2010) suggested that loneliness might be related to stress and PIU, but indicated that additional research is needed to understand this relationship. The current study sought to add to the research by exploring a moderation model to better explore the relationship between stress and PIU. It was hypothesized that loneliness would moderate the relationship between PIU and stress. Additionally, an exploratory analysis was conducted to see which study variables, or combination of variables, predicts PIU.

Method: Data were collected from 95 students in a participant pool at a mid-size, Midwestern university. Participants completed a demographic form, the Internet Addiction Test (IAT), the Undergraduate Stress Questionnaire (USQ), and the UCLA Loneliness Scale. The mean age of the participants was 20.29 years ($SD = 1.20$). Forty-four participants were male (46.3%) and 51 were female (53.7%). Racially, 85.3% were Caucasian, 5.3% were Black or African-American, 4.2% were Asian or Asian-American, 1% were Arab or Arab-American, 1% were Native Hawaiian or Other Pacific Islander, and 3.2% were bi- or multiracial. Regarding ethnicity, 91.6% were non-Hispanic or Latino and 8.4% were Hispanic or Latino.

Findings: Based upon a hierarchical linear regression analysis, stress was significantly positively correlated with PIU, $r = .45, p < .001$. Loneliness was also significantly positively correlated with PIU, $r = .25, p < .01$. Regarding the moderation model, the product of stress and loneliness explained a significant increase in variance in PIU over the main effects, $\Delta R^2 = .051, F(1,91) = 6.43, p = .01$. The regression equation suggests that both stress, $B = .39, t(91) = 3.12, p < .01$, and the interaction term, $B = .025, t(91) = 2.54, p = .01$, significantly predicted PIU, while loneliness did not, $B = .14, t(91) = 1.59, p = .12$. Post-hoc analyses were completed by examining the simple slopes at 1 SD above and below the mean of loneliness. The unstandardized simple slope at 1 SD below the mean of loneliness was $B = .12, t = .63, p = .53$, which is not significantly different from 0. The unstandardized simple slope for participants 1 SD above the mean of loneliness was $B = .66, t = 5.09, p < .001$, which is significantly different from 0. The effect of stress on PIU is dependent on the amount of loneliness that the individual is

reporting. At high levels of loneliness, PIU increases as stress increases. However, at low levels of loneliness, PIU does not change significantly as stress increases.

An exploratory analysis was conducted to determine if gender and the study variables of stress and loneliness significantly predicted PIU. The results of the analysis indicated that stress was a significant predictor in the regression equation, $B = .51$, $t(91) = 4.19$, $p < .001$, accounting for 14.9% of the variance, while loneliness was not a significant predictor, $B = .12$, $t(91) = 1.35$, $p = .18$, accounting for 1.56% of the variance. Gender was not significantly correlated with PIU, $r = -.146$, $p = .079$, and was not a significant predictor of PIU, $B = -1.37$, $t(91) = -.70$, $p = .48$, accounting for 0.42% of the variance.

Finally, exploratory analyses were completed in order to learn more about this sample of 95 college students and their use of the Internet. The mean number of hours spent online in the past seven days was $M = 24.45$ ($SD = 15.65$). Participants were asked to further classify their time spent online into four categories: (1) school-related activities: $M = 9.49$, ($SD = 5.85$); (2) work-related activities: $M = 2.40$ ($SD = 3.93$); (3) social activities: $M = 9.13$ ($SD = 9.42$); and activities not elsewhere classified: $M = 3.42$, ($SD = 4.40$). Interestingly, PIU scores were significantly correlated with total hours spent online, $r = .33$, $p < .001$ and activities not elsewhere classified, $r = .25$, $p = .01$, but not with school-related activities, $r = .17$, $p = .11$, work-related activities, $r = .21$, $p = .04$; or social activities, $r = .24$, $p = .02$, using a p value of .01 due to multiple comparisons. Participants were asked to rank order the most important purposes for which they use the Internet. Education was ranked as the #1 ("most important") use of the Internet by the most participants (45.3%), followed by Emailing (35.8%), and Social Networking (32.6%).

Implications: Support was found for loneliness being a significant moderator of the relationship between stress and PIU. The current findings suggest that individuals most vulnerable to PIU are those who report both high stress and high loneliness. At low levels of loneliness, the amount of PIU reported did not significantly change across levels of stress. A possible explanation for the current findings is that individuals who are experiencing stress, but are not lonely, may utilize other coping mechanisms such as reaching out to friends, rather than overusing the Internet. However, individuals who are both stressed and lonely might turn to solitary activities, such as using the Internet, to cope with their high levels of stress. Even at high levels of stress, being low in loneliness seems to buffer the individual from PIU. However, at high levels of loneliness when the buffering effects of social support are not present, the impact of stress on the individual becomes more significant. The results of this study demonstrate that the relationship between stress and PIU is not easily explained by any one factor. As with most newly developing areas of research, many earlier studies explored the relationship between PIU and individual variables. As more recent research has called for an examination of multifaceted models, this study explored one such model and found support for this method of studying PIU. Further studies should build on this literature by continuing to explore more sophisticated models of PIU in order to gain a more complete understanding of this problem.