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Smartphone addiction: psychological and social factors predict the use and abuse of a social mobile application

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ABSTRACT

As smartphones have been revealed as hosts for addictive behaviors, many studies have focused on the relationship between psychological factors and the generalized use of smartphones without considering the wide range of activities involved. By collecting data from a large sample, this study investigated the relative contribution of both psychological and social factors in predicting different usage levels of the social mobile application (app) LINE, which is very popular in Asia. The results indicated that subjective norms and social identity predicted positively for individuals in the addictive use cluster, while self-esteem and social skills predicted negatively. The predictive power of self-esteem and life satisfaction was positive for the heavy use of LINE with no serious problems while that of subjective norms was negative. No single factor was associative with the ordinary use. These results highlight that people deficient in self-esteem and social skills, but eager to obtain others' approval and a sense of belonging, are more inclined to develop an addiction to this app. Those who use LINE heavily with no serious problems are highly satisfied with life; they do not mind acting in accordance with others' expectations, because they have high self-esteem. Ordinary users are not influenced psychologically or socially. This research not only underscores the importance of considering a specific form of application to understand the smartphone addiction, but also advances the knowledge of social contributors in this issue.

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1. Introduction

Dramatic progress has been achieved in the latest generation of mobile phones (i.e., smartphones) during the past decade. For some individuals, smartphones are used for instrumental or leisure purposes, whereas for others, their use is attributed to an emotional attachment to social networking applications (apps). Early studies on mobile phones have emphasized their positive applications including health promotion, education, communication, and global connectivity (Green & Bavelier, 2008; Heather & Kershaw, 2010). However, in recent years, extensive research has been conducted to identify and analyze the dysfunctional use of smartphones, and accumulating evidence reveals that the overuse of smartphones is linked to several negative outcomes such as subjective distress and psychopathological symptoms that were traditionally associated with substance-related

addictions (Billieux, Maurage, Lopez-Fernandez, Kuss, & Griffiths, 2015; Kuss, Griffiths, Karila, & Billieux, 2014; Thomée, Harenstam, & Hagberg, 2011). Since this subject has appeared in the literature of psychiatric and clinical psychology, the problematic use of smartphones has been conceptualized as a disorder and an addictive behavior (Billieux, 2012; Billieux, Philippot, et al., 2015; Lopez-Fernandez, 2017).

The overuse of digital technologies has been recognized as a public health concern (WHO, 2014), but there is an important debate relating to whether this concern constitutes the generalized use of a certain technology (i.e., a device, such as a computer or smartphone) or a specific activity (i.e., particular types of online content such as online games or social networking services). Griffiths and Szabo (2014) distinguished between addiction to the Internet (i.e., as a medium) and to a specific online activity (i.e., content). This debate surrounding Internet addiction is now related to smartphone use as well (Lopez-Fernandez, 2017; Lopez-Fernandez, Kuss, Griffiths, & Billieux, 2015), because most research on excessive smartphone use has commonly focused more on generalized use, and less on specific forms. Without a thorough understanding of the excessive use of particular activities or mobile apps, comprehending the factors influencing smartphone addiction is difficult. Social networking apps are the most widely used and fastest growing among the various uses of smartphones and, as shown by the data, the top two popular apps in the world are WhatsApp and Facebook Messenger (Richter, 2016). In Taiwan and many Asian countries, LINE is the most used app, ahead of Messenger, WeChat, and Instagram (The China Post, 2017).

Following the conception of the cognitive-behavioral model of problematic Internet use (PIU), which states that psychosocial problems increase the likelihood of individuals experiencing cognitive or behavioral symptoms of generalized PIU (Davis, 2001), many studies have empirically explored the relationship between psychological factors and the excessive use of smartphones or social media (Bian & Leung, 2015; Pittman & Reich, 2016; Yuchang, Cuicui, Junxiu, & Junyi, 2017). Nevertheless, the main limitations of previous research in this field have been that insufficient attention has been paid toward the role of social factors. Social influence is about the changing of individuals' thoughts, feelings, attitudes, or behaviors that originate from interactions with others (Rashotte, 2007), and has been highlighted as one determinant of human behavior in information system studies (Chou, Wang, & Tang, 2015; Wang, Meister, & Gray, 2013). Social influence theory offers a complementary perspective on the use of information technologies. Given that social focus is an important characteristic of social mobile apps, the influence of social factors should not be ignored. Therefore, integrating the concept of the cognitive-behavioral model and the social influence theory, this study investigated the relative contribution of these two facets in predicting the different usage levels of the social mobile app LINE. This study contributes significantly to the literature by extending an existing theoretical model to examine a new phenomenon. In addition, the findings will be beneficial for the prevention of specific addictions in individuals.

