Relationships among smartphone addiction, stress, academic performance, and satisfaction with life

Article *in* Computers in Human Behavior · April 2016

DOI: 10.1016/j.chb.2015.12.045

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Computers in Human Behavior

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Full length article

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ARTICLE INFO

Article history:
Received 28 September 2015
Received in revised form
24 October 2015
Accepted 17 December 2015
Available online xxx

Keywords:
Smartphone addiction
Stress
Satisfaction with life
Academic performance
University students

ABSTRACT

Results of several studies have suggested that smartphone addiction has negative effects on mental health and well-being. To contribute to knowledge on this topic, our study had two aims. One was to investigate the relationship between risk of smartphone addiction and satisfaction with life mediated by stress and academic performance. The other aim was to explore whether satisfaction with life mediated by stress and academic performance facilitates smartphone addiction. To identify test subjects, systematic random sampling was implemented. A total of 300 university students completed an online survey questionnaire that was posted to the student information system. The survey questionnaire collected demographic information and responses to scales including the Smartphone Addiction Scale - Short Version, the Perceived Stress Scale, and the Satisfaction with Life Scale. Data analyses included Pearson correlations between the main variables and multivariate analysis of variances. The results showed that smartphone addiction risk was positively related to perceived stress, but the latter was negatively related to satisfaction with life. Additionally, a smartphone addiction risk was negatively related to academic performance, but the latter was positively related to satisfaction with life.

1. Introduction

Smartphones have not only replaced cellphones, but to a certain extent they have also replaced personal computers and a multitude of other devices. Their large screen size and inherent mobility allow for a plethora of functions to be accessed anytime and anywhere. With a smartphone, a person can make calls, send e-mails, watch and share photos and videos, play video games and music, keep track of appointments and contacts, surf the Internet, use voice search, check news and weather, use chat applications for voice calls and texting (e.g., Whatsapp) and interact on social networks (e.g., Facebook).

Smartphones are becoming an integral part of the lives of all ages worldwide. People feel inseparable from their smartphones (Lepp, Li, Barkley, & Salehi-Esfahani, 2015). For instance, in the USA, the latest data from the Pew Research Center shows that of smartphone owners, 46% said that their smartphone is something "they could not live without" (Smith, 2015). Meanwhile, smartphone ownership among American adults increased from 35% in 2011 to 64% in 2014 (Smith, 2015). In addition, 15% of American young adults between 18 and 29 years of age are classified as heavily dependent on smartphones for online access (Smith, 2015). The data from the EDUCAUSE Center for Analysis and Research shows that 86% of undergraduate students owned smartphones in 2014, which represents an increase from 76% in 2013 (Dahlstrom & Bichsel, 2014).

Smartphone use has been changing daily routines, habits, social behaviors, emancipative values, family relations and social interactions. The constant checking and/or use of smartphone applications 24 h a day has been linked to sleep disturbances, stress, anxiety, withdrawal and deterioration in well-being, decreased academic performance, and decreased physical activity (Thomée, Härenstam, & Hagberg, 2011). Fortunately, the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) addressed this behavior when it introduced a non-substance addiction (Internet gaming disorder) as a psychiatric diagnosis (*American Psychiatric Association: Diagnostic and statistical manual of mental disorders (5th ed.)*, 2013; Pontes & Griffiths, 2015). This addition to the DSM-5 gives hope to researchers who have been conducting studies on non-substance addiction, an area that is expanding to encompass not only Internet gaming disorder, but all types of digital addictions. For instance, some studies have addressed Internet addiction

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http://dx.doi.org/10.1016/j.chb.2015.12.045
0747-5632/

and video game dependency and their implications (Griffiths, 2015; Hawi, 2012; N. S. Hawi, Blachnio, & Przepiorka, 2015; Tsitsika et al., 2014). However, research investigating smartphone use and how it is affecting people's lives is still at a very early stage. Nevertheless, studies so far have shown that compulsive use of smartphones may lead to psychological disorders (Beranuy, Oberst, Carbonell, & Chamarro, 2009; Hawi & Rupert, 2015; Lee, Chang, Lin, & Cheng, 2014; Thomée et al., 2011). Belief in the severity of non-substance digital addiction has led some governmental and non-governmental organizations to open rehabilitation centers to treat or cure those suffering with digital dependency such as Hôtel-Dieu Grace Healthcare[1] and reStart.[2]

1.1. Smartphone use and academic performance

Several studies have found a negative association between cellphone use and academic performance (Judd, 2014; Karpinski, Kirschner, Ozer, Mellott, & Ochwo, 2013; Rosen, Carrier, & Cheever, 2013). In particular, a link has been identified between smartphone multitasking and a decline in academic performance (Rosen et al., 2013). In a sample of 451 US college students, a study identified a negative relationship between the use of social networking sites and GPA, and this relationship was moderated by multitasking (Karpinski et al., 2013). Similar results were obtained from studies on US university students, which revealed that use of Facebook and text messaging while doing schoolwork or attending class were negatively related to college GPAs (Junco & Cotten, 2012; Wood, et al., 2012).

