Original Paper

Young Adults' Cellphone Dependence, Stress, Depression and Self-Esteem

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Abstract

Cellphones have become an indispensable communication device, especially for young adults. Based on an online survey conducted in the Midwest, USA, the current study examined young adults' (N = 1,659, M age = 19.38, SD = 1.71) use of cellphone and its influence on their psychosocial states. Almost 90% of the participants owned their first cellphone at age 14 or younger; 96.5% of the cellphone owners were smartphone users. Women spent significantly longer time for both voice calling and texting, were more cellphone dependent, stressed and depressed than men. Both men and women spent significantly more time for texting than voice calling. Path analysis revealed that the time spent for texting and the fear of social isolation for being a non-texting user predicted cellphone dependence, which subsequently predicted self-esteem; the latter relationship was mediated by the level of perceived stress and depression. Implications of the findings are discussed.

Keywords

cellphone, gender, structural equation modeling, path analysis, addiction

1. Introduction

Rapid advancement of communication technology such as the Internet, e-mail, cellphone and text messaging has impacted our daily lives immensely. Particularly, the cellphone has been rapidly adopted by many people worldwide (The World Bank, 2017). It has become an indispensable device for more than a decade in some societies such as Norway where cellphone ownerships among 16-year-olds grew from 20% in 1997 to almost 100% in 2001 (Ling, 2002), leading adolescents to perceive cellphones as an integral part in their lives (Walsh, White, & Ross, 2008). Many people, therefore, perceive cellphones as a fundamental and indispensable tool in maintaining and managing their social worlds

(Bond, 2010; Hakoyama & Hakoyama, 2011; Nasar, Hecht, & Wener, 2007; Walsh et al., 2008). In addition, increased multi-functionality of the recent smartphones has led more and more adolescents (age 12-17) and young adults (age 18-30) to spend increased time on their cellphones, creating deep concerns for cellphone dependence (Choliz, 2012).

Young adults' preferred method of cellphone communication appears to have shifted from talking to texting, as they spent more than an hour a day sending more than 70 messages; this is twice as much time texting than talking on the phone (Lenhart, 2012). The heavy use of cellphone for numerous social networks may disrupt healthy psychosocial development among teenagers (Jenaro, Flores, Gomez-Vela, Gonzalez-Gil, & Caballo, 2009; Sanchez-Martinez & Otero, 2009). For instance, increased use of cellphone is associated with the importance of cellphone among young adults (Hakoyama & Hakoyama, 2011) and an adoption of cellphone at a younger age relates to poor cellphone manners (Hakoyama & Hakoyama, 2012). However, it is unclear the degree to which the heavy use of cellphone has effects on psychological states. Therefore, the current study, based on the responses of an online survey, examined cellphone use among young adults ($N = 1,659$) and its subsequent influence on their psychosocial states.

Non-drug addiction, especially the Internet and modern communication related addiction, such as video-gaming (Chiu, Lee, & Huang, 2004; Gentile, 2009), Facebook (Elphinston & Noller, 2011), Internet (Jenaro, Flores, Gomez-Vela, Gonzalez-Gil, & Caballo, 2009; Young, 2009), texting (Atchley & Warden, 2012), and cellphone (Billieux, Maurage, Lopez-Fernandez, Kuss, & Griffiths, 2015; Jenaro, Flores, Gomez-Vela, Gonzalez-Gil, & Caballo, 2009) has attracted interest of many social scientists. For instance, Elphinston and Noller (2011) examined the impacts of Facebook use on romantic relationships among college students and found that Facebook intrusion was associated with romantic relationship issues such as jealousy and relationship dissatisfaction.

Studies on gender effects on cellphone use reported that women were more likely to be heavier users than men (Hakoyama & Hakoyama, 2011; Roberts, Yaya, & Manolis, 2014). Numerous studies focused on cellphone dependence (Billieux, Linden, D'acremont, Ceshi, & Zermatten, 2007; Block, 2008; Pies, 2009; Choliz, 2012; van Deursen, Bolle, Hegner, & Kommers, 2015). Urgency and lack of perseverance, two of the four components associated with impulsivity, were related to cellphone dependence (Billieus, van der Linden, D'acremont, Ceschi, & Zermatten, 2007). Habitual use of cellphone and social stress positively influenced dependence to the smartphone and women were at a higher risk of addictive behavior than men (van Deursen et al., 2015). Addiction to cellphone may be life-threatening, as the risk for accidents increases when drivers engage in cellphone activities while driving (Horrey & ickens, 2006; McCartt, Hellinga, & Braitman, 2006).

