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Application of an Ecological Approach to Examine Online Activities and Internet Addiction among College Students

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This study investigated the relationships among Internet addiction, gender difference, loneliness, and depression from an ecological point of view. Data were collected from 132 college students at a research-intensive university in the mid-western United States. Findings from a hierarchical regression and MANOVA analysis revealed that male college students showed a higher level of Internet addictive symptoms than female students based on their everyday experience of online activities. Gender, use of smart phone, time spent online, and depression had a significant effect on Internet addiction. Recommendations are provided on how researchers can strengthen this growing field of research.

Keywords: ecological approach, Internet addiction, college students

Over the past few decades, Internet access and wireless use on college campuses in the United States have increased dramatically, with approximately 95% of students engaging in online activities (i.e., study, social network; Perrin &

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Duggan, 2015). In light of an unprecedented growth, Internet use and the related psychological problems among college students have aroused great concerns (Griffiths & Szabo, 2014; Northrup et al., 2015). Specifically, research indicates that Internet addiction (IA) has become one of the most common issues among college students (Anderson, 2001; Kiralla, 2005; Li et al., 2015). A recent survey of the general population reported a prevalence rate of IA between 1.5% and 8.2% in the United States and Europe (Weinstein & Lejoyeux, 2010). Much of the literature has focused on examining IA from a psychopathological perspective, often including excessive video game players, addictive online pornography, compulsive online shoppers, and even comparing IA to pathological gambling (Bipeta et al., 2015; Capetillo-Ventura & Juárez-Trevino, 2015; Ko et al., 2015; Kuss et al., 2014). However, research on IA is still in its relative infancy and researchers call for more statistically and empirically grounded studies, especially among college students (Li et al., 2015; Young, 2016). Considering that online activities play a critical role in daily lives of college students (Griffiths & Szabo, 2014), identifying the factors that contribute to development of IA can inform future treatment efforts. Thus, the purpose of this study was to adopt an ecological approach to investigate the relationship among online activities, IA, gender, and psychological well-being of college students.

Internet Addiction

Internet addiction is defined as "an impulse-control disorder which does not involve an intoxicant" (Young, 1999, p.21). Based on the Diagnostic and Statistical Manual of Mental Disorders (DSM; American Psychiatric Association, 1994), Young developed a validated instrument (Internet Addiction Test; 1998) and eight diagnostic criteria (1996). Of eight criteria, four components have been suggested as fundamental to IA diagnosis such as (a) excessive Internet use (feel preoccupied

with the Internet); (b) withdrawal (have negative emotions caused by stopping Internet use); (c) tolerance (use the Internet to relieve negative emotion); and (d) adverse consequences (cause social, psychological, and physical difficulties) (Northrup et al., 2015). These definition and criteria help provide a possible guideline for understanding IA and its related risk factors such as loneliness (Bozoglan, Demirer, & Sahin, 2013), depression (Cardak, 2013), online activities (Griffiths & Szabo, 2014; Northrup et al., 2015), self-control (Akin et al., 2015), online gaming (Northrup et al., 2015), psychological well-being (Cardak, 2013; Capetillo-Ventura & Juárez-Trevino, 2015), gender (Piguet et al., 2015), and suicide risk (Kurt, 2015).

Links between IA and psychosocial variables mentioned (Cardak, 2013; Chou et al., 2015; Ostovar et al., 2016; Young & Rodgers, 1998) are well documented in the existing literature. For example, in a study of 757 college students, Chen and Lin (2016) found that depression has a statistically significant and positive association with the level of IA. A high level of depression correlates with a high level of problematic Internet use. Similarly, Ayas and Horzum (2013) reported that depression and loneliness are two salient variables that predict IA. Vyjayanthi, Makharam, Afraz, and Gajrekar (2015), in an analysis of 810 Indian college students, found that the number of male students reporting IA was greater than female students. Many cross-sectional studies have attempted to examine IA and its related variables through hours spent in non-work online activities (Anderson, 2001; Capetillo-Ventura & Juárez-Trevino, 2015). However, literature suffers from lack of both established conceptual models and comprehensive understanding of IA. Thus, from an ecological perspective, the current belief is that known variables may be used to assess IA at individual, community, and societal level (Bronfenbrenner, 1994). Furthermore, an ecological perspective may provide researchers a better understanding of natural pattern and development of IA.