1.2. Smartphone, stress and satisfaction with life

Smartphones have been linked to leisure (Lepp et al., 2015) and satisfaction with life (Lepp, Barkley, & Karpinski, 2014). Factors including social self-efficacy, family pressure and emotional stress have positive predictive power for smartphone addiction (Chiu, 2014). Compulsive smartphone usage is positively associated with technostress, which is stress caused by information and communication overload (Ragu-Nathan, Tarafdar, Ragu-Nathan, & Tu, 2008). To the best of our knowledge no study has investigated the relationship between smartphone addiction and perceived stress. However, several studies have shown that perceived stress can be a predictor of satisfaction with life (Hamarat et al., 2001; Matheny, Roque-Tovar, & Curlette, 2008). In particular, students who report low levels of perceived stress also report higher levels of satisfaction with life (Coffman & Gilligan, 2002; Extremera, Durán, & Rey, 2009) and perceived positive stress is positively related to life satisfaction in the students regardless of academic success or failure (Abolghasemi & Varaniyab, 2010).

The aforementioned research contributions triggered our interest in investigating two relationships. First, we sought to explore the relationship between smartphone addiction risk and perceived stress, which influences satisfaction with life. Then, we also sought to explore the relationship between academic performance, which is influenced by smartphone addiction, and satisfaction with life. Looking at both of these relationships, a model was created (see Fig. 1) with elements including risk of smartphone addiction, perceived stress, academic performance, satisfaction with life, and their additional associations. Accordingly, our research hypotheses were as follows:

Hypothesis 1: Perceived stress mediates the relationship between risk of smartphone addiction and satisfaction with life.

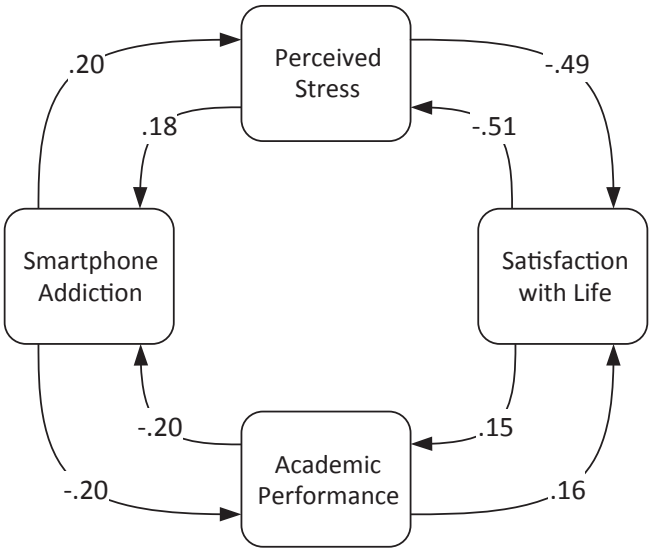

Fig. 1. Conceptual Framework using path analysis.

Hypothesis 2: Academic performance mediates the relationship between risk of smartphone addiction and satisfaction with life.

Hypothesis 3: There was a zero order correlation between smartphone addiction and satisfaction with life.

2. Method

2.1. Sample

The university research committee approved the research instruments. This cross-sectional study was based on stratified random sampling. An email was sent out to all students through the university email system. Before completing the survey, a form explained the purpose of the study and assured volunteers that data collection, storage, and reporting techniques would protect confidentiality and anonymity. A total of 293 respondents filled out the online survey through the university's student portal. The ages of students ranged between 18 and 25 years. Cases with invalid responses to trap question were removed from the dataset, which reduced the sample size to 249.

2.2. Data collection instruments

The survey was composed of four separate sections, including one for demographic information and three separate research instruments. The demographic information section included gender, age, education level, and academic major. The remaining sections encompassed the Smartphone Addiction Scale - Short Version (SAS-SV), the Perceived Stress Scale (PSS) and the Satisfaction with Life Scale (SwLS). The amount of time required to complete the survey was approximately 15–20 min.

