

# Smartphone use and smartphone addiction

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## Abstract

This study aimed to examine smartphone use patterns, smartphone addiction characteristics, and the predictive factors of the smartphone addiction in middle school students. According to the Smartphone Addiction Proneness Scale scores, 563 (30.9%) were classified as a risk group for smartphone addiction and 1261 (69.1%) were identified as a normal user group. The adolescents used mobile messengers for the longest, followed by Internet surfing, gaming, and social networking service use. The two groups showed significant differences in smartphone use duration, awareness of game overuse, and purposes of playing games. The predictive factors of smartphone addiction were daily smartphone and social networking service use duration, and the awareness of game overuse.

## Introduction

The Internet is very useful for a variety of purposes, such as convenient electronic commerce, rapid sharing of information, contact with other cultures, emotional support, and entertainment (Kraut et al., 1998; Morahan-Martin, 1999; Scherer, 1997). A smartphone combines the services of the Internet and a mobile phone. Smartphones offer qualitatively different services in addition to the benefits that the Internet offers. Young people watch videos, express themselves, communicate with friends, and search for information using smartphones, while older people use their smartphone for having video calls with their children living far away and for playing games. The portability and accessibility of a smartphone make it possible to use it anywhere, for any duration.

Worldwide, smartphones were used by 1.85 billion people in 2014. This number is expected to be 2.32 billion in 2017 and 2.87 billion in 2020 (Statista, 2017). In 2015, a median of 54 percent across 21 emerging and developing countries such as Malaysia, Brazil, and China reported using the Internet at least occasionally or owning a smartphone. In comparison, a median of 87 percent reported the same across 11 advanced economies, including the United States and Canada, major Western European nations, developed Pacific nations (Australia, Japan, and South Korea), and Israel (Pew Research Center, 2016). In the findings of a survey conducted in 40 nations, South Korea showed the highest rate of smartphone ownership (88%) followed by Australia (77%), and the United States (72%). In a survey on Korean smartphone use in 2016, 83.6 percent of Koreans aged over 3 years were found to use a smartphone. Among them, 86.7 percent of males and 80.6 percent of females reported using a smartphone, and 95.9 percent of teenagers were found to use a smartphone (Korea Internet and Security Agency, 2017). Indeed, smartphone users are increasing across the world.

In recent years, most of the global populations (especially college and university students), use smartphones, due to its wide range of applications. While beneficial in numerous ways, smartphones have disadvantages such as reduction in work efficacy, personal attention social nuisance, and psychological addiction. Currently, the addiction to smartphones among students is 24.8%–27.8%, and it is progressively increasing every year. Mobile phone is becoming an integral part to students with regard to managing critical situations and maintaining social relationships. This behavior may reduce thinking capabilities, affect cognitive functions, and induce dependency. The signs of smartphone addiction are constantly checking the phone for no reason, feeling anxious or restless without the phone, waking up in the middle of night to check the mobile and communication updates, delay in professional performance as a result of prolonged phone activities, and distracted with smartphone applications.

Mobile phone is the most dominant portal of information and communication technology. A mental impairment resulting from modern technology has come to the attention of sociologists, psychologists, and scholars of education on mobile addiction. Mobile phone addiction and withdrawal from mobile network may increase anger, tension, depression, irritability, and restlessness which may alter the physiological behavior and reduce work efficacy. Hence, the present study was planned to study the addiction behavior of mobile phone usage using an online survey.

## **Literature review**

### **Smartphone addiction**

Smartphone addiction is considered to be rooted in Internet addiction due to the similarity of the symptoms and negative effects on users. Internet addiction is defined as an impulse control disorder, characterized by pathological Internet use (Goldberg, 1996; Young, 1998). Smartphone addiction could be categorized as a behavioral addiction, such as Internet addiction. Behavioral and chemical addictions have seven core symptoms in common, that is, salience, tolerance, mood modification, conflict, withdrawal, problems, and relapse (Grant et al., 2010; Griffiths, 2005). These common points are not integrally researched, but each symptom has been found in smartphone addiction studies. For instance, Lin et al. (2014) reported four features of smartphone addiction, that is, compulsion, functional impairment, tolerance, and

withdrawal. Bianchi and Phillips (2005) suggested that smartphone overuse associated with psychological symptoms constitutes a form of behavioral addiction. Smartphone addiction is also considered a technological addiction that involves human-machine interaction (Griffiths, 1995).