Predictors of cellphone dependence include age of initial ownership (Geser, 2006; Hakoyama & Hakoyama, 2011), length of ownership (Hakoyama & Hakoyama, 2011), gender (Hakoyama & Hakoyama, 2011; van Deursen et al., 2015), degree of use (Zulkefly & Baharudin, 2009), texting, and social networking use (Ehrenreich, Underwood, & Ackerman, 2014; Pettigrew, 2009; Underwood,

Rosen, More, Ehrenreich, & Gentsch, 2012). The longer ownership, the younger initial ownership, and the longer minutes spent on the cellphone a day were likely to contribute to the sense of cellphone importance (Hakoyama & Hakoyama, 2011).

Further, the shift from flip-phones to multifunctional smartphones have given cellphone users access to numerous online social networking services, which might have contributed to cellphone addiction (Salehan & Negahban, 2013). It was found that the intensive use of cellphone was associated with low self-esteem (Bianchi & Phillips, 2005; Zulkefly & Baharudin, 2009), cellphone dependence, and depression among adolescents (Sanchez-Martinez & Otero, 2009). Stress may lead to depression (Bartolomucci & Leopardi, 2009) and excessive cellphone use induced stress and symptoms of depression (Panova & Lleras, 2016; Thomee, Harenstam, & Hagberg, 2011). Another study (Chesley, 2005) that utilized structural equation modeling for analyzing longitudinal data also indicated that cellphone use over time is associated with increased distress and family dissatisfaction.

Psychosocial theory (Erikson, 1968) describes adolescence and young adulthood as a stage of identity development. Teenagers, as their cognitive capacity increases, begin to explore who they are, what they want to be and with which group they wish to be identified. This is also a period when adolescents spend less time with their parents and more time with peers, frequently making their efforts to fit into their social world outweigh respecting their familial values (Richards & Larson, 1989). Adolescent egocentrism (Elkind, 1967) further describes adolescence as a period of heightened self-consciousness; adolescents become extra-sensitive to how they are viewed by their peers, known as *the imaginary audience*. These theoretical views explain commonalities among teenagers in their fashion, language, and selections of favorite music; adolescent developmental agendas for communication have shifted from face-to-face and phone conversation to the use of Facebook and texting (Lenhart, 2012). Empirical studies (Ling, 2002) support the view that adolescents are particularly susceptible to fashions and trends, making them to more willingly adopt new technological devices. These developmental agendas for teenagers likely continue well into their young adulthood.

1.1 The Current Study

Excessive engagement in cellphone activities and the need to be socially connected are reported to contribute to cellphone dependence among adolescents and young adults and such dependence is likely to influence psychosocial states. It is unclear, however, how these factors fit together. Based on the responses of online survey (N = 1,659), therefore, the current study examined the influence of cellphone dependence on psychosocial states among young adults. More specifically, path analysis examined the mediating effects of perceived stress and depressive state on the effects cellphone dependence has on self-esteem. The predictive effects of cellphone ownership, cellphone usage, and fear of social isolation were also examined, Figure 1.

While self-esteem may be considered a predictor in some instances rather than an outcome, self-esteem was considered an outcome in the current study, as it is an affective state as a result of self-evaluation of self-worth based on various previous experiences (Ghen, Gully, & Eden, 2001). For instance, studies

that examined predictive effects of self-esteem by comparing with those of self-efficacy suggested that self-efficacy is a better predictor of personal behavior than self-esteem (Bandura, 1986; Mone, Baker, & Jeffries, 1995); self-efficacy influences self-esteem, not vice versa (Lane, Lane, & Kyprianou, 2004). Numerous studies also treated self-esteem as an outcome (Hakoyama, Griffore, & Phenice, 2014; MaloneBeach, Hakoyama, &Traum, 2016).

