

The impact of smartphone on young adults

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Abstract

The excessive use of smartphone has increasingly become a problem for young adults. Negative consequences may include psychological, behavioral, and performance issues. Understanding the causes and consequences of smartphone addiction is an important research issue to address. This study investigates the impact of smartphone addiction on college students. We focus on life stressor to examine the predictability of the smartphone addiction. We hypothesize that the smartphone addiction can impact students' academic performance, intention to stay at college, digital overload and social wellbeing. More than one hundred college students participated in a survey. Our results demonstrate that there is a strong linkage between life stressor and smartphone addiction. In addition, life stressor strongly impacts smartphone addiction. Smartphone addiction is positively associated with digital overload and negatively associated with retention and academic performance. Implications and future research were discussed.

1. Introduction

The purpose of this study is to investigate the impact of smartphone addiction on college students' academic performance and intention to stay during their transition from postsecondary education to universities. The effect of life stressor on smartphone addiction is also examined. Smartphone addiction is defined in our study as "excessive use of smartphones that interferes with the daily lives of the users" (Lee et al., 2014).

The benefits of earning a college degree, even in the midst of a tough employment environment, increasing tuition costs and relatively flat wage earnings, still outweigh the cost and remain a good life investment for individuals (Abel & Deitz, 2014). The education-wage gap between Americans 25 to 32 with a college degree has also risen from \$9,690 in 1979 to \$17,500 in 2012 (Taylor et al. 2014). Monitoring and nurturing college students, especially in their early stage of the university life, become critical to ensure their adjustments and completion of their degree. With the Federal programs such as American Graduation Initiative and State funding formula based on graduation rate, time-to-degree or degree awarded to low-income or minority students, a renewed focus on college success and retention has sharpened.

For many college students during this transition, the adjustment can be stressful and liberating at the same time as they started enjoying the autonomy without close parental supervision and facing an unfamiliar university environment. Since this group of young adults grew up with Internet, cell phones and social media, they can easily turn to their smartphone for social, emotional, informational and enjoyment support. However, excessive use and time spent on these activities can also lead to addiction (Turel and Serenko, 2012). Studies on smartphone activities have shown that excessive use of smartphone can pose a number of possible risks for college students such as using smartphone as an escape mechanism or cheating tool (Roberts, et al, 2014), linking with sleep deprivation and attention deficits (Murdock, 2013), depression (Kim et al 2015) as well as academic performance (Hawi&Samaha, 2016).

To study whether stress can lead to smartphone addiction and the consequence of smartphone addiction on college students can help us understand the effect of the determinant and consequences of smartphone usage and how to devise intervention strategies to mitigate the impact of the addiction and establishing early support for college freshmen when they first enter into the

new college life. The study strives to provide three contributions. First: To examine both drivers of smartphone addiction and the consequences in our research model to provide a holistic view of this important issue. Two: To link the smartphone addiction to retention, academic performance, digital overload and social wellbeing also help us focus on the potential outcomes of the smartphone addiction. Three: To examine our research model with early college students which can give us more insights on their adjustment during their initial entry to a new environment. We have developed a strong attachment to our smartphones. Indisputably, smartphone provides many functions and features that enable us to perform our jobs, connect with people, stay informed and entertain ourselves whenever and wherever we desire.

2. Theoretical Background and Hypotheses

According to a recent survey, 90% of Americans have a cell phone, while 68% of American adults own a smartphone (Pew Research Center, 2015). Such a high smartphone ownership penetration rate has allowed more people to access Internet conveniently and constantly. For example, social networking services (SNS) such as Facebook has grown from 500 million users in 2010 to 1.09 billion daily users in 2016. However, more Facebook users are connecting through their mobile phones than through their computers (989 million mobile daily uses versus 1.09 billion total daily users) (Facebook, 2016). Each time smartphone users receive “likes” or “retweets” or “mentions” from their Facebook new posting or Twitter tweets or notifications from their emails and text messages, their sense of instant gratification or dopamine becomes elevated (Stone, 2014). With the portability, availability, constant access to Internet and Instant feedback from the smartphone, people become psychologically attached or even addicted to their smartphones. Although smartphone addiction or problematic use of smartphone has not been labeled as clinical substance abuse, the negative and compulsive nature of the smartphone abuse are treated as a behavioral addiction (Young, 2004, Lee et al. 2014).