Awareness regarding the severity of smartphone addiction has already been reflected in clinical science and praxis. The Diagnostic and Statistical Manual of Mental Disorders (DSM-5, American Psychiatric Association (APA), 2013) introduced the diagnostic criteria for Internet gaming disorder and encouraged further research for listing it as a formal diagnosis. Oulasvirta et al. (2012) reported that the awareness of problems with repeated use of smartphones was underestimated, and only a few reported that they were aware of it. The few respondents reported repeated usage of a smartphone as annoying, addicting, “a trap,” and distracting. They were aware that repeated use could lead to addiction; however, they were not aware of the severity of the repeated and intense use of a smartphone. If one is aware of the risks posed by smartphone addiction, one would do something against it. The awareness of the severity of smartphone addiction can, therefore, play a role in preventing it.

Life satisfaction pertains to the normal evaluation of one's surroundings, and subjective happiness or personal contentment (Diener et al., 1985; Scheufele and Shah, 2000). Addiction to media could increase depressive symptoms and substance use, and it could decrease well-being (Ha and Hwang, 2014; Yoo et al., 2014). Samaha and Hawi (2016) showed that smartphone addiction is not directly linked to life satisfaction, but it is linked via perceived stress and academic performance.

### **Socioeconomic status**

Gender, specifically, being male, is a risk factor for pathological Internet use (Frangos et al., 2011). Results from multivariate logistic regression analyses have suggested 50 percent increased odds for males to be addicted to the Internet (odds ratio (OR) = 1.5, 95% confidence interval (CI) = 1.1, 2.2) as compared with females (Lam et al., 2009). Women use the Internet mostly for social purposes and males do so for downloading programs, getting information, and for visiting pornographic sites (Tsitsika et al., 2009; Ybarra and Mitchell, 2005). In contrast to Internet addiction, studies on smartphone addiction reported that females were more dependent on smartphones than males were (Billieux et al., 2008). Females are more likely to be involved with their mobile than males are (Walsh et al., 2011), owing to the differences in the purpose of use of mobile phones. Males are more likely to use their phones for functional purposes, such as work-related use, whereas females primarily use their phones to keep in contact with valued people (Lemish and Cohen, 2005; Rees and Noyes, 2007). Thus, it seems that males and females have different smartphone use patterns.

Adolescents would be more at risk of smartphone addiction as compared with adults because adolescents are yet to develop self-control in smartphone use. Adolescents with working parents could be at a risk of smartphone addiction, possibly because such children could not be cared by their parents after school and they would use smartphones without any rules and guidance.

### **Smartphone usage pattern**

Smartphone addicts spend considerable time using their smartphone. The daily use duration of a smartphone is one of the most significant indicators of smartphone addiction. Torrecillas (2007) reported that 40 percent of adolescents and adults use smartphones for more than 4 hours a day to make calls and send messages. In addition, such people showed more problems in psychosocial, health, and technological dimensions, and they exhibited more preoccupation with smartphones and smartphone overuse as compared with those who used a smartphone for less than 4 hours per day (Alijomaa et al., 2016).