2. Literature review

2.1. Smartphone ownership and the social mobile app LINE

As a twenty-first century icon, smartphones provide an 'all-in-one' convenient service and expand the spectrum of information processing and communication regarding various

business, leisure, and social activities through wireless Internet accessibility and numerous types of mobile apps (Tu, Yuan, & Archer, 2014; Zhang, Zhu, & Liu, 2012). According to recent data, 32% of the world's population used a smartphone in 2017, up from 21.6% in 2014, with a penetration rate of approximately 65% in the largest regional market, Western Europe (Statistia, 2018). With a penetration rate of 75.8%, Taiwan has one of the highest levels of smartphone ownership in the world (SmartM, 2017).

Mobile apps are computer programs designed to run on smartphones or other mobile devices (e.g., tablets). Mobile apps are estimated to generate approximately US\$189 billion in revenue by 2020. As of March 2017, 2.8 million apps were available in the Google Play Store and 2.2 billion were available in Apple's App Store, the two leading app stores in the world. Moreover, social messaging apps have experienced a surge in popularity not only in the United States, but also worldwide. WhatsApp, the leading social mobile app in the world, has 1.2 billion monthly active users as of 2017 (Statistia, 2017a).

The app LINE, released initially in Japan, has the strongest user base in Asia apart from its home country, in countries such as Taiwan, Thailand, and India. LINE was developed initially by engineers at NHN Japan as an emergency solution for internal company use following the devastating Tōhoku earthquake in 2011. Later in the same year, it was released to the public. The main functions of LINE include exchanging text, photo, audio, and video messages; engaging in free Voice over Internet Protocol conversations and video conferences; and interacting with both personal connections and public accounts (Statistia, 2017b). In Taiwan, 80.9% of local smartphone owners use social apps every day, and LINE has become the most popular app in Taiwan (The China Post, 2017). The heavy dependency of some users on this app caused the concern that LINE use has become a modern anxiety pathogen, especially when messages are displayed to the sender as having been read by the receiver and no response is given back to the sender (Knowing, 2017; Yamana, 2017). Therefore, conducting research on this topic for gaining a deeper understanding is warranted.

2.2. Concerns for the overuse of social networking media

Smartphones allow individuals to participate in a wide range of online activities such as surfing the web, playing video games, or engaging in social networking. Although addiction to online games was included in the Diagnostic and Statistical Manual of Mental Disorders as a tentative disorder (American Psychiatric Association, 2013), social media addiction as a new disorder has not been recognized. Notably, social media has become a global phenomenon, because the number of worldwide users continues to grow and is expected to reach approximately 2.95 billion people in 2020, almost a third of the Earth's population (Statistia, 2017c). In addition, a growing body of evidence indicates that the excessive use of social media is a growing mental health concern (Bányai et al., 2017; Pantic, 2014; Ryan, Chester, Reece, & Xenos, 2014), and that social media platforms can cause psychological disorders, particularly among adolescent smartphone users (Van den Eijnden, Lemmens, & Valkenburg, 2016). As argued by Sherman and Smith (n.d.), 'the world has gone mobile, and so has social media engagement'.