Further, to examine the relationships among these variables, path analysis, a form of Structural Equation Modeling (SEM), was used. SEM requires a sophisticated estimation, however, it allows to examine directional and relative assumptions among the variables in the model (Olobatuyi, 2006). While the current study examines cross-sectional data, based on both theoretical perspectives and empirical findings that indicate constant conjunction (Greenstein, 2013) along with the use of SEM, it was hypothesized that both age of initial cellphone ownership (Geser, 2006), ownership history (Hakoyama & Hakoyama, 2011), cellphone usage and fear of social isolation (Roberts et al., 2014) predict cellphone dependence; cellphone dependence, mediated by perceived stress and depressive state, in turn, predicts self-esteem; higher cellphone dependence leads to increased stress (van Deursen et al., 2015) and depressive state (Sanchez-Martinez & Otero, 2009), resulting in lower self-esteem (Bianchi & Phillips, 2005; Zulkefly & Baharudin, 2009).
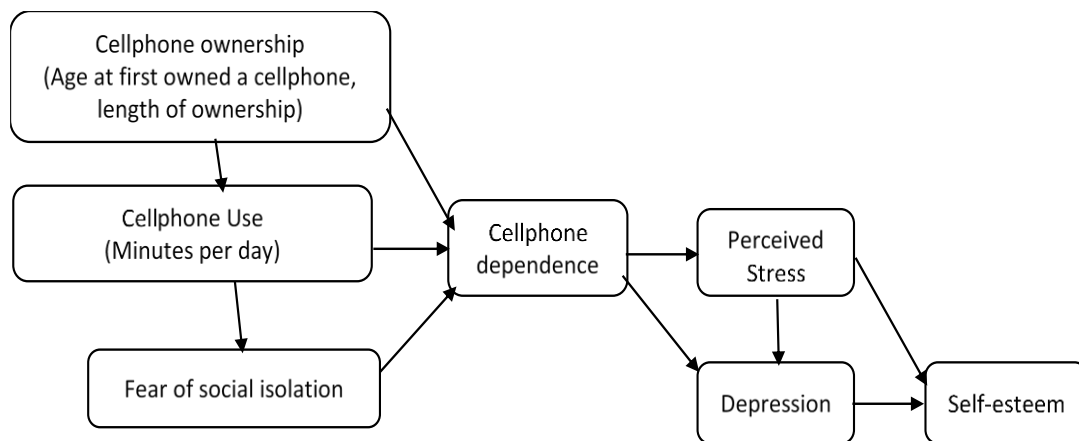
Figure 1. Predictors of Cellphone Dependence and Its Subsequent Effects on Psychosocial States: A Hypothesized Path Model

2. Method

2.1 Procedure

An Institutional Review Board (IRB) approved anonymous online survey was conducted in a midsize university in the Midwest, USA. Participants were recruited from numerous undergraduate courses in Human Development and Family Studies; many of these courses were introductory courses belonging to the university's basic education program taken by students of various disciplines. Students were provided extra credit for participation, a common incentive exercised on university communities for

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recruiting survey participants. Students interested in earning extra credit visited the online survey, which took approximately 30 to 40 minutes; when the survey was completed, participants were directed to a separate web survey where they entered necessary information for extra credit. *SPSS* Version 24 was used for quantitative analyses; *The Independent-Samples T test* was used to examine gender effects examinations and when significant, *Cohen's d* indicated the effect size. *Gates' delta*, and *Hedges' g* measured the effect size when there was a gap in the standard deviation or sample size between groups. *AMOS* was used for path analysis with maximum likelihood estimation. Due to a small number of missing cases (missing < 5%), mean replacement was used in dealing with missing cases (Takahashi, 1998).

2.1.1 Instrument

The survey consisted of more than 100 questions related to cellphone and Internet use, numerous scales (e.g., self-esteem, perceived stress, depression, personality, and academic attitudes), and demographic questions. Demographic questions included the participants' age, gender, ethnicity and marital status. Numerous questions asked participants' cellphone related behaviors such as the age of initial cellphone ownership, cellphone ownership history (years owned a cellphone), time spent a day talking and texting on the cellphone, most frequent correspondent, texting frequency, etc.).

Rosenberg's Self-Esteem Scale (RSES; Rosenberg, 1965) assessed participants' self-esteem, which consists of 4-point (1 = *Strongly disagree*, 4 = *Strongly agree*) ten-item statements, five positive (e.g., *On the whole I am satisfied with myself*; *I feel that I have a number of good qualities*) and five negative (e.g., *I feel that I do not have much to be proud of*; *I wish I could have more respect for myself*); scores of negative statements were reversed to create a composite which could range from 10 to 40.

Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983), a 5-point (1 = *Never*, 2 = *Almost Never*, 3 = *Sometimes*, 4 = *Fairly Often*, 5 = *Very Often*) 10-item statements, assessed participants' stress level; six statements expressed stress (e.g., *In the last month, how often have you been upset because of something that happened unexpectedly?*) while four were positive (e.g., *In the last month, how often have you felt confident about your ability to handle your personal problems?*); positive scores were reversed to create a composite score, which could range from 10 to 50.

A 5-item (I felt depressed, My sleep was restless, I felt lonely, I had crying spells, I could not get going) depression scale (Radloff, 1977) assessed participants' degree of depression; participants were asked to select one of the four choices (1 = *rarely or none/less than 1 day*; 2 = *some or a little of the time/1-2 days*; 3 = *occasionally or a moderate amount of time/3-4 days*; 4 = *all the time/5-7 days*) based on how frequently they felt this way in the past week. A composite was created which could range from 5 to 25.

Test of Mobile Phone Dependence (Choliz, 2012) assessed participants' degree of cellphone dependence, which consists of two sections; the first 10 items (e.g., *I have put a limit on my mobile phone use and I couldn't stick to it*; *When I am bored, I use my mobile phone*) are a 5-point (1 = *Never*, 5 = *Frequently*) scales and the following 12 items (e.g., *I need to use my mobile phone more and more often*; *I would grab my mobile phone and send a message or make a call right now*) are 5-point (1 =

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Completely disagree, 5 = *Completely agree*) scales. The current study applied a composite of 13 items by eliminating items irrelevant to the current focus and the nature of participants (e.g., items related to cost such as *I have argued with my parents or family members about the cost of my mobile phone*; *I spend more money on my mobile phone now than when I first got it*).