The SAS-SV, developed by (Kwon, Kim, Cho, & Yang, 2013a)), looks at smartphone usage to identify the level of risk for smartphone addiction, but does not diagnose addiction. This scale is a shortened version of the original Smartphone Addiction Scale (SAS), which consists of 33 questions and 6 points developed by (Kwon, Lee, et al., 2013b). The SAS-SV consists of 10 items rated on a six-point Likert-type scale, ranging from “Strongly Disagree”, coded 1, to “Strongly Agree”, coded 6. In the present study, the scores for this scale ranged from 10 to 54. A cutoff value of 31 is suggested for boys and a cutoff value of 33 is suggested for girls. High scores

[1] http://www.hdgh.org.
[2] http://www.netaddictionrecovery.com.

indicate a high risk. We employed the SAS-SV in this study for its strong internal consistency, for which Cronbach's alpha coefficient was .91 (Kwon et al., 2013a). Similarly, other studies have also shown solid psychometric properties when using SAS-SV (Akın, Altundağ, Turan, & Akın, 2014; Demirci, Orhan, Demirdas, Akpınar, & Sert, 2014). In the present study, Cronbach's alpha coefficient was .84.

The PSS, developed by (Cohen, Kamarck, & Mermelstein, 1983), measures the perception of stress, i.e., the degree to which situations are appraised as stressful, by asking respondents to rate the frequency of their thoughts and feelings related to situations occurred in the last month (Cronbach's alpha coefficient = .79). It is one of the most widely used psychological instruments. Used in hundreds of studies and validated in many languages, the PSS offers useful psychometric properties (Andreou et al., 2011; Leung, Lam, & Chan, 2010; Reis, Hino, & Añez, 2010; Remor, 2006; Roberti, Harrington, & Storch, 2006). It consists of 10 items rated on a five-point Likert-type scale, ranging from "Never", coded 0, to "Very Often", coded 4. In the present study, the scores for this scale ranged from 6 to 34, and Cronbach's alpha coefficient was .87.

The SwLS, developed by (Diener, Emmons, Larsen, & Griffin, 1985), concerns subjective well-being, assessed by measuring cognitive self-judgment about satisfaction with one's life. It consists of 5 items rated on a seven-point Likert-type scale, ranging from "Strongly Disagree", coded 1, to "Strongly Agree", coded 7. In the present study, the scores for this scale ranged from 6 to 34. High scores on the SwLS indicate higher satisfaction with one's life. This scale has a very good internal consistency with Cronbach's alpha coefficient equal to .87. Several studies have confirmed its strong internal consistency (Alfonso, Allison, Rader, & Gorman, 1996; Ferrans & Powers, 1985; Neto, 1993; Pavot, Diener, Colvin, & Sandvik, 1991). In the present study, Cronbach's alpha coefficient was .82.

2.3. Data analysis

The data were analyzed with SPSS.[3] Pearson product–moment correlation coefficients were calculated. The analyses were used to examine the associations between computed variables and satisfaction with life. In all of the hierarchical multiple regression analyses, preliminary analyses were first conducted to ensure that there was no violation of the assumptions of normality, linearity, multicollinearity and homoscedasticity.

3. Results

Of 249 respondents, 54.2% were male. The average respondent was 20.96 years old (SD = 1.93) with an overall range between 17 and 26 years old. The percentage of students who were at high risk of smartphone addiction (44.6%) was slightly lower than that of students at low risk (49.1%). The percentage of students identified as having high levels of perceived stress (53.4%) was slightly greater than the percentage of students reporting low levels of perceived stress (46.6%).

The correlation between risk of smartphone addiction (as measured by SAS-SV) and satisfaction with life (as measured by Satisfaction with Life Scale) was investigated using a Pearson product–moment correlation coefficient. Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity, and homoscedasticity. Between risk of smartphone addiction and perceived stress (as measured by the Perceived Stress Scale), there was a small, positive correlation, $r = .2$, N = 249, $p < .002$, with high risk of smartphone addiction associated with high levels of perceived stress. That is, if smartphone addiction risk increases by one standard deviation from its mean, perceived stress would be expected to increase by .2 standard deviations from its own mean, while holding all other relevant regional connections constant. Additionally, the relationship between perceived stress and satisfaction with life was investigated using a Pearson product–moment correlation coefficient. Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity, and homoscedasticity. There was a strong, negative correlation between the two variables, $r = -.5$, $n = 249$, $p < .0001$, with high levels of perceived stress associated with lower levels of satisfaction with life. That is, if perceived stress increases by one standard deviation from its mean, satisfaction with life would be expected to decrease by .5 standard deviations from its own mean, while holding all other relevant regional connections constant. The aforementioned results confirm the first hypothesis. Similar analysis confirmed the second hypothesis (see Table 1).