Theoretical Framework

Bronfenbrenner's (1977, 1979, 1994) Process-Person-Context-Time (PPCT) ecological model of human development guided the hypotheses of the current study. The hypothesis proposes that understanding IA and related online activities among college students needs to occur within a context of the system of relationships that are formed from their environment. The context of 'surrounding' is considered a critical location for interactions between college students and the environment. More specifically, the surrounding is focused on the way college students are experiencing in and being shaped by this Internet-dependent environment, ranging from their personal attributes to behaviors, identity, and learning (Evans et al., 2010).

According to Bronfenbrenner (2005), the PPCT model consists of four main components: (a) process, (b) person, (c) context; and (d) time. First, *process* refers to "particular forms of interaction between organism and environment, called *proximal process*, that operate over time" (Bronfenbrenner & Morris, 2006, p.795). In this study, *process* (or *proximal process*) refers to interactions between college students and online environment at a particular period. The researchers assessed the process interactions by examining naturally-occurring daily online activities of college students, including reading emails, watching online videos, search information, and so on. Second, *person* refers to biological and personal characteristics of individuals. The researchers assessed the characteristics of college students through demographic variables (i.e., age, time spent online) as well as level of psychological well-being (i.e., loneliness, depression). Third, context, or the environment, includes five distinct levels: (a) microsystem (immediate environment surrounding individuals), (b) mesosystem (interpersonal relations occurring between two and two more settings), (c) exosystem (environment that influences individuals, but individuals do not have direct contact), (d) macrosystem

(sociocultural context), and (e) chronosystem (development over the life course) (Bronfenbrenner, 1977, 1979, 1994). Specifically, Bronfenbrenner defined *macrosystem* as a context which "consists of overarching pattern of micro-, meso-, and ecosystems characteristics of a given culture, subculture, or other extended social structure" (1993, p.25). Here, the researchers examined the two most common macrosystems (male and female college student group), distinguished by gender, based on previous research (Renn & Arnold, 2003; Tudget et al, 2003; Tudget et al., 2009). The last component of the ecological model is time, which consistently influences and interacts process, person, and context within individual lives (Bronfenbrenner & Morris, 2006). Tudget et al (2009) recommended that *time* should be assessed in a longitudinal study and at a historical point in time. Thus, the current study does not assess the effect of time on college students due to the nature of the research design.

Purpose of Present Study

This study served as an initial examination of online activities and IA of college students in an ecological model. Based on Tudget et al's (2009) suggestion on the application of Bronfenbrenner's model, the researchers investigated process (online activities), person (age, time spent online, psychological well-being), and context (male and female college student groups). Based on extant literature and research, the study began with the proposal of the following specific hypotheses: (a) a significant gender difference exists in types of online activities engaged by participants; (b) a significant gender difference exists in IA and psychological well-being; and (c) process, person, and context have a significant impact on IA.

Method

Participants and Procedure

After receiving institutional review board approval, the researchers recruited an initial pool of 600 students randomly selected through a campus survey center at a midsize university in the Midwestern United States. Next, they used convenience sampling methods. Exclusion criteria for selection included that students (a) were not full-time, and (b) felt uncomfortable answering our surveys. Students were sent an E-mail inviting them to participate in an online study about IA and online activities when they are at both home and school. The invitation e-mail included a summary of the study and a web address linked to the survey on Qualtrics. After participants provided online assent, they anonymously responded to all of the measures (i.e., Internet Addiction Test, Homesickness & Contentment Scale) and a brief demographic. Four of all participants who completed the surveys received a $25 gift card for a local restaurant. Then, the researchers collected 178 completed surveys, with a response rate of 30%, and having removed 46 surveys from the analysis due to incomplete responses. Therefore, the final sample comprised a total of 132 students with 77 male students, 53 female students, 65 undergraduate students and 67 graduate students. Age ranged from 18 to 55 years old with the average of 26 years old.

Measures

Internet Addiction Test. The Internet Addiction Test (IAT; Young, 1998) is a 20-item scale that measures the presence and severity of Internet dependency among adults. The IAT views *Internet addiction* as an impulse-control disorder and the term *Internet* refers to all types of online activity (Young, 1998). The 20-item questionnaire measures characteristics and behaviors associated with compulsive use of the Internet that include compulsivity, escapism, and

dependency. Questions also assess problems related to addictive use in personal, occupational, and social functioning. Questions are randomized and each statement is weighted along a Likert-scale continuum that ranges from 0 = *less extreme behavior* to 5 = *most extreme behavior* for each item.