Studies on social networking addiction have focused on Facebook, and most have used a sample composed of Western individuals. The results of these studies suggest that Facebook addiction is linked to personality (Andreassen, Pallesen, & Griffiths, 2017) and

motivation (Marino et al., 2016a), as well as certain psychological variables such as depression (Shensa et al., 2017), self-esteem, and life satisfaction (Błachnio, Przepiorka, & Pantic, 2016). The Bergen Facebook Addiction Scale, specifically developed for assessing the addictive use of Facebook (Andreassen, Torsheim, Brunborg, & Pallesen, 2012), has been utilized by many of the aforementioned studies. Although the scale has demonstrated reliability and validity, a generic instrument capable of capturing all social networking apps, as opposed to evaluating the problematic use of one specific social networking site only (e.g., Facebook), has been called for (Griffiths, Kuss, & Demetrovics, 2014). The Social Media Disorder (SMD) scale was thereafter developed (Van den Eijnden et al., 2016). However, understanding the nature and effects of social networking apps still requires the examination of individual platforms (Frost & Rickwood, 2017).

2.3. Psychological factors for smartphone and social media addiction

A growing body of literature has explored the effect of psychological factors such as depression, loneliness, anxiety, stress, self-esteem, and life satisfaction on smartphone or social media addiction. A recent review study identified 23 academic papers examining the relationship between problematic smartphone use and psychopathology (Elhai, Dvorak, Levine, & Hall, 2017). Across the literature, depression, anxiety, and stress has been consistently related to problematic smartphone use. However, self-esteem has been inconsistently related. This conflict has also been revealed in studies focusing on Internet addiction, and this can be attributed to the two competing hypotheses formulated as ‘social compensation’ versus ‘social enhancement’ (Kraut et al., 2002; Zywicka & Danowski, 2008). People with low self-esteem often compensate for their problems in social relations by using the Internet. People with high self-esteem receive strong gratification from making friends through the Internet, although they already have a large number of friends in the real world. Additionally, a review study revealed 65 academic papers examining the relationship between Facebook use and mental problems (Frost & Rickwood, 2017). Facebook addiction was reported to be significantly correlated with lower self-esteem (Andreassen et al., 2017; Błachnio et al., 2016).

Studies have also reported inconsistent results regarding the effect of life satisfaction on the excessive use of Facebook and smartphones. Numerous studies have indicated a positive relationship between life satisfaction and the level of Facebook use (Elphinston & Noller, 2011; Grieve, Indian, Witteveen, Tolan, & Marrington, 2013; Valenzuela, Park, & Kee, 2009). By contrast, a negative association was revealed for both extraverts and individuals with mental disorders who replaced traditional social interactions with online engagements (Chan, 2014). Regarding smartphone addiction, no significant relationship was found with life satisfaction (Lepp, Barkley, & Karpinski, 2014; Samaha & Hawi, 2016). In summary, self-esteem and life satisfaction are two factors that often result in conflicting conclusions regarding the effects of many psychological factors on problematic smartphone and Facebook use.

2.4. Social aspect of smartphone and social media use

Because the relationship between psychological factors and Internet addiction has often been identified, research on smartphone and social media addiction has accordingly

focused on these psychological aspects. The influence of social factors has rarely been studied.

Notably, social influence theory has been adopted by researchers to examine how social influence factors predict participation intention and, in turn, actual behavior in virtual communities (Dholakia, Bagozzi, & Pearo, 2004; Zhou, 2011). Social influence theory states that an individual's behavior is affected by three social processes: compliance (normative influence from others' expectations), internalization (congruence of one's goals with others' goals), and identification (conception of one's self in terms of the group's defining features) (Kelman, 1974). These processes may be operationalized as subjective norms, group norms, and social identity (Shen, Christy, Matthew, & Chen, 2011; Zhou, 2011). Subjective norms mean that a person acts in accordance with the opinions of significant others in order to obtain their support or approval. Group norms indicate that a person accepts group influence because of the similarity between his or her goals and those of other group members. Social identity refers to a person's sense of belonging and efforts to maintain a satisfying or self-defining relationship with other people in the group.