A 4-point item (1 = *No, I don't think there will be any change*, 4 = *Yes, absolutely;* Hakoyama & Hakoyama, 2011) assessed the degree to which participants felt whether they think they will be out of their friends' loop and their social life will be damaged if they did not use texting. Participants were also asked at what age they first owned their cellphone, how long (converted into months) they have owned a cellphone, how many minutes a day they spend talking on their cellphones or texting.

2.1.2 Participants

Of the 1,668 questionnaires returned, the current study focused on 1,659 (99.5%) undergraduate students who owned a cellphone; their ages ranged from 18 to 30 ($M = 19.38$, $SD = 1.71$); 71.9% were women; 86.0% were White, followed by African American (6.4%). A great majority (93.5%) were single. Of those who owned a cellphone, 96.5% (1601/1659) reported that their cellphones were smartphones.

3. Result

Age at Initial Cellphone Ownership

More than one half of the participants (60.0%) first owned a cellphone at age 12 to 14 and 26.0% owned it at 11 years or younger; this means that 86.0% of the participants owned their first cellphone at age 14 years or younger ($M = 12.55$, $SD = 2.00$). Female participants' age at first owned a cellphone ($M = 12.44$, $SD = 1.95$) was significantly younger than that of male participants ($M = 12.83$, $SD = 2.09$), $t(1657) = 3.55$, $p < .001$, 95% CI [.17, .60], $d = .19$, $delta = .19$, $g = .20$.

Length of Cellphone Ownership

Participants' cellphone ownership length ranged from one month to 212 months ($M = 87.85$, $SD = 24.96$); 99.0% of them have owned a cellphone for 24 months or more. No gender difference was found in the length of cellphone ownership between male ($M = 89.26$, $SD = 26.46$) and female ($M = 87.30$, $SD = 24.34$) participants, $t(792.157) = 1.39$, $p = .166$. Of those who owned a smartphone ($n = 1601$), more than one half (54.5%) owned a smartphone for 24 months to 59 months (2 years to 4 years 11 months) and more than one third (37.4%) owned it for 60 months (5 years) or more; only 8.1% owned a smartphone for less than two years ($M = 50.95$, $SD = 23.33$). No gender difference was found in the length of smartphone ownership, $t(1599) = 1.28$, $p = .202$.

Length (Minutes) of Cellphone Talk per Day

More than three quarters (75.8%) talked on their cellphones for 30 minutes a day or less and only 10.5% spent for more than 60 minutes ($M = 27.43$, $SD = 29.06$). Female participants ($M = 29.87$, $SD = 30.21$) talked significantly longer than their male counterparts ($M = 21.20$, $SD = 24.86$), $t(1026.97) = -6.00$, $p < .001$, 95% CI [-11.51, -5.84], $d = .31$, $delta = .29$, $g = .30$.

Length (Minutes) of Texting per Day

About one quarter (26.8%) spent 30 minutes or less a day for text messaging while more than one half (54.4%) spent 60 minutes or more. (*M* = 63.85, *SD* = 55.88). Female participants (*M* = 69.56, *SD* = 56.08) spent significantly more time texting than their male counterparts (*M* = 49.21, *SD* = 52.65), *t*(891.41) = -6.92, *p* < .001, 95% *CI* [-26.12, -14.57], *d* = .37, *delta* = .36, *g* = .37.

Time (minutes a day) spent for texting (*M* =63.85, *SD* = 55.88) was significantly longer than time spent talking (*M* = 27.43, *SD* = 29.06), *t*(1645) = 24.83, *p* < .001, 95% *CI* [33.67, 39.44], *d* = .82. Time spent for texting and for talking were weakly correlated, *r*(1644) = 1.22, *p* < .001.

Fear of Social Isolation

A 4-point item (1 = *No, I don't think there will be any change*, 4 = *Yes, absolutely*) assessed participants' views on the importance of being a texting user in relation to social networking. While 17.7% thought that their social world will not change even if they were non-texting users, 12.0% thought that their social world will be absolutely damaged (*M* = 2.39, *SD* = .91). Women's mean score (*M* = 2.45, *SD* = .92) was significantly higher than that of men (*M* = 2.24, *SD* = .89), *t*(1647) = -4.15, *p* < .001, 95% *CI* [-.30, -.11], *d* = .23, *delta* = .23, *g* = .23. For both men and women, no significant difference was found between smartphone owners and flip-phone owners, *t*(461) = .67, *p* = .502; and *t*(1184) = 1.17, *p* = .241, respectively.

