



Internet use and psychological well-being among college students: A latent profile approach

Ssu-Kuang Chen*

Institute of Education, National Chiao Tung University, 1001 Ta-Hsueh Rd., Hsinchu 300, Taiwan, ROC

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ABSTRACT

Studies of correlations between Internet use and psychological well-being (PW) have produced mixed results. The present study used a latent profile analysis to distinguish among populations in terms of PW profiles, and then used a multinomial logistic regression to determine how online entertainment, social use, problematic Internet use (PIU), and gender predicted each latent PW profile. The initial sample consisted of 757 Taiwanese college freshmen. Four ordered latent groups were established as follows: good PW, normative, minor-disadvantageous, and severe-disadvantageous. No latent PW profile stability was found in subsequent years: three groups (normative, minor-disadvantageous and severe-disadvantageous) emerged in Year 2, and only one group emerged in Year 3. The results indicate (a) no relationship between PW and online entertainment or gender, (b) greater PIU increased the likelihood of disadvantageous PW and decreased the probability of good PW, and (c) greater use of online resources for social purposes was related to increased probability of a participant being in the good PW group, but not associated with fewer PW problems.

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1. Introduction

Due to their unlimited access to the Internet via a range of wireless tools, today's college students tend to spend large amounts of time online, and therefore have significant potential to experience symptoms of problematic Internet use (PIU), for example, remaining online longer than intended. The impacts of Internet use on psychological well-being (PW) are receiving greater research attention, but with mixed results and conclusions (Huang, 2010). Some researchers have found positive effects in terms of social relationships (McKenna, Green, & Gleason, 2002), while others report that prolonged Internet usage increases the potential for depression, loneliness, and other psychological and emotional problems (Ceyhan & Ceyhan, 2008). Still others have gathered evidence indicating concurrent positive and negative effects of Internet usage (Campbell, Cumming, & Hughes, 2006).

Huang (2010) points out that most researchers in this area have relied on correlation analyses when reporting statistically significant relationships between PW and Internet usage, however, many have reported small effect sizes. This implies that PW may need to be treated as categorical in order to capture more complex and perhaps non-linear relationships (see also Pasta, 2009). In addition, most Internet use researchers have employed individual PW variables such as observed or latent depression and loneliness as

outcomes for their statistical analyses, with few considering the specific PW profiles of individual Internet users. When performing latent profile analyses, Internet users are classified so that all individuals in a group have similar PW profiles. Identifying latent profiles and classifying students according to their individual PW profiles is likely to provide insights to individual differences in psychological development (Magnusson & Cairns, 1996) and to support investigations of relationships between groups and Internet-use covariates.

The primary objectives for the present study were to identify latent PW profiles for a group of Taiwanese college students; to utilize the resulting information to evaluate connections between those profiles and frequency of online entertainment, frequency of social Internet use, and level of Internet dependence; and to examine the effect of gender. A cross-sectional approach was used to analyze data collected during the participants' freshman, sophomore, and junior years.

1.1. Positive impact of Internet usage on PW

Today, a large number of individuals use the Internet for significant proportions of their social needs, including support and affirmation (Sproull & Faraj, 1997). According to Caplan and Turner (2007), the anonymity and absence of non-verbal and demographic cues provide Internet users relief from emotional distress. As a result, adolescents feel more comfortable to communicate with people online. Wei (2000) asserts that the Internet facilitates

* Tel.: +886 3 5712121x58065; fax: +886 3 5738083.

E-mail address: Schen75025@gmail.com

adolescent development by deemphasizing family ties and expanding ranges of interpersonal relationships. Cotten (2008) suggests that Internet access helps students make the transition from high school to college by decreasing uncertainty, improving communication, and fostering online social interaction.

When emphasizing the positive impacts of Internet social usage on PW, Kang (2007) and Shaw and Gant (2002) claim that Internet chatting decreases loneliness and depression, increases feelings of happiness, and significantly enhances perceptions of social support and self-esteem. Kraut et al. (2002) assert that greater Internet usage leads to better communication and greater social involvement, resulting in an enhanced sense of well-being. Amichai-Hamburger and Furnham (2007) also provide evidence supporting the argument that when used appropriately, the Internet can greatly improve user quality of life and PW.