Social variables were observed to be associated with perceived frequency of Facebook use and problematic Facebook use in different ways among adolescents (Marino et al., 2016b). Subjective norms were related to problematic Facebook use rather than perceived frequency of Facebook use. Group norms were associated with both uses. Social identity affected the frequency of use but did not result in problematic engagements. In a study conducted to determine the factors facilitating mobile commerce adoption, social influence variables were reported to be an important facet in continuous usage intention for social mobile apps (Wang & Chou, 2016). Besides, Caplan's (2010) social skill model of generalized PIU revealed that a social skill deficit predisposes an individual to develop a preference for online interactions, which further leads to problematic use. The literature suggests that social skills and social influence variables should be taken into consideration when the addictive use of social mobile apps is involved.

The objective of this study was to examine the association of psychological factors (self-esteem and life satisfaction) and social factors (social skill, subjective norms, group norms, and social identity) with the addictive use of the social mobile app LINE. In addition, this study investigated the relative contribution of these two constructs in predicting different levels of LINE use. Based on the discussion, we posed three hypotheses and one research question.

H1. Psychological factors are negatively related to LINE addiction.

H2. Social skills are negatively associated with LINE addiction.

H3. The social influence variables are positively associated with LINE addiction.

RQ. How do psychological and social factors differ in predicting different levels of LINE use?

3. Method

3.1. Participants and procedure

Because statistics indicate that people in the age group of 18–24 years are more likely to use mobile apps than those in any other group (Business 2 Community, 2017), a large

convenience sample of 2000 late adolescents and young adults was recruited from three universities in Taiwan. The only condition one had to meet for participating in this study was having a LINE account. All responses to the online instruments (outlined as follows) were completed during a regular school day in classrooms and in the presence of research assistants. The participants were 2000 LINE users (50.9% were women). The mean age of the sample was 20.52 years, $SD = 1.53$, with a range from 17–23 years.

3.2. Instruments

The online survey comprised 44 items that were grouped into the following eight subscales:

3.2.1. LINE intensity and LINE addiction scales

Two scales were applied to assess LINE use. The LINE intensity scale comprising seven items, adapted from the *Facebook Intensity Scale* (Blachnio et al., 2016; Ellison, Steinfield, & Lampe, 2007), was used to measure the amount of time spent using the LINE mobile app. With each of the nine items adapted to the LINE context, the *SMD Scale* (explained in the Literature Review) was used to measure the consequences of LINE use. Each item represented one of nine core elements of addiction (preoccupation, tolerance, withdrawal, persistence, displacement, problems, deception, escape, and conflict). As LINE has developed into a social network with features similar to Facebook, such as a timeline where users can update their status, and other functions to facilitate both personal and public interactions, the scale for Facebook or social media in general would be applicable to LINE. It was confirmed with the high Cronbach α reliability levels of the adaptive scales being .93 and .92 respectively.

3.2.2. Self-esteem

The Rosenberg Self-Esteem Scale was applied to provide an overall evaluation of a person's self-esteem (Rosenberg, 1965). The 10-item measurement was adapted into a 5-point Likert scale. The internal consistency of this scale was .81.

3.2.3. Life satisfaction

This variable was measured through the *Satisfaction with Life Scale* (Diener, Emmons, Larsen, & Griffin, 1985). It consists of five items for assessing cognitive self-judgment relating to satisfaction with one's life. The reliability of the scale was .81.

3.2.4. Social skills

The *Social Skill Self-Efficacy Scale* was applied to evaluate the confidence of behavioral aspects in social situations (Grieve, Witteveen, Tolan, & Jacobson, 2014). In this study, the scale comprised five items, with the Cronbach α value being .82.

3.2.5. Subjective norms/group norms/social identity

Three social influence variables were assessed with items adapted to the context of LINE use from previous studies (Dholakia et al., 2004; Marino et al., 2016b; Wang & Chou, 2016). Subjective norms were measured using two items, group norms were evaluated

using two items, and social identity was assessed using four items. The Cronbach α reliability values of the three scales were .92, .83, and .88, respectively.

All items were rated using a 5-point scale ranging from 1 ('definitely disagree') to 5 ('definitely agree'), with a higher score indicating a higher strength of the factor. The only exception was the question that asked participants the average time spent on LINE per day, with the options being 1 = 'less than 1 hour,' 2 = '1–2 hours,' 3 = '2–3 hours,' 4 = '3–4 hours,' and 5 = 'more than 4 hours.'