Cellphone Dependence

Participants' composite score of *Test of Mobile Phone Dependence* (13 items) ranged from 13 to 65 (*M* = 42.28, *SD* = 8.60), *α* = .84. Women's mean score (*M* = 43. 56, *SD* = 8.37) was significantly higher than that of men (*M* = 39.96, *SD* = 8.29), *t*(1590) = -9.86, *p*<.001, 95% *CI* [-5.51, -3.68], *d* = .55, delta = .55, g = .55. Smartphone owners' ratings, for both men (*M* = 39.31, *SD* = 8.13) and women (*M* = 43.76, *SD* = 8.18), were significantly higher than those of flip-phone owners (men: *M* = 33.35, *SD* = 8.99; women: *M* = 35.50, *SD* = 11.79), *t*(443) = 3.61, *p* < .001, 95% *CI* [2.72, 9.22], *d* = .70, *delta* = .73, *g* = .73 and *t*(27.65) = 3.69, *p* = .001, 95% *CI* [3.67, 12.86], *d* = .81, *delta* = 1.01, *g* = .10.

Perceived Stress

Participants' perceived stress scores ranged from 10 to 46 (*M* = 28.93, *SD* = 5.43), *α* = .79. Women's mean score (*M* = 29.46, *SD* = 5.42) was significantly higher than that of men (*M* = 27.56, *SD* = 5.22), *t*(1657) = -6.50, *p*<.001, 95% *CI* [-2.48, -1.33], *d* = .36, *delta* = .35, *g* = .35. No difference was found between smartphone owners and flip-phone owners for both men, *t*(465) = .08, *p* = .935, and women, *t*(1190) = -.29, *p* = .773.

Depression

Participants' depression scores ranged from 5 to 20 (*M* = 9.13, *SD* = 3.38), *α* = 83. Women's mean score (*M* = 9.30, *SD* = 3.34) was significantly higher than that of men (*M* = 8.70, *SD* = 3.44), *t*(1657) = -3.25, *p* = .001, 95% *CI* [-.96, -.24], *d* = .18, *delta* = .18, *g* = .18. No significant mean difference was found for men or women between smartphone owners and flip-phone owners, *t*(465) = -1.21, *p* = .227, and *t*(1190) = -1.18, *p* = .239 respectively. Perceived stress and depression were moderately correlated

for both men and women, Table 1.

Self-Esteem

Participants' self-esteem scores ranged from 11 to 40 (M = 29.80, SD = 5.17) α =.87. Men's self-esteem (M = 30.24, SD = 5.15) was significantly higher than that of women (M = 29.63, SD = 5.16), $t(1657)$ = 2.16, p = .031, 95% CI [.06, 1.16], d =.12, $delta$ =.12, g =.12. No significant difference was found between smartphone owners and flip-phone owners for both men and women, $t((465)$ = 1.13, p = .258, and $t(1190)$ = 1.32, p = .186, respectively. For both men and women, self-esteem was negatively correlated with depression and with perceived stress, Table 1.

Table 1. Correlations and Descriptive Statistics: Variables for the Final Models (Figures 2 and 3)

Figure 2 (N = 1161)

		1	2	3	4	5	6
1	Texting time	-					
2	Fear	.04	-				
3	Cellphone Dependence	.19***	.37***	-			
4	Stress	.01	.07*	.23***	-		
5	Depression	.03	.05	.22***	.54***	-	
6	Self Esteem	.03	-.02	-.10***	-.55***	-.52***	-
V		1	2	3	4	5	6
M		69.93	2.67	43.76	29.46	9.28	29.66
SD		56.32	.91	8 .03	5.41	3.32	5.17

Figure 3 (N=440)

		1	2	3	4	5	6
	Texting time	-					
1	Fear of social isolation	.10*	-				
2	Cellphone dependence	.25***	.37***	-			
3	Perceived stress	.06	.07	.24***	-		
4	Depression	.04	.11*	.25***	.47***	-	
5	Self esteem	.01	-.04	-.17***	-.61***	-.57***	-
V		1	2	3	4	5	6
M		50.26	2.47	39.30	27.57	8.66	30.30
SD		53.57	.93	7.93	5.27	3.40	5.19

+ p<.10, *p<.05, **p< .01, *** p< .001.

Predictors of Cellphone Dependence and its Subsequent Effects on Psychosocial States

Focusing on the smartphone owners (n = 1601), *path analysis*, a form of structural equation modeling

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(SEM; Kline, 2005), was used to examine predictive effects of cellphone ownership (age at first owned a cellphone and the length of ownership), use (minutes of voice calling and text messaging) per day, and psychological states (fear of social isolation by disengaging from text messaging) on cellphone dependence and its subsequent effects on the participants' psychosocial states (perceived stress, depression and self-esteem) as expressed in the hypothesized model, see Figure 1. While the gender difference was apparent in many of the variables considered in the model, inclusion of nominal variables in the model violates SEM assumptions (Gallini, 1983); therefore men and women were examined separately.