Studies have found that the IAT is a reliable measure that covers the key characteristics of problematic Internet use (Boysan et al., 2017). The test measures the extent of client's involvement with the computer and classifies the addictive behavior in terms of mild, moderate, and severe impairment. The IAT is a validated and globally renown testing instrument, known as one of the most widely used Internet addiction scales. The test has been translated in several languages including English, Chinese, French, Italian, Turkish, and Korean. Cronbach's Alpha estimated for this study is .92.

Psychological Well-Being. The Homesickness & Contentment Scale (HC; Shin & Abell, 1999) is a 20-item, self-report measure designed to assess emotional and psychological adjustment to a new culture. It includes three subscales (i.e., homesickness, loneliness, depression) that are culturally sensitive to college students. The HLD scale has a 5-point Likert-type response set, ranging from 1 (*very often*) to 6 (*never*). Researchers decided to reverse the scale for this study so that its direction would be consistent with other measures. Example of sub-scale questions include, "*I miss my friends and family back home*", "I feel lonely", and "*I feel depressed*". Subscale reliabilities for homesickness, loneliness, and depression are .71, .94, and .96, respectively (Shin & Abell, 1999). Internal consistency scores in the present sample were .95.

Type of Internet Activities. Participants were asked by researchers "*how often do you spend time on the following Internet activities?*" Participants responded to a list of Internet activities including social networks, emails, online

video, Internet searches, online gaming, work/study, use of smart phone (i.e., consistent access to the Internet on a smart phone), online news, and others (See Table 1). Response format is 1= *Never*, 2 = *Rarely*, 3 = *Sometimes*, 4 = *Quite Often*, and 5 = *Very Often*.

Time on Internet. The researchers asked, "*how many hours per day do you spend on the Internet?*" Response format ranged from 1 (*less than one hour*) to 6 (*16 hours or more*).

Data Analysis

Several data analysis procedures were utilized to answer the research questions. First, researchers examined gender difference in IA using chi-square analyses. Second, the analysis examined gender difference in IA, and psychological well-being using Multivariate Analysis of Variance (MANOVA). In addition, the researchers conducted a multiple regression line to examine the relationship between IA and ecological variables. They entered four clusters of variables representing the PPCT model into the regression analysis: (a) types of Internet activities; (b) age, gender; (c) psychological well-being; and (d) time spent online. All analyses were performed using SPSS 21.0,

Results

Internet Activities

The researchers performed a chi-square analysis on gender difference in how students spent time on different types of Internet activities. Students responded to a list of Internet activities including social networks, emails, online video, Internet searches, online gaming, smart phone, work/study, online news, and

shopping. Distributions of time spent on online activities by gender are presented in Table 1. In addition, the results of chi-square analysis and effect sizes (*Eta*) are also summarized in this table. Of the eight types of Internet activities listed on the table, watching online video is the only activity that shows significant gender difference. Significantly, more male students (53.3%) than female students (35.2%) reported that they were either often or very often watching online video [χ^2 (4) = 13.33, p = .01].

Except for watching online video, the researchers did not find significant differences in other types of Internet activities as a function of gender. However, it is worth noting that social media, online gaming, and online news were three of the Internet activities approaching statistical significance with *p*-value smaller than 0.2. Data suggested that male students tended to spend more time on playing online games and reading news than their female counterparts, while female students spend more time on social networking, though these differences were not statistically significant.

TABLE 1

Chi-Square Test of Online Activities

Types	Never	Rarely	Sometimes	Often	Very Often	χ^2	*p*	*Eta*
Social Network						6.39	0.17	0.22
Male	5.2 [a]	16.9	28.6	29.9	19.5			
	5.7	3.8	26.4	43.4	20.8			
Female								
Emails						0.45	0.92	0.22
Male	0.0	7.9	31.6	40.8	19.7			