1.2. Negative impacts of Internet usage on PW

Another group of researchers considers the lack of non-verbal cues and physical contact in Internet communication potentially problematic. These researchers argue that online interactions fail to provide sufficient depth or feelings of support associated with in-person relationships, resulting in an overall decrease in well-being (Green et al., 2005). Kraut et al. (1998) assert that excessive Internet usage exerts a negative effect on face-to-face interactions by reducing time spent with friends and family members, thereby decreasing PW (see also Valkenburg & Peter, 2007). van den Eijnden, Meerkerk, Vermulst, Spijkerman, and Engels (2008) report a link between excessive use of instant messaging and depression in adolescents. In studies involving undergraduates, students using the Internet at excessively high levels have been described as lonelier (Engelberg & Sjöberg, 2004; Moody, 2001) and showing weaker development in terms of identity and intimacy (Huang, 2006). Lin and Tsai (2002) indicate that Internet usage disturbs interpersonal relationships as well as work and study functions, resulting in reduced adolescent happiness. According to Whang, Lee, and Chang (2003), Internet-dependent students report higher degrees of loneliness, depression, and compulsivity compared to non-dependent students. Evidence indicating associations between prolonged Internet use, compulsive behaviors, and psychological problems among college students has been gathered by Ko (2006) and Hwang and Yang (2004). van der Aa et al. (2009) also suggest that compulsive Internet use impacts PW.

1.3. Latent profile analysis

The development of extended algorithms supports complex computer analyses of data containing multiple variables, resulting in greater interest in latent models. In contrast to older models with parameters that only describe relationships among observed variables, latent profile models can be used to identify latent and homogeneous populations within large heterogeneous populations, with meaningful groups of individuals profiled in terms of observable variables. (For a detailed overview, see Magidson & Vermunt, 2004 and Muthén, 2001.) In educational psychology studies, latent profile analyses of achievement goal orientations have resulted in better differentiation and more accurate predictions of achievement-related outcomes (Pastor, Barron, Miller, & Davis, 2007; Tuominen-Soini, Salmela-Aro, & Niemivirta, 2008, 2011). Furthermore, in studies of teenagers, latent profile analyses have helped in the identification of depressed adolescent subtypes, thus providing usable data in support of optimum treatment and prevention decisions (Herman, Ostrander, Walkup, Silva, & March, 2007).

1.4. The present study

1.4.1. Definition of PW

According to the literature, associations exist between PW and Internet usage, yet there is no clear agreement on a definition of PW. van der Aa et al. (2009) describe depression, loneliness, and self-esteem as indicators of PW; others such as van den Eijnden et al. (2008) and Whang et al. (2003) exclude self-esteem. Niemz, Griffiths, and Banyard (2005) provide evidence indicating that problematic Internet users are more likely to have low self-esteem. In contrast, Shaw and Gant (2002) believe that PIU affects self-esteem, but not as quickly as it triggers feelings of depression and loneliness. The present study will use a definition that includes self-esteem.

1.4.2. Type of Internet use

Today's college students use the Internet for social purposes, leisure activities, information searches, and online shopping (Morgan & Cotten, 2003). There is no significant relationship between time spent using the Internet in general and life satisfaction (Green et al., 2005) or psychological adjustment (Gross, Juvonen, & Gable, 2002). Gordon, Juang, and Syed (2007) believe it is necessary to precisely determine what online activities individuals participate in (as opposed to simply measuring total time spent online). Support for this idea comes from Kim, LaRose, and Peng (2009), who note that compared to social usage, entertainment usage is more likely to result in psychological problems. In addition, Chou, Condon, and Belland (2005) advocate specific online activities such as chat rooms or online games are more important in determining PIU than other Internet usages. Therefore, type of Internet use will be considered in the present study.

1.4.3. Gender

Gender differences have been reported in terms of the relationships between PW and Internet usage (Amichai-Hamburger & Ben-Artzi, 2003; Kang, 2007). According to Amichai-Hamburger and Ben-Artzi (2003), the correlation between social use and loneliness is stronger for females than for males, while for males the relationship between leisure use and loneliness is stronger. Kang (2007) observes that female chat users tend to be happier than male chat users. More research is needed in order to determine whether gender differences exist in terms of correlations between Internet usage and PW.