Life Stressor and Smartphone Addiction:

This phenomenon can be even more prevalent among college students as they tend to be open to explore and adopt new and innovative technologies. When college students started their university life, the stress to adjust and fit in the new environment can be tremendous and traumatic. Research has shown that stressors from interpersonal and school-related anxiety were significantly related to smartphone addiction (Samaha and Hawi, 2016; Chiu, 2014) as individual experience vulnerability. Smartphone can provide its users instant connections with their social contacts and act as an easy escape (Wang et al, 2015). Table 1 presents prior research that is related to our study. In this study, we hypothesize that:

H1. Life Stressor positive affects Smartphone Addiction.7

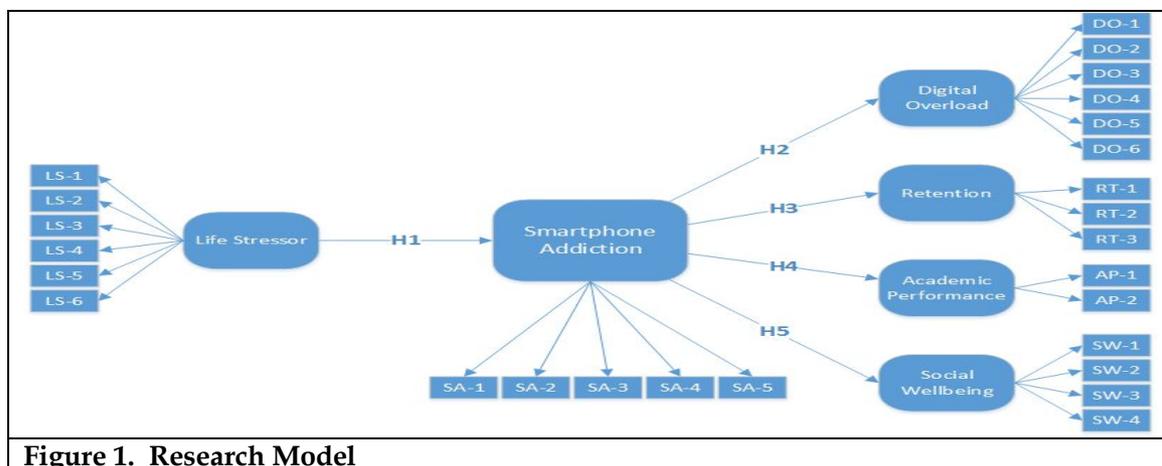


Figure 1. Research Model

Consequences of Smartphone Addiction:

Most of the studies on smartphone addiction have focused on investigating the determinants of smartphone addiction (Sapacz et al 2016; Wang et al 2015; Roberts et al 2014; Zhang et al 2014; Zhang et al 2014) with a few exceptions on the consequences of the smartphone addiction. Samaha and Hawi (2016) found smartphone addiction is negatively related to satisfaction with life. Lee et al (2014) reported that smartphone addiction is positively reported to technostress while Lepp et al (2014) found the negative association with GPA (See Table 1 for detail information).

Although many reports have demonstrated the myriad benefits of earning a college degree, only 59% of incoming college freshmen graduated within 6 years from college (U.S. Department of Education, 2015). About 41% of these college freshmen never graduated. With the renewed focus on college student success, more possible consequences should be investigated that are the results of smartphone addiction so that effective intervention strategies or support mechanisms can be established. As new college students are more stressed with new environment, their vulnerability can lead to smartphone addiction. The overarching outcomes should be related to not only academic performance, their intention to stay (Solberg Nes et al., 2009) at school is equally important to explore. Furthermore, the psychological impact on their social wellbeing (Samaha and Hawi, 2016) and the overwhelming processing demands of information and communication from the smartphone (Karr-Wisniewski and Lu, 2010) are also important to examine. Finding the linkage between these outcomes and smartphone addiction can provide valuable insight and solutions in dealing with smartphone addiction. Thus, we hypothesize:

H2. Smartphone Addiction is positively associated with Digital Overload

H3. Smartphone Addiction is positively associated with Retention

H4. Smartphone Addiction is negatively associated with Academic Performance

H5. Smartphone Addiction is negatively associated with Social Wellbeing

Table 1: Sample Studies on Smartphone Addiction

Samaha and Hawi 2016	Perceived stress, Academic performance	Satisfaction with life	Smartphone addiction negatively impacts academic performance and negatively relates to satisfaction with life
Sapacz et al 2016	Social anxiety, addiction-proneness and social connectedness	Frequent cell phone use	Social anxiety and addiction-proneness are significant predictors while social connectedness is not.
Bian and Leung 2015	Demographic, shyness, loneliness, smartphone usage	Smartphone addiction, bonding social capital	Shyness, loneliness and usage are positively related to smartphone addiction & further significantly impact social capital.
Chiu 2014	Various life stress, learning self-efficacy, social self-efficacy	Smartphone addiction	Family stress, Emotional stress, social self-efficacy directly and significantly predicting smartphone addiction
Wang et al 2015	Perceived stress, entertainment and escapism motivations	Problematic Smartphone Use (PSU)	Perceived stress moderated between entertainment motivation and PSU for both high and low users but only moderate between escapism and PSU for high users.
Lepp et al 2014	Smartphone addiction	GPA and Anxiety	Cellphone use and texting both negatively affects GPA and positively relate to anxiety
Lee et al 2014	Locus of control, social interaction anxiety, need	Technostress	All determinants are positively related to smartphone compulsive usage, and

	for touch, materialism, gender		smartphone compulsive usage positively relate to technostress.
Mok et al 2014	Gender, Internet Addiction and Smartphone addiction	anxiety level, neurotic personality traits, severity levels	Males more addicted to Internet, Females, smartphone; anxiety level and neurotic personality traits increased with addiction severity levels
Roberts et al 2014	Cell phone activities (CPA); gender	Cell phone addiction	Certain CPA significantly associated with cell phone addiction (Instagram, Pinterest) while others not (Internet use and Games); gender also show significant differences
Zhang et al 2014	Six motives for smartphone usages	Smartphone Addiction	Perceived enjoyment, mood regulation, pastime and conformity are positive related to smartphone addiction while information seeking and social relationship are not significant
Zhang et al 2014	Social Network Service (SNS) intensity, network size, use of SNS mobile application, gender	Mobile addiction	All determinants are significantly related to Mobile phone addiction except gender
Turel and Serenko 2012	Perceived Enjoyment, Usage, Time, Habit	Addiction and High Engagement	Time, Usage, Perceived Enjoyment are positively related to Habit, Habit is positively related to Addiction while Perceived enjoyment is also positively related to High Engagement

3. Methods

Paper based survey was used to collect data from randomly selected students in a regional public university in US. Before completing the survey, a consent form was delivered to each participant to explain the purpose of this study and ensure the confidentiality of their responses. The survey consists of three sections: demographic information, actual time spent on various smartphone applications, and questions for each construct. Measures of each construct were adapted from previous research with minor modifications to reflect the context of the study.

Variables for each construct used a 7-point Likert scale from "Disagree Strongly" (Coded 1) to "Strongly Agree" (Coded 7). Smartphone addiction was measured by 5 questions (Turel and Serenko 2012, Zhang et al., 2014). Life Stressor consists of 6 questions adapted from the instruments measuring stress and anxiety among international and North American students developed by Fritz et al. (2008). Digital overload was adapted from multiple studies (Lee et al., 2016, Ragu-Nathan et al., 2008) and consists of 6 questions measuring information overload and communication overload. Social wellbeing measures consist of 4 questions and was adapted from Diener 1985 measuring satisfaction with life. Academic performance is measured by two questions. Retention measures were adapted from Bean's 1982 and consist of three questions. The average score, standard deviation, and correlation for all measures can be found in table 2.

4. Results

A total of 118 surveys were completed by students who were enrolled in the university at the time of the study. 44 were male students and 74 were female students. Average age is 24.42, suggesting most participants are from the millennials generation. 48% of participants have one or more part-time jobs, and 21% of the participants have one or more full time jobs. 55% of the participants are involved in student organizations. On average, each student spends most time on the following smartphone applications per day: 3.7 hours on music/itunes, 2.8 hours on snapchat,

2.4 hours on Facebook, 2.3 hours on Google Search, 2.0 hours on Instagram, 1.8 hours on school email, 1.0 hour on Online Shopping, 1.0 hour on Gmail, and 0.8 hour on Twitter.

Measurement Model

Table 3 shows the factor loadings, T-value for each indicator, and Cronbach’s Alpha, Composite Reliability for each construct. Factor loadings of all indicators (except LS-5) are great 0.50, which supports the convergent validity of these measures. Cronbach’s alpha (from 0.65 to 0.87) and composite reliability (CR) (from 0.73 to 0.90) support the internal reliability of the measurement model.