The causes of smartphone use can be attributed to the technological and content-related features of a smartphone. Regarding technological features, Oulasvirta et al. (2012) reported that the motivation of smartphone use is triggered by accessibility, portability, easiness of operation, connectedness, user interface, design, music and video player, navigation, and so forth. In Europe, smartphone users touched their phones about 10 to 200 times a day, for a mean duration of 10–250 seconds, and they used up 1–1000 megabyte (MB) data per day (Falaki et al., 2010). Oulasvirta et al. (2012) suggested that smartphone addiction increased owing to the habit of checking the phone on hearing a notification sound or message. With reference to content-related features, Van Deursen et al. (2015) reported that social smartphone use is one of the risk factors increasing smartphone addiction. Salehan and Negahban (2013) suggested that the predictive variable for smartphone addiction is the use of social networking services (SNSs). Park and Lee (2012) reported that smartphone addicts prefer to use SNSs, which could explain why females are more addicted to smartphones than males are. Song et al. (2004) classified the types of Internet use in relation with addictive behaviors. One type is process-related gratifications, which are acquired during consuming or prosuming media. Pleasurable experiences function as rewards and increase the risk of habitual or addictive behaviors. Another type of Internet use is social usage. Smartphone addicts spend most of their time on their smartphone for social purposes (Li and Chung, 2006; Lopez-Fernandez et al., 2014). Furthermore, excessive use of SNSs can negatively impact one's academic performance (Enriquez, 2010; Junco, 2012). In relation gaming, one study reported that the use of a smartphone for gaming and the use of multiple apps for gaming were potential risk factors for smartphone addiction, because, in smartphone gaming, it is easy to interact with other players through other social networking apps. Smartphone gaming, with or without the use of multiple apps, increases the risk of smartphone addiction

### **Material and methods**

#### **Participants**

Participants were 1824 middle school students who used a smartphone. They were sampled randomly from strata based on city, age, and sex. The mean age of the participants was

15.6 years (standard deviation (SD)=0.78), with 51 percent males and 49 percent females. Furthermore, 498 (27.3%) of them were in the first grade,

724 (39.7%) were in the second grade, and 602 (33.0%) were in the third grade of middle school in 17 cities in South Korea, for example, Seoul, Busan, Daegu, and Daejeon. Trained interviewers conducted face-to-face interviews with the participants. Before they were interviewed, the participants were informed about the survey and their consent to participate in the study was sought. Their participation was rewarded by a gift worth 5000 won (US\$4). This survey was conducted by Korean Information Society Agency, to investigate the status of smartphone addiction in Korea and the perception of the Korean people on the same.

## Questionnaire

The questionnaire included items on demographic variables, smartphone addictive behavior, and risk factors for smartphone addiction. The participants responded to questions on smartphone use patterns, such as the duration of daily smartphone use; commonly used content of a smartphone, such as game, SNS, music, or learning; and the purposes of the content used, such as fun/stress reduction, communication with people, accessing latest information, or passing time. Regarding smartphone content, we asked more about the SNS and game that were used most frequently (e.g. Facebook, Twitter, Kakaostory, Band, Instagram, or others), the duration and purpose of SNS and game use, the time slot of gaming, the awareness of gaming overuse, the use frequency of a PC room (PC room is a place where one can use the fastest PC for gaming by paying some money), and the monthly expenditure for using a PC room.

In addition, we assessed physical and psychological health problems caused by smartphone use. Physical health problems included dry eyes, sleep disturbances, pain in neck/wrist/back, digital dementia, chronic tiredness, and others. Psychological problems included anger, annoyance, anxiety, depression, aggression, lethargy, and others. Participants could choose multiple responses to report the problems that they faced.

Regarding smartphone addiction, we sought responses to questions on the degree of life and relationship satisfaction, and future career plan. These questions were rated on a 4-point Likert-type scale from 1 (not at all) to 4 (very much), to respond to the following statements: "I am satisfied with my life," "I am satisfied with my relationships," "I have a career plan after graduating from the school."

We assessed the awareness on the severity of smartphone addiction in Korea, experience of prevention education on smartphone addiction, and efficacy of the education using the

following questions: “Is the prevention education on smartphone addiction helpful?” The question was rated on a 4-point Likert-type scale from 1 (not helpful at all) to 4 (very helpful).