1.4.4. Study purpose

The present study aimed to determine the most appropriate latent classifications for a group of Taiwanese college students based on their self-reported levels of depression, loneliness, and self-esteem. After identifying the most appropriate groups, the next step was to determine whether gender, Internet use type, and PIU are adequate predictors for the probability of an individual belonging to a specific PW category. An important motivation was to test an approach to inspecting the relationship between Internet usage and PW, one that differs from correlational analyses involving continuously distributed variables. This investigation followed the same group of undergraduates from their freshman to junior years. Although the present study examined group changes and the predictive power of covariates across 3 years, it was not the intention of the study to analyze trajectory changes longitudinally.

2. Method

2.1. Participants and instrument

A survey was used to collect data for 757 freshmen (51.1% male) entering a college in southern Taiwan in 2008. Participants were

asked to sign informed consent documents and received a small gift for completing the survey. The same sample was surveyed two more times, during the students' sophomore and junior years. The instrument was designed to elicit data on demographics (age, gender, major), Internet habits, and four scales: Self-Esteem Scale (Rosenberg, 1965), Loneliness Scale (De Jong Gierveld & Kamphuis, 1985), Beck's Depression Inventory II (Beck, Steer, & Brown, 1996), and short form PIU (Lin & Tsai, 2002). The survey items focus on two aspects of Internet usage: entertainment (e.g., watching videos, gaming) and social usages (e.g., email, instant messaging). Frequencies were coded on a scale of 0 (never) to 8 (7 days per week).

2.1.1. Self-Esteem Scale

Five of the 10 items in Rosenberg's (1965) Self-Esteem Scale were translated into Chinese. Global self-esteem was measured according to responses to five statements (e.g., "I feel I'm a person of worth") using a 5-point scale (1 = never true; 5 = always true). All items were reverse-coded, therefore higher scores indicate lower self-esteem. Cronbach's α coefficients for this scale ranged from .88 to .93 over the 3-year study period, indicating good internal consistency.

2.1.2. Loneliness Scale

A Chinese version of De Jong Gierveld and Kamphuis's (1985) Loneliness Scale was employed. The scale consists of five positive and six negative dichotomously scored items (1 = yes; 0 = no). An example of a positive item is "There are many people that I can trust completely." An example of a negative item is "I experience a general sense of emptiness." KR20 coefficients for this scale were .78 (freshman), .85 (sophomore), and .74 (junior). According to the scale's authors, the loneliness construct includes social (e.g., "There are plenty of people that I can rely on when I have problems") and emotional factors (e.g., "I often feel rejected"). Negatively worded items were reverse-coded, thus higher scores reflect higher loneliness in either social or emotional.

2.1.3. Beck Depression Inventory II

Participants were asked to report their experiences with 21 depression symptoms in Beck Depression Inventory II (BDI-II) (Beck et al., 1996) using a 1–4 severity scale. Total scores ranged from 0 to 63. Cronbach's α coefficients ranged from .88 to .91 over the 3-year study period. Byrne, Stewart, and Lee (2004) used BDI-II to measure the following three factors in a sample of Hong Kong adolescents: negative attitude, performance difficulty, and somatic elements. An item on change in sexual interest that was deleted from the Byrne et al. project was included in the present study. According to Ward (2006), the sexual interest item should load onto the somatic factor. Negative attitude symptoms include sadness, pessimism, and self-dislike; performance difficulty symptoms include loss of pleasure, loss of interest, agitation, indecisiveness, irritability, and concentration difficulty; and somatic elements include loss of energy and changes in sleep patterns, appetite, and sexual interest. Higher scores indicate a higher level of depression in negative attitude, performance difficulty, or somatic elements.

2.1.4. PIU scale

Parts of Lin and Tsai's (2002) Internet Addiction Scale were used to measure PIU behaviors such as tolerance and compulsivity. Responses to the five items were measured along a 5-point scale ranging from 1 ("never") to 5 ("always"). Example items are "Though I plan to use the Internet for just a while, I stay online longer than I originally intended" and "When I try to cut down or stop my Internet use, I feel anxious." Cronbach's α coefficients for this scale ranged from .78 to .85 over the 3 years, indicating moderate-to-high internal consistency.