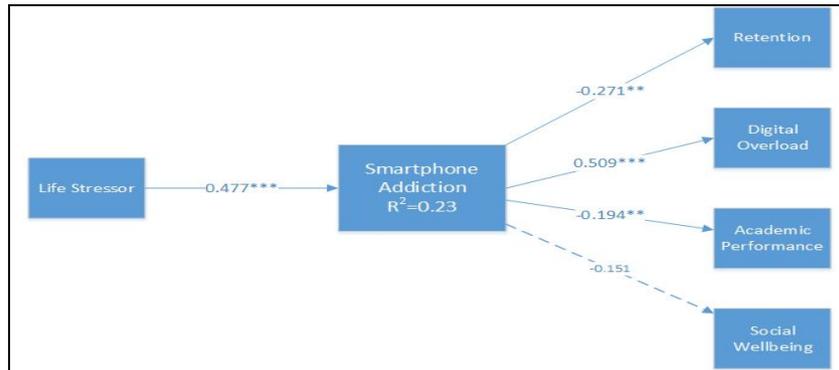


Figure 2. Smartphone Addiction Structural Model

Structural Model

Structural equation modeling was used to test our hypotheses. We used SmartPLS 3 to examine the structural model to evaluate the significant for each hypothesis. Figure 2 shows the results of the structural model. The results show that life stressor is a significant predictor of Smartphone addiction (b=0.477, p<0.001) accounting for 23% of variance in Smartphone addiction. Thus, H1 is supported. Smartphone addiction significantly impacts Retention (b=-0.271, p<0.01), Digital Overload (b=0.509, p<0.001), and Academic Performance (b=-0.194, p<0.01). Thus, H2, H3, H4 were supported. However, the impact of Smartphone addiction on Social wellbeing was not significant. Therefore, H5 was not supported.