3.3. Data analysis

The data were analyzed with Pearson product-moment correlation coefficients to examine the associations between computed variables and LINE addiction. In order to examine different levels of LINE use, *k*-means cluster analysis was performed for the two variables, LINE addiction and LINE intensity. A cluster analysis involves dividing data into clusters so that objects in the same group are more similar to each other than those in other groups, and *k*-means is a widely used clustering technique (Codeahoy, 2017). Hierarchical multiple regression analyses were conducted to examine the degree to which psychological and social factors can predict different levels of LINE use based on the results of the *k*-means cluster analysis.

4. Results

4.1. Descriptive statistical analysis and correlation analysis

Table 1 presents data on the measured variables, including the descriptive statistics, distributions, and correlation coefficients. A normal distribution test of the variables indicated that all skewness and kurtosis measurements were between 1 and -1 ; therefore, the normality assumption was justified. Subjective norms and social identity were positively associated with LINE addiction. However, self-esteem, life satisfaction, social skills, and group norms were negatively associated with LINE addiction.

To examine different levels of LINE use, *k*-means cluster analysis was performed for the two variables LINE addiction and LINE intensity. Three clusters were identified in this analysis (Table 2). Cluster 1 consisted of 706 participants characterized by a high level of both LINE addiction ($M = 3.96$, $SD = 0.17$) and LINE intensity ($M = 3.86$, $SD = 0.32$);

Table 1. Descriptive statistics and correlation coefficients between study variables.

	1	2	3	4	5	6	7	8
1. LINE addiction	1.00							
2. LINE intensity	.76**	1.00						
3. Self-esteem	-.10**	.17**	1.00					
4. Life satisfaction	-.32**	-.23**	.24**	1.00				
5. Social skill	-.10**	.00	.22**	.42**	1.00			
6. Subject norms	.08**	.22**	.68**	.26**	.24**	1.00		
7. Group norms	-.06**	.05*	.19**	.53**	.46**	.19**	1.00	
8. Social identity	.09**	.20**	.49**	.36**	.25**	.50**	.27**	1.00
Mean	2.93	3.01	3.28	3.24	3.46	3.43	3.44	3.55
Standard deviation	.89	.79	.62	.60	.54	.65	.56	.47
Skewness	-.26	-.29	-.62	-.20	-.32	-.63	-.33	-.58
Kurtosis	-.61	-.33	.71	.22	.44	.98	.46	.10

* $p < 0.05$; ** $p < 0.01$.

Table 2. Result of *k*-means cluster analyses.

	Cluster 1 (<i>n</i> = 706)		Cluster 2 (<i>n</i> = 925)		Cluster 3 (<i>n</i> = 369)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
LINE intensity	3.86	0.32	2.74	.41	2.08	.57
LINE addiction	3.96	0.17	2.61	.35	1.79	.55

this group was labeled ‘addictive use of LINE (AUL).’ Cluster 2 consisted of 925 participants with a medium level of LINE addiction ($M = 2.61$, $SD = 0.35$) and LINE intensity ($M = 2.74$, $SD = 0.41$); this group was labeled ‘heavy use of LINE (HUL).’ Cluster 3 consisted of 369 participants with a low level of both LINE addiction ($M = 1.79$, $SD = 0.55$) and LINE intensity ($M = 2.08$, $SD = 0.57$); this group was labeled ‘ordinary use of LINE (OUL).’ Notably, the addicted and heavy users constituted over 80% of the sample.