2.2. Data analysis

When using multiwave panel data, it is necessary to determine whether the lost data in the subsequent data collection is "missing at random" (Graham, 2009). Independent *t*-tests were performed to examine whether the participants who completed the same survey and those who withdrew from the survey in Year 2 differed on Year 1 PW indicators (i.e., negative attitude, performance difficulty, somatic elements, social loneliness, emotional loneliness, and self-esteem). The test results showed that the former group exhibited slightly higher self-esteem than the latter group ($M = 7.50$, $SD = 4.03$, $N = 643$ vs. $M = 6.67$, $SD = 3.52$, $N = 109$; $t[750] = 2.23$, $p < .05$). No differences were noted for any of the other PW indicators. The results from a comparison of Year 1 self-esteem levels between the students with full data and the students with incomplete data in Year 3 indicated a small difference favoring the group with full data ($M = 7.55$, $SD = 3.52$, $N = 590$ vs. $M = 6.77$, $SD = 3.82$, $N = 162$; $t[750] = 2.46$, $p < .05$). Again, no differences were noted for any of the other PW indicators. Cohen's *d* values for the self-esteem *t*-tests were small (.23 and .22), therefore self-esteem was included in the analysis.

The use of different scales in the latent profile analysis required the calculation of standardized scores for all indicators. Latent PW groups were analyzed using Mplus 6 (Muthén & Muthén, 2010) with an exploratory approach. Multiple latent profile models (1-group to 5-group) were fit to determine the best-fitting model and the most appropriate number of latent groups. The statistics that are most often used to select the best-fitting model are Akaike's (1987) Information Criterion (AIC), Schwartz's (1978) Bayesian Information Criterion (BIC), and Sclove's (1987) Adjusted BIC (ABIC). In all cases, lower values indicate better model-data fit and identify a simpler model given two models with similar fit to the same data. The Vuong–Lo–Mendell–Rubin likelihood ratio test (VLMR) (Lo, Mendell, & Rubin, 2001) for comparing models of k and $k - 1$ groups produces p values that indicate whether the fit of k -group model is significantly better than that of $(k - 1)$ -group model. Mplus also calculates the probabilities of membership in each group for each individual and assigns persons to the group associated with the largest probability. Precision-of-classification indicators (e.g., entropy statistics) are used in assessing the classification utility of the model. The final model was determined by consulting the above statistics. To determine stability, PW profile analyses were conducted for data collected from the same group of students during their sophomore and junior years. After determining the most appropriate number of groups, the study investigated gender effects, and the relationships between latent groups and covariates using multinomial logistic regressions (SPSS 18.0).

3. Results

3.1. Latent constructs

Confirmatory factor analyses (CFAs) were used to examine the latent constructs for the Loneliness Scale and BDI-II. The model fit statistics shown in Table 1 were compared with cutoff criteria of a comparative fit index (CFI) > 0.90 and a root mean square error of approximation (RMSEA) < 0.10 (Browne & Cudeck, 1993; Hu & Bentler, 1999; McDonald & Ho, 2002); the scales expressed moderate model-data fit. The same was true for data collected during the second and third years. Self-esteem was examined using exploratory factor analyses because the model fit statistics were less satisfactory for CFA when error correlations were disallowed. In the factor analysis for Year 1, one factor was extracted according to the rule of eigen value > 1.0 and judgment based on a scree plot; this factor accounted for 67.1% of all item variance. Accordingly, it

Table 1
Model fit statistics for CFA (N = 757).

Scale	χ^2	df	CFI	RMSEA	SRMR/WRMR
Loneliness Scale, 2-factor	191.60***	43	0.96	0.068	1.716 (WRMR)
BDI-II, 3-factor	625.24***	186	0.90	0.056	0.043 (SRMR)

Note. CFI = robust comparative fit index; RMSEA = robust root mean square error of approximation; SRMR = standard root mean squared residual; WRMR = weighted root mean squared residual.
*** $p < .001$.

was deemed appropriate to use scale or subscale scores (standardized) as PW indicators during the next analytical stage.

3.2. Latent profiles

Model fit statistics for the proposed latent profile models are presented in Table 2. As shown, AIC, BIC, and ABIC decreased slightly after the fifth group was specified, indicating little improvement. According to the p -value from the VLMR likelihood ratio test (p -VLMR), no statistically significant difference was found between the 5-group model and the 4-group model; that is, the 5-group model did not improve model specification compared to the 4-group model. Further, the high entropy value for the 4-group model (.813) suggested a high level of precision in assigning individuals to their appropriate groups. Therefore, the 4-group model was considered as the best-fitting model.