Linear regression was carried out to ascertain the extent to which risk of smartphone addiction (measured using SAS-SV) can predict levels of perceived stress (using the Perceived Stress Scale). Risk of smartphone addiction explained 3.8% of the variance in perceived stress, $F(3, 215) = 2.80$, $p = .041$. Also, perceived stress explained 24.3% of the variance in satisfaction with life (measured with Satisfaction with Life Scale), after controlling for sex and age, $F(3, 215) = 25.88$, $p < .0005$. This confirms hypothesis 1 that perceived stress mediates the relationship between risk of smartphone addiction and satisfaction with life. Similarly, risk of smartphone addiction explained 3.9% of the variance in GPA after controlling for sex and age, $F(3, 215) = 10.30$, $p < .0005$. Also, GPA explained 2.2% of the variance in satisfaction with life, after controlling for sex and age, $F(3, 215) = 3.28$, $p = .02$. This confirms hypothesis 2 that academic performance mediate the relationship between risk of smartphone addiction and satisfaction with life. All beta values are included in the hypothesized path model (see Fig. 1).

4. Discussion

The main aim of this study was to examine the relationship between smartphone addiction risk and satisfaction with life. Our results showed that a relationship does not exist, which supported Lepp et al. (2014) findings. In other words, the level of smartphone addiction risk does not predict the level of satisfaction with life. Nevertheless, results showed that risk of smartphone addiction can be linked to satisfaction with life via perceived stress and academic performance. The hypothesized path model in Fig. 1 depicts the relationships amongst these variables. At the same time, in Fig. 1 the absence of arrows between smartphone addiction and life satisfaction indicates that no correlation was found to link them. This rejects hypothesis 3. First, risk of smartphone addiction is

Table 1
Pearson correlations between research variables.

Variable	Sex	SAS-SV	PSS	SwLS
GPA	.279***	−.143*	−.049	.182**
Sex	–	.164*	.008	.147*
SAS-SV		–	.193***	.077
PSS			–	−.492***
SwLS				–

Note. SAS-SV = Smartphone Addiction Scale Short Version score, PSS = Perceived Stress scale, and SwLS = Satisfaction with Life scale.
*$P < .05$.
**$P < .01$.
***$P < .0005$.

[3] SPSS 20.0 software proprietary of IBM, New York, United States of America.

related positively to perceived stress and negatively to academic performance. For instance, university students with high risk of smartphone addiction experienced higher levels of perceived stress. Second, a strong negative relationship was found between perceived stress and satisfaction with life. For instance, university students with higher levels of perceived stress experienced low levels of satisfaction with life. Third, there was only a weak positive correlation between academic performance and satisfaction with life. These results shed light on some similarities between our sample and those of other studies. Furthermore, the hypothesized path model emphasized the bidirectional nature of relationships whereby variables have reciprocal influences. Beranuy et al. (2009) suggested that Internet addiction and psychiatric symptoms can interact and precipitate each other. For instance, the higher the risk of smartphone addiction is, the higher the level of perceived stress would be, and the higher the level of perceived stress is, the higher the risk of smartphone addiction would be. In other words, anything that raises the level of perceived stress might increase the risk of smartphone addiction. Meanwhile anything that raises the risk of smartphone addiction might influence an increased level of perceived stress, which moves a student into a dangerous zone characterized by the high risk of smartphone addiction, a high level of perceived stress, and a low level of satisfaction with life. This pattern confirms the relationship with satisfaction with life perspective and is a novel contribution to the literature. For instance, students experiencing low levels of satisfaction with life were less likely to achieve satisfactory cumulative GPAs and were more likely to shift to higher levels of perceived stress; consequently, these students were more likely to be prone to smartphone addiction.