Path analysis estimates directional and relative assumptions between variables, however, it requires a sophisticated estimation process; generally a range of indices is used to report the model fit. Common indices for a good model fit include: insignificant *Chi-squared test* result (*p* > .05); *Root Mean Square Error of Approximation* (RMSEA) of ≤ .08 to be an acceptable fit and ≤ .05 as a good fit; .95 or higher *Goodness of Fit Index* (GFI), *Incremental Fit Index* (IFI), *Comparative Fit Index* (CFI), *Normed Fit Index* (NFI) and *Non-Normed Fit Index* (NNFI) also known as *Tucker-Lewis Index* (TLI); and .90 or higher *Adjusted Goodness of Fit Index* (AGFI) (Marsh, Balla, & Hau, 1996). Numerous indices indicate that the data fit well for both gender models, Table 2. Insignificant predictors and factor loadings were eliminated from the model, therefore, all the coefficients, variances and covariances shown in the final models were significant (*p* < .01), Table 3. As a result, several variables were eliminated from the final model for both genders.

Table 2. Fit Statistics for the Models Tested

	N	X^2	df	p	X^2/df	RMSEA	PCLOSE	GFI	AGFI	CFI	IFI	NFI	TLI
Figure 2	1161	9.88	7	.195	1.411	.02 [.00, .04]	.985	1.00	.99	1.00	1.00	.99	1.00
Figure 3	440	4.87	7	.676	.696	.00 [.00, .05]	.964	1.00	.99	1.00	1.00	.99	1.00

Note. RMSEA = root mean square error of approximation; GFI = goodness of fit index; AGFI = adjusted goodness of fit index; CFI = comparative fit index; IFI = incremental fit index; NFI = normed fit index; TLI = Tucker-Lewis Index.

As shown in Figure 2 and Figure 3, for both men and women, time (minutes a day) spent texting and fear of isolation by disengaging from text messaging predicted cellphone dependence; the stronger fear of social isolation for disengaging from text messaging predicted stronger cellphone dependence, explaining 19% of the variance in cellphone dependence for men; for women, texting time and fear of social isolation also predicted cellphone dependence, explaining 16% of the variance in cellphone dependence. Further, standardized coefficients indicated that the fear factor had greater effects than the minutes of texting per day, Figure 2, Figure 3, Table 4. For both men and women, cellphone dependence, mediated by perceived stress and depression, as hypothesized, predicted self-esteem,

explaining 47% of the variance in self-esteem for men and 37% of the variance for women, Figure 2, Figure 3.

Table 3. Unstandardized and Standardized Estimate, and Significance Level for the Models Tested