According to their profiles (Fig. 1a), Group 1 students were normative (47%), Group 2 students were slightly PW disadvantageous (27%), Group 3 had good PW (18%), and Group 4 students were severely PW disadvantageous (7%). Therefore, the four groups were labeled as normative, minor-disadvantageous, good PW, and severe-disadvantageous. The normative and good PW groups represented the majority of freshmen and exhibited below average negative PW indicator scores. In contrast, the minor- and severe-disadvantageous groups exhibited higher negative PW indicator scores than average. The general linear model analyses and post-hoc comparisons showed statistically significant differences in average standardized scores among the four groups for all six indicators, the exception being for emotional loneliness scores between the minor-disadvantageous and severe-disadvantageous groups ($f[3,750] = 286.65, p < .001, \text{partial } \eta^2 = .53$; Games-Howell post-hoc test $p = .82$). Note that the average emotional loneliness

Table 2
Latent profile model fit statistics for Years 1, 2 and 3.

	1	2	3	4	5
Number of groups	1	2	3	4	5
Number of parameters	12	19	26	33	40
<i>Year 1 (N = 757)</i>					
BIC	12889.403	11982.399	11674.560	11495.684	11472.972
ABIC	12851.298	11922.066	11591.999	11390.896	11345.955
AIC	12833.851	11894.441	11554.196	11342.916	11287.797
p -VLMR		0.000	0.016	0.000	0.300
Entropy		0.827	0.821	0.813	0.793
<i>Year 2 (N = 647)</i>					
BIC	11059.925	10249.624	9881.453	9790.639	9724.937
ABIC	11021.826	10189.300	9798.904	9685.865	9597.938
AIC	11006.257	10164.649	9765.172	9643.052	9546.043
p -VLMR		0.016	0.001	0.178	0.697
Entropy		0.869	0.852	0.793	0.840
<i>Year 3 (N = 592)</i>					
BIC	10031.544	9335.231	9065.144	8928.481	8839.774
ABIC	9993.448	9274.912	8982.602	8823.717	8712.786
AIC	9978.942	9251.945	8951.173	8783.825	8664.433
p -VLMR		0.223	0.363	0.354	0.526
Entropy		0.864	0.889	0.840	0.835

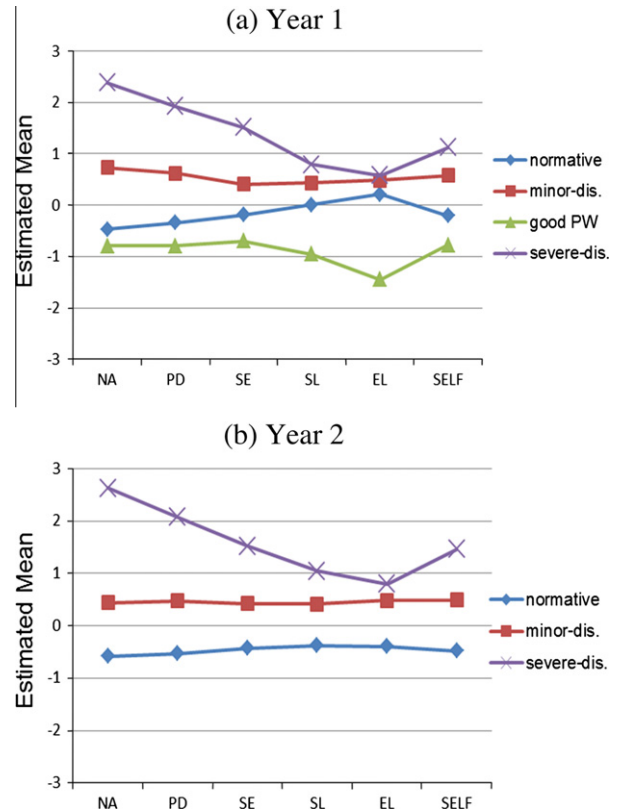


Fig. 1. Latent profiles based on negative attitude (NA), performance difficulty (PD), and somatic elements (SE), social loneliness (SL), emotional loneliness (EL), and self-esteem (SELF) for individual groups (Year 1 vs. Year 2).

score of the good PW group was lower than those of the other groups (see Fig. 1a). Overall, the good PW and severe-disadvantageous groups were only different quantitatively in terms of all six indicators. Students in the severe-disadvantageous group scored particularly high on negative attitude, whereas those in the good PW group scored relatively low on emotional loneliness.