	0.0	7.5	26.4	45.3	20.8			
Female								
Online Video						13.33	0.01	0.32
Male	6.5	10.4	29.9	32.5	20.8			
	0.0	31.4	33.3	17.6	17.6			
Female								
Search Information						0.19	0.98	0.04
Male	0.0	5.3	24.0	41.3	29.3			
	0.0	5.7	26.4	37.3	30.2			
Female								
Online Gaming						5.76	0.22	0.21
Male	5.3	9.2	15.8	27.6	42.1			
	55.8	21.2	15.4	3.8	3.8			
Female								
Smart Phone*						3.96	0.41	0.18
Male	5.3	9.2	15.8	27.6	42.1			
	3.8	11.3	7.5	20.8	56.6			
Female								
Work or study						1.95	0.75	0.12
Male	2.6	1.3	26.0	39.0	31.2			
	3.8	3.8	20.8	34.0	37.7			
Female								
Online News						6.32	0.18	0.22
Male	11.7	18.2	33.8	26.0	10.4			
	15.4	34.6	28.8	15.4	5.8			
Female								
Online Shopping						2.19	0.70	0.13

Male	6.5	36.4	39.0	13.0	5.2
	11.3	26.4	39.6	17.0	5.7
Female					

Note. [a] *percentage of response; smart phone: consistent access to the Internet on a smart phone.*

Internet Addiction and Psychological Well-Being

Researchers conducted a MANOVA to examine gender difference in Internet addiction and psychological well-being. The summarized results are found in Table 2. Multivariate tests indicated significant gender differences in Internet addiction [F (1, 1909.77) =12.81, p = .001] and homesick [F (1, 305.03) = 6.99, p =.009]. Male students reported higher Internet addiction behaviors while female students reported higher homesickness than their counterparts. There were no significant gender differences in loneliness [F (1, .65) = .020, p =.888], and depression [F (1, 34.07) = 1.35, p =.009].

TABLE 2

Means of Internet Addiction and Psychological Well-being

Types	Male		Female		*F*	*P*	*Effect*
	M	*Sd*	*M*	*Sd*			*Size*
Internet Addiction	40.5	14.5	32.7	7.7	12.81	.000	.62
Homesickness	32.8	5.6	29.7	7.8	6.99	.009	.45
Loneliness	12.0	5.8	12.1	5.6	.02	.888	.04
Depression	10.4	5.0	11.4	5.0	1.35	.247	.20

PPCT model of Internet Addiction

A hierarchical multiple regression analysis was performed to examine the PPCT model of Internet addiction (IA). Table 3 summarizes the results from the last step of the multiple regression analysis. Four variables were identified in the model as significant predictors. Results of multiple regression showed significant effect of gender (t = 4.19, p < .000), smart phone (t = 2.49, p < .014), time spent online (t = 4.19, p < .015), and depression (t = 3.23, p < .002) on IA. Among nine different types of Internet activities described in the study, consistent access to the Internet on a smart phone stands out as the stronger predictor of IA. Holding all other factors constant, male students were significantly more likely than female students to become addicted to Internet (β = .33). Approximately 26% of variance in IA is accounted for by the model. Of the four PPCT components, *context* as represented by gender variable appeared to be most predictive of IA.

TABLE 3

Significant Predictors of Internet Addiction

Variables	*b*	*S.E.*	β	*t*	*p*
Smart Phone	2.054	.827	.197	2.485	.014
Gender	8.451	2.019	.325	4.186	.000
Depression	.635	.197	.250	3.229	.002
Time spent online	2.383	.966	.194	2.468	.015

Note. $R^2 = 0.26$

Discussion

In the present study, the researchers sought to examine the relationship between online activities and Internet addiction (IA) among college students by

using a Process-Person-Context-Time mode (PPCT; Bronfenbrenner, 2005). Given that students may engage in different online activities in different settings, by using different methods, and at different times of the day, researchers decided to observe their common activities through an ecological perspective. The PPCT model allowed us to focus on the proximal processes of college students in two different macrosystems. First, this result showed there was a significant difference in types of online activities engaged between male and female college students. The finding is consistent with previous research with larger samples (Griffiths & Szabo, 2014; Jones, 2003; S, Makharam, Afraz, & Gajrekar, 2015) and joins a growing body of literature suggesting that online activities have incorporated into and have impact on everyday life of college students. For a PPCT perspective, these two social groups at the level of the macrosystem significantly differed in terms of resources, coping, and lifestyle when online activities occurred at the level of microsystem (i.e., home, school). This major difference might be in part due to gender difference (Winn & Heeter, 2009). Therefore, if there are campus-wide initiatives that increase students' awareness of Internet use from the ecosystem level (e.g., institutional policy makers) and mesosystem level (e.g., college advisors & counselors), results show that students should use the Internet appropriately and reduce their online activities.