|	Parameter Estimate			Unstandardized	Standardized	p
Figure 2	Texting time	→	Fear of isolation	.00	.08	.005
(N=1161)	Texting time	→	Cellphone dependence	.02	.16	.000
	Fear of isolation	→	Cellphone dependence	3.10	.35	.000
	Cellphone dependence	→	Perceived stress	.16	.23	.000
	Cellphone dependence	→	Depression	.04	.10	.000
	Perceived stress	→	Depression	.32	.52	.000
	Perceived stress	→	Self-esteem	-.36	-.37	.000
	Depression	→	Self-esteem	-.50	-.32	.000
Figure 3	Texting time	→	Fear of isolation	.00	.19	.000
(N=440)	Texting time	→	Cellphone dependence	.03	.18	.000
	Fear of isolation	→	Cellphone dependence	3.26	.37	.000
	Cellphone dependence	→	Perceived stress	.16	.24	.000
	Cellphone dependence	→	Depression	.07	.15	.000
	Perceived stress	→	Depression	.28	.44	.000
	Depression	→	Self-esteem	-.55	-.36	.000
	Perceived stress	→	Self-esteem	-.43	-.44	.000
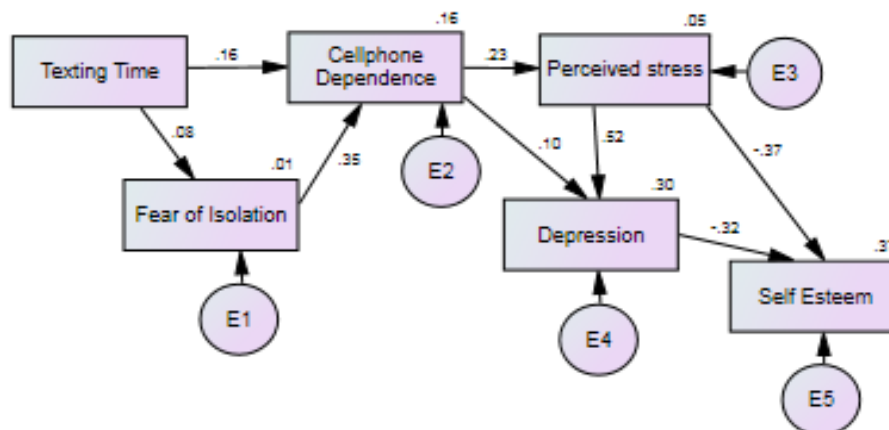
Figure 2. Cellphone Use, Cellphone Dependence, Perceived Stress, Depression and Self-Esteem: Path Analysis (Women, N = 1161)
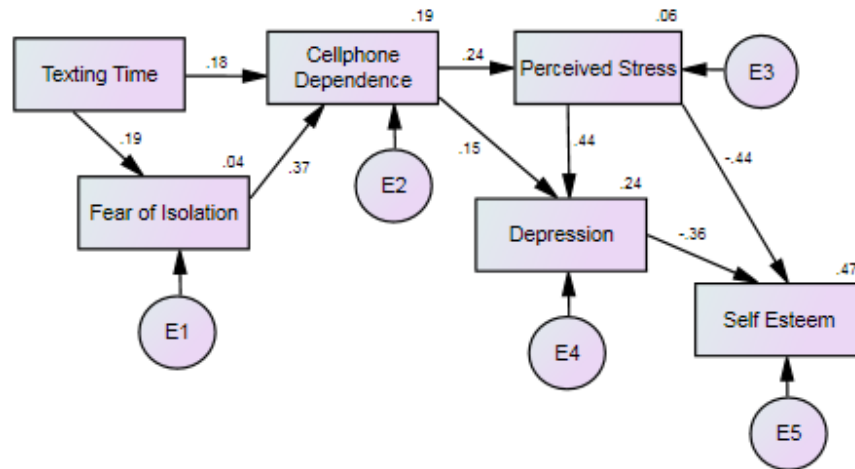
Figure 3. Cellphone Use, Cellphone Dependence, Perceived Stress, Depression and Self-Esteem: Path Analysis (Men, *N* = 440)

Table 4. Standardized Direct and Indirect Effects for the Models Tested

Figure 2 (*N* = 1161)

	Texting time		Fear of Isolation		Cell dependence		Perceived stress		Depression	
	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect
Fear of Isolation	.083	.000	.000	.000	.000	.000	.000	.000	.000	.000
Cell dependence	.164	.029	.354	.000	.000	.000	.000	.000	.000	.000
Perceived stress	.000	.045	.000	.082	.231	.000	.000	.000	.000	.000
Depression	.000	.042	.000	.076	.096	.120	.519	.000	.000	.000
Self-esteem	.000	-.030	.000	-.055	.000	-.155	-.373	-.166	-.320	.000

Figure 3 (*N* = 440)

	Texting time		Fear of isolation		Cell dependence		Perceived stress		Depression	
	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect
Fear of isolation	.194	.000	.000	.000	.000	.000	.000	.000	.000	.000
Cell dependence	.175	.071	.367	.000	.000	.000	.000	.000	.000	.000
Perceived stress	.000	.058	.000	.086	.235	.000	.000	.000	.000	.000
Depression	.000	.063	.000	.093	.151	.103	.436	.000	.000	.000
Self-esteem	.000	-.048.	.000	-.072	.000	-.195	-.439	-.158	-.362	.000

4. Discussion

The current study examined multiple aspects of young adults' use of cellphone and the degree of cellphone dependence as well as its subsequent effects on their psychosocial states. Almost 100% of the

participants have been cellphone owners for quite a long period of time (*mean months* = 87.75) and almost all of them (96.5%) have shifted to smartphones; more than 90% of the smartphone owners made this shift more than two years ago. A great majority (86.0%) of the participants of the current study owned their first cellphone at age 14 or younger (*mean age* = 12.55). These results indicate that cellphones have truly become an integral part of young adults' and adolescents' life (Bond, 2010; Hakoyama & Hakoyama, 2011; Ling, 2002; Nasar, Hecht, & Wener, 2007; Walsh et al., 2008). Consistent with what has been previously reported (Lenhart, 2012), young adults spent more than one hour a day sending more than 70 messages; this is twice as much time than talking on the phone, confirming the previous finding that their communication preference has shifted from talking to texting (Lenhart, 2012).

Consistent with previous findings (Hakoyama & Hakoyama, 2011; Junco, Merson, & Salter, 2010), young women in the current study were more likely to have owned their first cellphone at a younger age than men, were more likely to talk on the phone for a longer period of time, and also spent more time for text messaging than men. Women were also more likely to perceive that disengaging from text messaging would lead to social isolation. Further, for both men and women, smartphone owners' cellphone dependence was significantly higher than flip-phone owners, and again, women tended to be more cellphone dependent than men. These findings strongly indicate that women are more engaged in cellphone activities and are at a higher risk of cellphone dependence.