Latent profile analyses were also conducted for the Year 2 data; the model fit statistics are shown in Table 2. According to the p -VLMR data, the 4-group model did not improve model specification compared to the 3-group model, thus making the latter the most

appropriate latent profile model. The majority of sophomores were in Group 1 (58%), followed by Groups 2 (35%) and 3 (7%). According to their profiles, these groups were labeled as normative, minor-disadvantageous, and severe-disadvantageous (Fig. 1b). The results from general linear model analyses and post-hoc comparisons indicated statistically significant differences among the three groups for all six indicators. The minor-disadvantageous and severe-disadvantageous group profiles of sophomores were similar to those of freshmen. The good PW group and normative group identified in the freshman year became homogeneous in latent profiles in the second year.

The Year 3 results indicated that the 1-group model exhibited the best model-data fit; that is, the PW profile of the junior students was homogeneous. The model fit statistics are shown in Table 2.

3.3. Covariates

Given that the 4-group model exhibited a better model-data fit, providing meaningful PW classifications for the freshmen students, the next task was to examine the connection of covariates with the four profiles. The groups were regressed on gender (binary), frequency of social and entertainment Internet usage (continuous), and PIU (continuous). The interaction of gender and frequency of social Internet usage was also examined, based on previous findings of a gender difference in the correlation between social Internet usage and PW (Amichai-Hamburger & Ben-Artzi, 2003; Morgan & Cotten, 2003). The multinomial logistic regression results are presented in Table 3. The normative group served as the reference group. According to the non-significant logistic regression coefficient results, females and males were equally likely to be in any of the four groups. No significant relationship of entertainment usage with PW groups was found.

For each point of increase in social use frequency, the odds of being in the good PW group increased from 1.0 to 1.160 when the other covariates were held constant (Table 3). Students at the high end of social use frequency were more likely to be in the good PW group than the normative group. This result was consistent for both males and females, as the interaction of gender and social use was not significant. As shown in Fig. 2, the probabilities of being in

the good PW group changed when social use frequency increased, regardless of gender.

Students with higher PIU values were more likely to be in the minor- or severe-disadvantageous PW groups than the normative group. As shown in Table 3, with all other covariates held constant, for each point increase in PIU score, the odds of being in the minor-disadvantageous group increased from 1.0 to 1.498, the odds of being in the good PW group decreased from 1.0 to 0.499, and the odds of being in the severe-disadvantageous group increased from 1.0 to 2.325.

Next, the relationships between each of the three PW groups and the covariates were examined for the sophomore year participants. The multinomial logistic regression results indicated that PIU was associated with the likelihood of being in the minor- or severe-disadvantageous group compared to the normative group. None of the other covariates were related to the probability of being in any of the non-normative PW groups. Because there was only one latent profile group among the Year 3 students, associations with covariates were not analyzed.

4. Discussion

4.1. Latent PW profiles

There was a clear order of PW groups according to the 4-class model for the freshman year students as follows: good PW, normative, minor-disadvantageous, and severe-disadvantageous. Individuals in the severe-disadvantageous group displayed relatively high scores on nearly all of the negative PW indicators, particularly depression. Members of the good PW group exhibited the lowest negative psychological indicator scores. The largest difference between the good PW and severe-disadvantageous groups was in negative attitude. Students with severe PW disadvantages were more pessimistic than their good PW counterparts. The data also indicate that students with good PW had relatively low emotional loneliness scores compared to all other students, implying that college freshmen with good PW enjoy quality relationships with friends and family despite entering a new environment.

However, the data also suggested that important changes in latent profiles occurred during the second year, with the four groups being reshuffled into three as follows: normative,

Table 3

Logistic regression coefficients and odds ratios for 4-group model with gender, entertainment/social use frequency, and PIU as covariates for Year 1 (normative group = reference group).