In uniquely addressing the relationship between smartphone addiction and perceived stress, the results of this study should alter the prevalent understanding of smartphone addiction. Most research tackling similar topics has addressed the relationships between Internet addiction and psychological distress (Beranuy et al., 2009)), anxiety, and depression (Caplan, 2006; Yen, Chou, Liu, Yang, & Hu, 2014). Young and Rodgers were among the first to show that increased levels of depression were associated with Internet addiction. Consistently, studies that followed showed similar results (Ha et al., 2007; Kim et al., 2006). For instance, higher ADHD and depression were associated with Internet addiction [Yen 2011]. Depression, anxiety and stress were positively related to Internet addiction in Akin's study (Akin & Iskender, 2011), and higher scores for depression, alexhytimia and anxiety were observed in a group of university students diagnosed with moderate/high Internet addiction (Dalbudak et al., 2013). The aforementioned studies tackled Internet addiction using desktops or laptops. These machines are being gradually overtaken by smartphones which not only encompass Internet use via Wi-Fi and mobile communications technology such as 4G, but highly addictive apps for texting, online gaming and social networking. Smartphones are glued eternally to owners' bodies with a portal to Internet 24 h a day. For this reason, to test smartphone addiction, researchers are employing the Smartphone Addiction Test – Short Version that stemmed from the Internet Addiction Test with modifications to make it smartphone-specific (Kwon et al., 2013a). Lepp et al. (2014) showed a negative relationship between smartphone addiction and anxiety (Lepp et al., 2014) and suggested more research to investigate this relationship and to search for other relevant variables such as physical activity. To contribute to the literature, we started a new line of research that focuses on perceived stress rather than on anxiety. Furthermore, while many studies in the field used Kimberly Young's Internet Addiction Test (Young, 1998), in our study we employed the Smartphone Addiction Test – Short Version. The latter stemmed from the Internet Addiction Test with modifications to make it smartphone-specific.

Our research confirmed several studies that showed a negative association between academic performance and technology use (Kibona & Mgaya, 2015). For instance, Junco & cotten, (2012) determined that using Facebook and texting while doing schoolwork negatively affects a student's overall GPA. In a sample of 263 US students between 11 and 25 years old, those who used Facebook and texted while studying had lower GPAs than students who did not (Rosen et al., 2013). In another sample of 480 US university students, those who spent more time using technology spent less time studying, which had a strong negative relationship on GPAs (Wentworth & Middleton, 2014). A cross-cultural study between US and European university students compared the effects of social networking on academic performance, and found that only the US sample showed a negative relationship (Karpinski et al., 2013).

When designing interventions, researchers might want to consider the resolution of stress as a practical starting point for helping people who are at risk of smartphone addiction (Wang, Wang, Gaskin, & Wang, 2015).

4.1. Limitations and recommendations

First, because smartphones constitute a new technology, the availability of prior research exploring the impact of smartphone addiction on perceived stress and vice versa is limited. Nevertheless because the research results did uncover an association between them, there is now an open opportunity to conduct further investigations on samples both within the same culture as well as across cultures. First, the novelty of the results invites a stronger overall set of evidence from which to draw. Second, the cross-sectional design of this study identified current associations between smartphone addiction, stress, academic performance, and satisfaction with life. However, the research design does not reveal cause and effect relationships. Third, students' self-reported data on smartphone habits and perceived stress could not be independently verified. The understanding of each questionnaire item measuring an abstract concept vary from one participant to another. Add to this that the researchers are not available for clarifications. So, self-reported responses may be inaccurate despite honesty. Rating scales could be filled in different ways. While some people like to use the edges such as strongly agree and strongly disagree, others respond with choices around the middle. Still, there are participants who keep all the choices within the pool but do not pay enough attention to the questionnaire items. Furthermore, response bias is another limitation where participants respond positively to every questionnaire items which influences correlations between scales. Future studies can lessen the influence of response bias by reversing half of the questions on each scale.

This study included only university students. Future research might investigate the hypothesized model in general, delving into the association between smartphone addiction and stress in adolescents; according to Pew research data, teens own the highest percentage of smartphones (Smith, 2015).

5. Conclusion

Results of this study showed the existence of a positive relationship between smartphone addiction and stress, a negative relationship between smartphone addiction and academic performance and a mediated negative relationship between smartphone addiction and satisfaction with life. There was a zero order correlation between smartphone addiction and satisfaction with life on one hand and between perceived stress and academic performance on the other hand. Some of these findings are congruent with other studies especially the relationship with academic performance

(Jackson, Von Eye, Witt, Zhao, & Fitzgerald, 2011; Jacobsen & Forste, 2011; Junco & Cotten, 2012; Kibona & Mgaya, 2015; Lepp et al., 2014; Wentworth & Middleton, 2014). More studies are needed to investigate if smartphone addictions can be linked to anxiety, depression, family relations, etc. As smartphone use continues to be on the rise despite all the alarming negative implications mainly behavioral addiction, intervention programs must be developed and implemented without further ado with the most vulnerable population segments children and adolescents.

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