4.2. Regression analysis

A hierarchical regression analysis was conducted to examine the degree to which psychological and social factors can predict different levels of LINE use. Table 3 presents the regression analysis results. Gender and age are presented in Block 1, explaining 2.2% of the variance for AUL ($F_{2,703} = 7.84$, $p < .001$) and 1.8% of the variance for OUL ($F_{2,366} = 3.31$, $p < .05$), but they had no significance in explaining the variance for HUL. Age contributed significantly to AUL ($\beta = .015$, $p < .001$) and OUL ($\beta = -.055$, $p < .05$). After demographics were controlled for, psychological factors and social factors, entered in Block 2, explained 20.9% of the variance for AUL ($F_{6,697} = 27.46$, $p < .001$) and 3.7% of the variance for HUL ($F_{6,916} = 5.60$, $p < .001$), but they had no significance in explaining the variance for OUL. After demographics were controlled for, social identify ($\beta = .100$, $p < .05$) contributed the most for AUL, followed by subjective norms ($\beta = .087$, $p < .05$), social skills ($\beta = -.052$, $p < .001$), and self-esteem ($\beta = -.043$, $p < .01$). For HUL, subjective norms ($\beta = -.099$, $p < .001$) contributed the most, followed by self-esteem ($\beta = .079$, $p < .001$), and life satisfaction ($\beta = .071$, $p < .01$). For OUL, no significant predictive power was demonstrated by any of the psychological and social factors.

5. Discussion

Smartphone innovations have engendered considerable lifestyle changes that some critics believe to be leading us into a scenario of being ‘alone together’ (i.e., getting together virtually by technology but being physically alone due to heavy dependence on technology, Turkle, 2013); accordingly, in some instances, such as the use of social mobile apps, such changes may result in the development of addictive usage patterns. The main aim of this study was to examine an individual’s psychological and social characteristics in different usage levels of social mobile apps.

To obtain insight into the effects of psychological and social factors, LINE use was divided into three clusters, ranging from normal to excessive usage patterns, by conducting a cluster analysis for the two variables LINE addiction and LINE intensity. People in the OUL group were determined to use the app in a normal way with a minimum level of addiction and engagement. The HUL group comprised individuals who often depend heavily on LINE but without serious problems. Those in the AUL cluster were observed to over engage in LINE and to have serious problems arising from this addiction.

Table 3. Predictors for different levels of LINE use.

	AUL (<i>n</i> = 706)	HUL (<i>n</i> = 925)	OUL (<i>n</i> = 369)
Step 1			
Gender (0 = F, 1 = M)	.003	.029	.042
Age	.015***	.005	-.055*
<i>R</i> ²	.022***	.002	.018*
Step 2			
Gender	.006	.015	.037
Age	.011**	.003	-.053*
Self-esteem	-.043**	.079***	-.068
Life satisfaction	-.031	.071**	-.006
Social skills	-.052***	-.024	.076
Subjective norms	.087*	-.099***	.089
Group norms	.004	-.034	-.099
Social identity	.100*	-.019	-.008
<i>R</i> ²	.209	.037	.032
Adjusted <i>R</i> ²	.200	.029	.011
<i>R</i> ² change	.187***	.035***	.014

p* < 0.05; *p* < 0.01; ****p* < 0.001.

5.1. Implications

The Pearson correlations indicate that self-esteem was negatively associated with LINE addiction, which agrees with the findings of studies on Facebook (Andreassen et al., 2017; Błachnio et al., 2016) as well as on mobile phones (Khang, Kim, & Kim, 2013; Smetaniuk, 2014), whereas the regression results demonstrate that the predictive power of self-esteem was positive for HUL but negative for AUL. People with higher self-esteem tend to use LINE heavily, and those with lower self-esteem are inclined to use LINE addictively. This result confirms the two competing hypotheses of ‘social enhancement’ versus ‘social compensation.’ As explained in the literature, ‘social enhancement’ hypothesizes that people with high self-esteem depend heavily on the Internet in order to engage with more friends outside of the real world, whereas ‘social compensation’ hypothesizes that people with low self-esteem depend on the Internet to compensate for their problems in real life social interactions. Life satisfaction was also observed to be negatively associated with LINE addiction, which disagrees with the findings of some studies on Facebook (Grieve et al., 2013; Valenzuela et al., 2009), whereas the predictive power was significantly positive for HUL. People with higher self-esteem and higher life satisfaction tend to use LINE heavily, probably because they are highly motivated to present themselves positively to others through the social mobile app, but they may not have encountered any serious problems. The absence of a relationship between LINE addiction and life satisfaction in the AUL cluster is consistent with the findings of research on general smartphone addiction (Lepp et al., 2014; Samaha & Hawi, 2016). Through the division of the sample into three clusters, the relationships between the variables and LINE use were demonstrated in greater detail. Therefore, H1, indicating a negative relationship between the psychological factors of self-esteem or life satisfaction and LINE addiction were partially supported (or partially denied).