Group	Effect	β	SE	Wald's χ^2	Odds ratio
Minor-disadvantageous	Intercept	-1.188	.427	7.753	
	Gender (female)	-.498	.560	.791	.607
	Entertainment use	.034	.040	.695	1.034
	Social use	-.071	.052	1.859	.931
	Gender \times social	.126	.086	2.160	1.134
	PIU	.404***	.140	8.378	1.498
Good PW	Intercept	-1.173	.568	4.259	
	Gender (female)	.189	.747	.064	1.208
	Entertainment use	.070	.047	2.181	1.072
	Social use	.149**	.069	4.602	1.160
	Gender \times social	-.012	.110	.013	.988
	PIU	-.695***	.196	12.527	.499
Severe-disadvantageous	Intercept	-2.935	.728	16.238	
	Gender (female)	-.053	.898	.003	.949
	Entertainment use	-.076	.067	1.295	.927
	Social use	-.081	.074	.740	.923
	Gender \times social	.088	.140	.400	1.092
	PIU	.844***	.214	15.566	2.325

Note. Cox and Snell $R^2 = 0.083$; Nagelkerke $R^2 = 0.091$; McFadden $R^2 = 0.036$.

** $p < .01$.

*** $p < .001$.

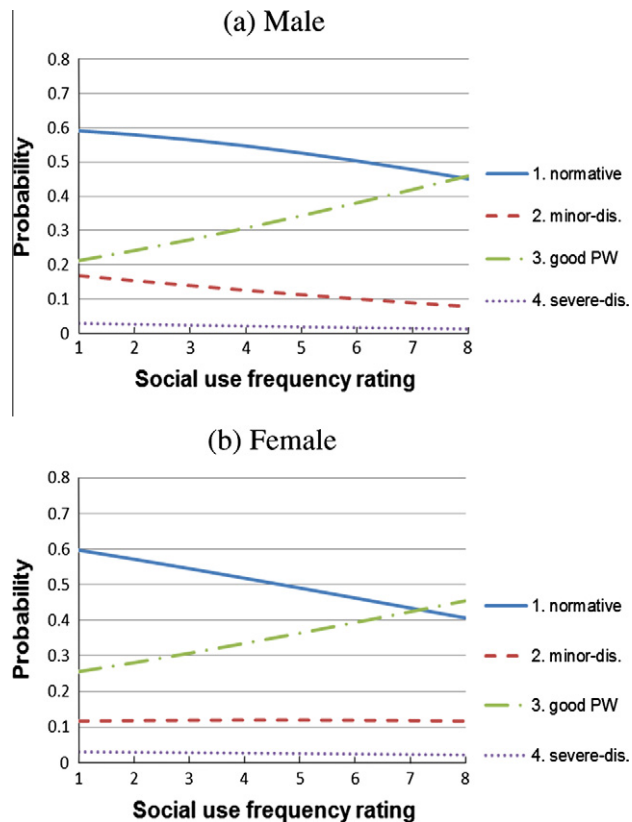


Fig. 2. Estimated probability of PW group membership in light of increased social use (PIU held at 0) for Year 1 study participants (male vs. female).

minor-disadvantageous, and severe-disadvantageous. Only one latent group was identified for the third-year students. Students with either complete or missing data during the successive data collection period differed only slightly in terms of self-esteem, and “missing at random” was ensured in the present study. Therefore, structural changes in latent profiles over time may have been due to their adaptability to life in college, resulting in homogeneous PW states. More research is required to identify the reasons for these changes.

4.2. Gender, entertainment, social usage, and PIU

According to the present study, high-PIU students were more likely to be in the severe- and minor-disadvantageous PW groups, and low-PIU students were more likely to be in the good PW group. Similar results were found for the second-year students, although the nature of the latent groups differed. This result confirms van der Aa et al.’s (2009) finding that PIU exerts the strongest and most direct effect on depression, self-esteem, and loneliness among their study participants. The present study also provides support for Whang et al.’s (2003) results that individuals who are strongly addicted to the Internet are more likely to be lonely and depressed than those who are less strongly addicted.

According to the first-year data, the logit of online social use frequency for the good PW group indicated that the students who used the Internet primarily for social purposes were more likely to be in the good PW group than the normative group. This result was not observed for the severe- or minor-disadvantageous PW groups; that is, online social use did not decrease the probability of being in the disadvantageous PW groups. This result partially supports claims made by Kang (2007) and Shaw and Gant (2002) that social use mitigates negative feelings such as loneliness and

depression. The good PW group had relatively low emotional loneliness compared to all other PW indicators, implying that social usage of the Internet is associated with decreased emotional loneliness. Since a good PW group did not emerge during the second year, the significant association with social usage disappeared.