Table 2. Mean, Standard Deviation, Cross-Correlations among Indicators

	Mean	SD	DO-1	DO-2	DO-3	DO-4	DO-5	DO-6	AP-1	AP-2	RT-1	RT-2	RT-3	LS-1	LS-2	LS-3	LS-4	LS-5	LS-6	SA-1	SA-2	SA-3	SA-4	SA-5	SW-1	SW-2	SW-3	SW-4
DO-1	3.276	1.942																										
DO-2	4.051	1.908	0.3845																									
DO-3	2.898	1.663	0.3595	0.5291																								
DO-4	3.041	1.584	0.4144	0.5261	0.5208																							
DO-5	2.408	1.609	0.6270	0.2492	0.4351	0.3619																						
DO-6	2.408	1.772	0.4982	0.2293	0.2670	0.3177	0.5179																					
AP-1	5.278	1.376	-0.0773	-0.0760	-0.0966	-0.2180	-0.2490	-0.0515																				
AP-2	5.857	1.187	-0.1600	-0.2897	-0.2815	-0.4312	-0.2367	-0.0596	0.6209																			
RT-1	6.031	1.522	-0.0823	-0.0105	-0.1234	-0.2036	-0.1257	0.0185	0.3014	0.3981																		
RT-2	6.592	0.957	-0.1482	-0.2625	-0.4111	-0.3662	-0.3957	-0.1847	0.1673	0.4341	0.5269																	
RT-3	5.867	1.855	-0.1286	-0.0039	-0.1830	-0.1510	-0.2793	-0.0177	0.0493	0.1165	0.2579	0.3605																
LS-1	2.866	1.782	0.0810	0.1358	0.3973	0.3155	0.3054	0.0613	-0.2846	-0.2924	-0.0316	-0.1502	-0.0513															
LS-2	3.041	1.895	0.1772	0.2817	0.2118	0.1627	0.2288	0.1227	-0.1431	-0.1699	0.0215	-0.1541	-0.0623	0.4601														
LS-3	2.611	1.945	0.2074	0.2584	0.3380	0.3094	0.2708	0.2204	-0.2087	-0.3073	-0.2783	-0.2427	-0.0404	0.5269	0.4890													
LS-4	1.939	1.361	0.2225	0.1466	0.2992	0.3608	0.5378	0.2515	-0.3965	-0.3844	-0.2892	-0.4188	-0.1689	0.4960	0.3728	0.5207												
LS-5	2.969	1.887	-0.0645	0.2159	0.0836	0.0790	0.0445	0.0098	-0.2883	-0.3984	-0.1628	-0.1991	-0.0070	0.3131	0.2087	0.2294	0.2575											
LS-6	2.112	1.634	0.1671	0.2665	0.1882	0.2860	0.3474	0.1498	-0.2753	-0.3495	-0.1934	-0.3101	-0.1465	0.2796	0.3808	0.2483	0.3883	0.5504										
SA-1	2.278	1.557	0.2456	0.3691	0.3325	0.4074	0.3910	0.2209	-0.0882	-0.2412	-0.1512	-0.2496	-0.1649	0.3554	0.2195	0.3004	0.4922	-0.0359	0.0896									
SA-2	3.371	1.971	0.1606	0.3529	0.1618	0.3306	0.3082	0.1396	-0.1790	-0.2146	-0.0263	-0.1307	-0.0469	0.1880	0.2945	0.1937	0.3660	-0.0004	0.2108	0.5823								
SA-3	2.418	1.784	0.1346	0.2606	0.2414	0.3985	0.3103	0.2042	-0.0303	-0.1308	-0.1698	-0.2886	-0.0942	0.2117	0.2123	0.2578	0.4013	0.0008	0.2464	0.5905	0.5817							
SA-4	2.792	1.755	0.3168	0.3200	0.2752	0.2952	0.4096	0.1873	-0.0650	-0.1417	-0.0601	-0.2269	-0.1070	0.3145	0.3734	0.2287	0.3723	-0.0117	0.2978	0.6276	0.6421	0.6048						
SA-5	2.515	1.648	0.1439	0.2498	0.3467	0.2893	0.3535	0.2441	-0.1166	-0.1005	-0.1176	-0.2549	-0.1928	0.1813	0.1500	0.1193	0.2800	-0.0213	0.2796	0.4458	0.4145	0.5256	0.5991					
SW-1	4.816	1.459	0.0287	-0.1139	-0.0077	-0.0762	0.0102	0.2539	0.3623	0.3561	0.0761	0.2387	0.0626	-0.1826	-0.0969	-0.1051	-0.1700	-0.2466	-0.1112	-0.0346	-0.1231	0.0452	-0.1074	0.0287				
SW-2	4.813	1.599	0.0885	-0.1070	0.0374	-0.0718	0.0952	0.2402	0.2801	0.3364	0.0417	0.1284	-0.0621	-0.0494	0.0242	-0.0406	-0.1157	-0.1458	-0.0166	-0.0524	-0.0993	0.0027	0.0590	0.0814	0.5056			
SW-3	5.144	1.457	0.0993	-0.0818	0.0374	-0.0771	0.0688	0.1511	0.3516	0.4074	0.2130	0.1856	0.1004	-0.1767	-0.2598	-0.2104	-0.2660	-0.2312	-0.1556	-0.1791	-0.2056	-0.1354	-0.0731	-0.0686	0.5638	0.5845		
SW-4	4.347	1.813	-0.0561	0.0096	0.0659	-0.0618	0.0529	0.1782	0.2101	0.1226	0.0031	0.0228	0.0713	-0.1195	-0.0219	-0.0856	-0.0245	-0.0088	0.0351	-0.0963	-0.1181	-0.0196	-0.0498	-0.0515	0.3789	0.2892	0.3182	

Table 3: First-Order Measurement Model with Item Measures, Loadings, T-Values, Composite, and Construct Reliability.