Social skills and group norms were negatively associated with LINE addiction, whereas the other two social influence factors (i.e., subjective norms and social identity) were positively associated. The predictive power of subjective norms was negative for HUL, and no predictive power was revealed in group norms or social identity. These results elucidate

the psychological and social characteristics of people who use LINE heavily but have no addiction problems. They are highly satisfied with life and do not act in accordance with others' expectations because they have high self-esteem and are confident in themselves. For AUL, social skill predicted LINE addiction negatively, and subjective norms and social identity predicted positively; however, no predictive power was indicated by group norms. These results illuminate the characteristics and personalities of people inclined to get addicted to LINE. They are eager to obtain others' approval; they long for a sense of belonging and a satisfying relationship with others, but they probably lack or neglect the consensus for integration into social groups due to their deficiency in self-esteem and social skills. Therefore, H2, indicating a negative relationship between social skills and LINE addiction, and H3, indicating that a positive relationship between social influence variables with LINE addiction, were partially supported (or partially denied).

To address the difference in the predictive power of the psychological and social variables for LINE use, we performed a hierarchical regression analysis and found a difference in the three levels of usage pattern. None of the factors had the power to predict for OUL. In other words, the purpose of LINE use in this cluster is not psychologically or socially influenced but just for its own sake; consequently, individuals are not overinvolved and do not have addictive problems. The HUL cluster was predicted positively by psychological factors and negatively by the subjective norms, highlighting the high extent to which individuals in this cluster feel good about themselves. This result is somewhat consistent with those of studies that demonstrated a positive association between narcissism and excessive engagement in online social networking activities (Andreassen et al., 2017; La Barbera, La Paglia, & Valsavoia, 2009; Ryan & Xenos, 2011; Wang, Jackson, Zhang, & Su, 2012; Weiser, 2015). The current study indicated that people with narcissistic characteristics tend to use LINE heavily but do not display serious addictive problems. The AUL cluster was more heavily influenced by social factors. Such individuals are deficient in social skills and goal consensus but seek the approval of others and a sense of belonging. In general, to avoid addictive behaviors of mobile social activities, both family and school education should focus more on the cultivation of strengthened social skills and the characteristics necessary for integrating with others to develop a healthy social life.

5.2. Strengths and limitations

Prior studies have explored the factors of general smartphone addiction and have focused on the psychological aspect of this addiction. Our research is one of few studies to first highlight the importance of research on the specific forms of problematic smartphone use and to consider the social factors that influence it. This study clearly delineates the psychological and social characteristics of individuals belonging to different usage patterns of social mobile apps. Furthermore, this study collected data from a large sample, which represents another key strength. The results offer a scientific reference for prevention of problematic smartphone use as well as an open opportunity for future research to investigate samples either within a Western culture or across various cultures. In addition, longitudinal studies could obtain insights into the cross influences of the variables before and after a period of certain smartphone activities.

However, this study has some common shortcomings such as the use of self-report methods and a relatively homogeneous sample. Correspondents' perception and self-reported data for the measurement of each questionnaire item could vary from person to person. Therefore, self-reported responses may be imprecise, even when answered honestly. The sample used in this study comprised only university students, indicating that the conclusions are only primary and cannot be generalized to the public. Future studies should explore the prediction of variables through various population groups.

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Disclosure statement

No potential conflict of interest was reported by the author.

Notes on contributor

Chi-Ying Chen's primary research focuses on new media, technology and culture, and information sociology. Her publications appear in prominent journals such as *Telematics and Informatics*, *Games and Culture*, and *Mass Communication Research*. She serves as an associate professor in the Department of Information Communication at Asia University, Taiwan, and she may be contacted at [email: megychen@asia.edu.tw].

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