As Amichai-Hamburger and Ben-Artzi (2003) note, correlations between loneliness and social Internet usage have been found for females, but not for males. In contrast, Morgan and Cotten (2003) argue that email usage decreases depression in males but not in females. They suggest that because females are more active in communication, the effects of e-mail on depression are less obvious for them. Findings from the present study indicate that female and male students were equally likely to be in any PW group, and that the relationship between social Internet usage and PW did not differ by gender. This result supports Subrahmanyam and Lin’s (2007) finding of no gender difference in the relationship between loneliness and Internet usage, and van den Eijnden et al.’s (2008) finding of no moderating effect of gender in predicting PW from Internet communication usage.

The findings also indicate that greater use of the Internet for entertainment purposes was not associated with the higher probability of being in any non-normative PW group during Years 1 and 2. However, the entertainment category was not broken down into specific types such as gaming and non-gaming, which is important in light of previous research findings of a negative relationship between gaming and PW (Anderson & Bushman, 2001; Mannell, Zuzanek, & Aronson, 2005).

5. Conclusion, implications and future research

Researchers of human behavior search for theoretical and statistically meaningful patterns among multiple co-occurring variables. Person-centered approaches (e.g., latent profile analyses) use configurations of multiple variables to identify quantitative differences in profile level, qualitative differences in profile shape, or both (Marsh, Lüdtke, Trautwein, & Morin, 2009). This allows researchers to conceptualize PW as a holistic latent construct with complex relationships among depression, loneliness, and self-esteem. The present study differs in that detailed profiles of depression and loneliness were created and broken down into negative attitude, performance difficulty, and somatic elements measures (depression) as well as social loneliness and emotional loneliness measures (loneliness). Therefore, the latent profile results presented in this paper represent a unique contribution to the understanding of PW among Taiwanese undergraduates, facilitating risk detection among students and practical implications for treatment and prevention. PW profile identification may also support adjustments in interventions to best address the needs of specific groups. In the present study, negative attitude was identified as the most discriminated negative indicator of PW. According to Beck (1993), the way individuals think about a problem can cause stronger negative psychological states than the problem itself. Negative attitudes and strong pessimistic beliefs about the ability to complete tasks are strong obstacles to academic success; individuals with negative attitudes are more inclined to dislike themselves and to lack the ability to enjoy normal day-to-day activities (Morrison & O’Connor, 2004). It is hoped that the findings of the present study will support efforts to identify individuals suffering from negative attitudes so that useful interventions can be enacted.

This study also contributes to the literature by providing a complex analysis of the relationship between Internet usage and PW beyond a linear correlational relationship. Classifying students using latent profile analyses plays a critical role in such an analysis for two reasons. First, latent profiles provide a more complete

picture by connecting all individual indicators rather than considering them separately. Second, by treating PW as categorical instead of continuous, the non-linear relationships can be detected. The study found that the relationship between social use of the Internet and PW differed across PW groups. Online social usage did not decrease the probability of study participants having psychological problems, however, students who used the Internet for social purposes were likely to be psychologically healthy. Therefore, the findings suggest that online social usage should be encouraged (or at least not discouraged) if an individual does not exhibit high PIU. However, professional intervention is called for when a student is clearly in a severe-disadvantageous PW category. The study results also confirm that PIU is significantly associated with negative PW, as reported by Ko (2006) and van der Aa et al. (2009). These results suggest that interventions in this population should focus on reducing PIU. Young (2007) has discussed several promising long-term approaches to reducing and managing PIU, especially cognitive behavioral interventions.

The study purpose was not to track changes in PW group membership over time, but to identify developmental changes in the PW construct. Since an exploratory approach was used, theoretical hypotheses were neither proposed nor tested. Future researchers may be interested in constructing a latent transit model for students across all four undergraduate years to produce a complete picture of how college students develop in terms of PW and the effects of Internet usage over longer time periods. In addition, a larger and more representative sample would support an effort to generalize the current findings to all Taiwanese college students.

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