Construct	Item	Question	Loading	T-Value	Cronbach's Alpha	CR	
Digital Overload	DO-1	I feel that I generally get too many notifications of new postings, push messages, news feeds, etc. from my Smart Phone while performing other tasks.	0.73	9.39	0.81	0.86	
	Lee et al 2016 Ragu-Nathan et al 2008	DO-2	I am often distracted by the excessive amount of information provided from my Smart Phone.	0.70			11.16
		DO-3	I find that I am overwhelmed by the amount of information that I process on a daily basis from my Smart Phone.	0.74			9.89
		DO-4	My problem is with too much information to synthesize instead of not having enough information to make decisions.	0.76			14.20
		DO-5	I often feel overloaded with communication from my Smart Phone.	0.74			10.20
		DO-6	I receive too many messages from friends (or acquaintances) through my Smart Phone than I can respond.	0.61			5.81
Smartphone Addiction	SA-1	My social life has sometimes suffered because of using my smartphone.	0.83	22.58	0.87	0.90	
	Turel and Serenko 2012	SA-2	Using smartphone sometimes interfered with other (e.g., work or study).	0.80			18.92
	Zhang et al., 2014	SA-3	When I am not using smartphone, I often feel agitated.	0.82			13.02
		SA-4	I have made unsuccessful attempts to reduce the time using smartphone.	0.86			21.61
		SA-5	I find it difficult to control my smartphone use.	0.72			7.20
Life Stressor	LS-1	It is hard to adjust to new environment and social differences at this University.	0.75	10.10	0.78	0.84	
	Fritz et al., 2008	LS-2	I don't see my family/friends often since I started at this University.	0.72			9.12
		LS-3	I am having a hard time making new friends at this University.	0.75			10.10
		LS-4	I am not able to function productively at this University.	0.82			25.60
		LS-5	I experience academic pressure at this University.	0.40			2.25
		LS-6	I experience peer pressure at this University.	0.60			4.59
Academic Performance	AP-1	I feel positive about my performance in all my classes in this semester.	0.83	4.80	0.77	0.89	
		AP-2	I am making satisfactory progress toward receiving my degree.	0.95			13.08
Retention	RT-1	I have strong intention to graduate with this degree from this University.	0.71	3.54	0.65	0.80	
	Bean 1982	RT-2	I intend to finish my current semester.	0.91			8.76
		RT-3	I intend to enroll next semester.	0.64			3.84
Social Wellbeing	SW-1	So far, the conditions of my life are excellent.	0.52	2.58	0.78	0.73	
	Diener et al., 1985	SW-2	So far I have gotten the important things I want in life.	0.50			2.18
		SW-3	So far, I am satisfied with my life.	0.82			2.91
		SW-4	If I could live my life over, I would change almost nothing.	0.58			2.56

5. Discussion and Conclusion

Our study contributes towards both smartphone addiction and college student success literature. Research on smartphone addiction has mainly focused on the predictors of smartphone addiction and has not fully addressed the consequences of smartphone addiction. College student success literature has not considered the impact of technological abuse, particularly the smartphone addiction on college student success. Our results demonstrated that smartphone addiction can be associated with digital overload, academic performance and retention. Our study findings also highlight the importance of helping college students with their initial entry to college and the adjustment with the university life as stress induced from away from family, academic pressure and new environment can create opportunities for new students to retreat to smartphones for comfort, support as well as social networking services.

The findings supported all of our hypotheses except H5. H1 stated and confirmed that there exists a significant relationship between life stressor and smartphone addiction which is consistent with previous studies (Chiu et al., 2014; Sapacz et al 2016). Smartphone can provide an easy and instant distraction for people facing stressful events and serve as a copy or escaping mechanism (Snodgrass et al., 2014). H2 stated and supported that smartphone addiction can predict negative retention which is a novel insight created from this study as current smartphone addiction has not linked the consideration with the college retention. H3 stated and confirmed that smartphone addiction can be positively associated with digital overload which is in line with the study on smartphone addiction and technostress (Lee et al., 2014). Digital overload in terms of information and communications can overwhelm and distract human's information processing capacity and create further negative outcomes (Karr-Wisniewski and Lu, 2010). H4 examined and supported that smartphone addiction and academic performance has a negative relationship. This finding is consistent with two other recent studies (Lepp et al., 2014; Samaha and Hawi 2016). H5 examined the

smartphone addiction and social wellbeing but the finding is inconclusive. It could also be speculated that we have only analyzed a portion of our current dataset. Although smartphone addiction was found to have a negative relationship with social wellbeing on other studies (Samaha and Hawi, 2016), more research studies are needed to establish a more robust relationship and conclusion.

6. Limitations and Recommendations

Our research model is only tested with the university student population, the determinant and consequences will need further examined in different population such as *silver surfers* to have better generalizability. More studies need to examine the relationship between smartphone addiction and social wellbeing as the findings can help us understand the full effects of the smartphone addiction.

7. Conclusion

The adoption and use of Smartphone are continuously rising. Our study provides linkages between smartphone addiction and retention, academic performance and digital overload. We also find life stressor as a strong predictor to smartphone addiction among early college student population. These findings can help college administrators, researchers and educators to devise effective intervention strategies early on to achieve the best adjustment for young college students when facing a new university life on their own. Additionally, our finding can provide to IT managers or organizational designers methods to create a desirable working environment for younger workers so they don't resort to smartphone addiction when adjusting the stress associated with the new environment.

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