The current study also examined predictors of smartphone dependence and its subsequent effects on psychosocial states. Contrary to the previous finding (Hakoyama & Hakoyama, 2011), cellphone history (length of ownership and the initial age of cellphone ownership) failed to predict cellphone dependence; time spent for texting and fear of social isolation due to disengagement from text messaging, however, predicted cellphone dependence; cellphone dependence further predicted perceived stress, depression, and self-esteem, partially supporting the hypothesis and enhancing previous findings (Chesley, 2005; Panova & Lleras, 2016; Thomee et al., 2011).

Cellphone history such as the initial age of cellphone ownership and the length of ownership no longer predicted cellphone dependence, maybe because a great majority of these young adults have started using their cellphones at a young age and have used cellphones for quite a long period of time, the effects of these factors on cellphone dependence has dissipated. Their patterns of use may have become normative.

Considering the significant associations between cellphone dependence and psychosocial states, especially the negative effects of cellphone dependence on perceived stress, depression and self-esteem, cellphone use needs to be examined and monitored regularly. Dissemination of the research findings (e.g., the higher cellphone dependence contributes to higher stress and greater depression, leading to lowered self-esteem) would help cellphone users to more consciously engage in cellphone activities, resulting in reducing the risk of cellphone dependence, which would subsequently improve their psychosocial states. Knowing the vulnerability to peer influences during early adolescence (Elkind,

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1967; Erikson, 1968), parents may need to pay closer attention to their children's use of cellphone to prevent them from being negatively affected by excessive and inappropriate use of and dependence to the cellphone. The following tips are believed to help protect adolescents and young adults from heavy dependence on the cellphone.

First, it is important to provide research findings that dependence to the cellphone could lead to numerous negative psychosocial states such as increased stress and depression and lower self-esteem. Second, introducing coping strategies may help to control the use of cellphone. Some of these strategies include self-monitoring, goal setting and restrictive use. Numerous studies indicated that self-monitoring is effective for behavior modification (Altrows & Alberts, 1990; Freeman & Dexter-Mazza, 2004; Gansle & McMahon, 1997; Kobori & Uebuchi, 2001; Toney, Kelley, Lanclos, 2003); simply monitoring and recording certain behaviors such as the number of times engaged in texting or minutes a day spent on Facebook would contribute to reduced engagement. Other methods include goal setting, and restrictive use. For instance, set a rule to disengage oneself from cellphone activities associated with certain spaces, time, or activities. Examples include disengaging in cellphone activities while driving, cooking, or walking and set an automatic reply message informing the unavailability during these periods; turning off the cellphone when going to bed; or disengage from cellphone activities in a certain environment such as classrooms, bedrooms, or on public transportation. Set a goal such as the number of minutes allowed for each voice-calling or to spend a minute or a message less each day than the previous day. These methods will help gain control of cellphone use. Cellphones, like any other devices, help us enrich our daily lives. However, we should be aware of possible negative consequences when misused or overused.

Clearly, cellphones have become indispensable for young adults' social life, who prefer texting to voice-calling. Young cellphone users may focus mainly on its functionality and dismiss possible negative effects associated with its excessive use. However, the results of the current study provide evidence that excessive texting leads to cellphone dependence, which subsequently causes stress and depression, resulting in lower self-esteem. Women tend to engage in texting more extensively than men; however, negative effects on psychosocial states due to excessive texting and cellphone dependence appear to be evident for both men and women. In order to promote young adults' healthy psychological wellbeing, therefore, it is imperative that researchers, educators and parents proactively endeavor to share possible negative effects of excessive cellphone use and coping strategies with young cellphone users.

Limitations and Future Research

Due to ethnic homogeneity of the current sample, the findings of the current study may be limited in their generalizability to ethnic minority groups. Use of and dependence to the cellphone may be different for non-college bound young adults. The current study examined cellphone history and the use of cellphone as predictors of cellphone dependence; some of these variables failed to predict cellphone dependence. Other factors such as time spent for other functions and access to the Internet via

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cellphones were not included. Future research that incorporates these limitations are bound to help us better understand the roles of cellphone in our daily lives and further provide science-based tips that encourage wise cellphone usage while simultaneously limiting its negative effects. Despite these limitations, the findings of the current study eloquently illuminated young adults' cellphone-related behaviors and gender differences in the use of cellphone. It has also reminded us that modern communication devices such as cellphones may provide us convenience and even joy, however, we constantly need to remind ourselves of negative effects due to overuse and to consciously maintain control over them.

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