In support of the second hypothesis, a significant gender difference was found in IA and homesickness. That is, male college students showed a higher level of Internet addictive symptoms than female students based on their everyday experience of online activities (online games). These results confirm what previous researchers (Tateno et al., 2016) have found in that males used the Internet mainly for online games, which is an important factor for IA (Tone et al., 2014), while females preferred social networking. Moreover, social networking was not found to moderate the relationships between homesickness, loneliness, and depression in female college students in the current study. Instead, females who engaged a higher

level of social networking reported more intense homesickness. The finding is different from the previous study (Guo et al., 2014) reporting positive effect of social networking on psychological well-being.

Lastly, the study findings supported the third hypothesis. In the PPCT mode, researchers can examine how environments shape IA and psychological well-being for college students in a more empirical manner. First, the PPCT model may contribute to understanding the development and behavior pattern of IA. This interpretation is responding to previous research (Carlisle et al., 2016). Moreover, we would recommend that understanding IA should occur in a proximal process through different levels (i.e., microsystem, macrosystem). Second, our findings on variables related to IA in the PPCT model are consistent with previous research in the field (Cardak, 2013; Capetillo-Ventura & Juárez-Trevino, 2015; Griffiths & Szabo, 2014; Northrup et al., 2015), thus adding additional empirical support to the impact of gender, age, time spent online, and depression on IA. Therefore, the researchers believe that these factors still play an important role in predicting IA. Moreover, this is the first study, to the researchers' knowledge, to show an ecological understanding of IA among college students.

Limitations

Although this study makes important contributions to the literature, it is necessary to discuss limitations of the study. First, the participants in this study were undergraduate and graduate students recruited in a Midwestern research university, which has the ability to prevent generalizability of the findings to other student populations such as high school students and other universities in the United States and world. Additionally, although we sent our participation letters of invitation to a pool of 600 students, the current study only has a completion rate of 22%, which is quite a bit lower than the 30% response rate. Second, the researchers

examined the two macrosystems distinguished by gender. However, looking at other macrosystems (e.g., culturally or socially different groups) could have brought additional highlights. Third, the study did not assess time, one of important factors in the PPCT model. It is possible that results would be different if this research is conducted in a longitudinal format over multiple points in time. Finally, the use of self-reported measures may limit the interpretation of the study findings.

Practical Implications for Colleg e Counselors and Future Research

Despite these limitations, the study focuses on both methodological, as well as praxis imperatives for IA to be conceptualized and understood as an ecological process. Given the complexity (Carlisle et al, 2016) of college student experiences, we offer the following tentative recommendations whose utility and appropriateness may vary depending on the individual and specific context. First, given that fact that context (i.e., gender group) and process (i.e., online activities) were found to be two crucial factors in understanding IA, exploring types of online activity at the beginning of counseling sessions might increase clients' attitudes and willingness to continue counseling in college settings. Furthermore, college counselors may design preventative strategies (e.g., informative brochures that focus on all types of online activity) for different genders and age groups. Second, selecting group members from the same gender pool would increase meaningful feedback and self-disclosure in a group counseling format that focuses on IA and relevant psychological problems. Lastly, in the culture of college students, college counselors as advocates and change agents should help increase students' awareness of IA and identify social, institutional, and cultural factors that affect students.

The findings from this study constitute a theoretical contribution to IA research by highlighting the importance of PPCT model. Future studies should

further investigate the important role that four components play in influencing college students' behaviors and attitudes related to Internet activities. First, researchers might examine how and why online activities influence psychological well-being and addictive symptoms of students using the PPCT model. A longitudinal design might more effectively reveal the direct or indirect influences of time (i.e., three-year high school, four-year college or university) on IA. Second, future studies might focus on student characteristics (e.g., socioeconomic status, race/ethnicity, family background, parental influence, low academic achievement) using a larger and more representative sample. Last, examining how family, dorm, departmental, and campus climates influence students' reaction to online activities could provide important contributions to the literature in this field.

Conclusion

This study examined the predictive nature of gender, online activities, and psychological well-being on Internet addiction (IA) from a perspective of PPCT ecological theory. We found that gender, consistent access to the Internet on a smart phone, time spent online, and depression have a significant effect on IA. This information can inform professional counselors working with college students who are more dependent on the Internet at home and school. However, this study is a starting point, and researchers should further examine the relationships among the variables with a larger and more diverse sample.

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