To measure the prevalence of smartphone addiction in middle school students, we used a validated Smartphone Addiction Proneness Scale (Korean Information Society Agency, 2011). This self-rating questionnaire contains 15 items across three subscales, namely, daily difficulties, intolerance, and withdrawal. Sample items include “My school grades dropped due to excessive smartphone use,” “My family or friends complain that I use my smartphone too much,” and “I panic when I cannot use my smartphone.” The items are rated on a 4-point Likert-type scale from 1 (never) to 4 (always). Some items are scored in reverse order to avoid a response bias. The scores range from 15 to 60, with a clinical cutoff score of 42. The internal consistency of this tool was  $r = 0.82$  (Korean Information Society Agency, 2011).

### **Data analysis**

A chi-square test was conducted to investigate differences in the demographic variables and smartphone use behaviors between the smartphone addiction and normal user groups. A t test was used to examine differences in the use duration of smartphone, SNS, game, and messenger services between the two groups. Subsequently, a multiple linear regression analysis was conducted to identify the predictors of smartphone addiction. Results were considered significant at  $p < 0.05$ . Statistical analyses were performed using SPSS 22.0

### **Discussion**

This study aimed to reveal the smartphone usage pattern of addicted and nonaddicted middle school students, and to identify the predictors of smartphone addiction. Therefore, we examined the prevalence of smartphone addiction, demographic characteristics, daily use duration of a smartphone, commonly used content, and SNS and game usage pattern. To explore the risks and predictive factors of smartphone addiction, we examined the physical and psychological health problems caused by smartphone usage, the awareness of smartphone addiction severity, and the effect of prevention education on smartphone addiction.

The prevalence of smartphone addiction in Korean middle school students was 30.9 percent. It is a very high rate compared with that reported in other countries. The percentages of smartphone addiction in adolescents were 10 percent in England, 21 percent in the Philippines, and 18 percent in Hong Kong (Lopez-Fernandez et al., 2014; Mak et al., 2014). The Korean government has recognized the severity of smartphone addiction problems in adolescents, and the Framework Act on National Informatization was established in 2013, to help tackle this problem. According to Article 30 of the act, all schools and public institutions are obliged to carry out prevention education on smartphone addiction. Although this rule exists since 2013, merely 13.4 percent of the present sample reported having received smartphone addiction prevention education, which could be regarded as very low without considering other circumstances such as budget, reward, and administrative procedures. Among those who



received such education, a high proportion of the respondents reported that the prevention education was very helpful or helpful, and this proportion was higher in the risk group for smartphone addiction (78.0%) than that in the normal user group (63.6%). This result indicated that the education was effective, and that it needs to focus more on those at risk of developing smartphone addiction rather than on normal users.

Contrary to our hypothesis, smartphone addiction was not related with gender, family income, or parents' education. These results are consistent with those of some studies that reported that smartphone addiction is not significantly related with gender (Attamimi, 2011; Chung, 2011; Kwon et al., 2013; Prezza et al., 2004). In a study on cell phone usage of children aged 8–18 years, neither household income nor parents' education was found to have an effect on the use of smartphones (Groupe Speciale Mobile (GSMA), 2011). As smartphones offer a variety of content tailored to individual interests, every individual from different socioeconomic backgrounds could find content that he or she is interested in, or which fulfills his or her need or deficiency. Thus, demographic variables showed no relationship with smartphone addiction.

The main purposes of using SNSs and games were fun, stress reduction, and communication with people. This result seems to be natural, but it should be interpreted by reflecting on the Korean society, which emphasizes greatly on children's education. Adolescents in Korea have been expected to exhibit good academic performance in a competitive social atmosphere. They experience high levels of stress associated with academic performance (Park et al., 2014). They are forced to study for about 7 hours 50 minutes per day for exams to enter a prestigious university. This is much longer as compared with that reported in other countries, where the duration of studies ranges from 3 to 6 hours (National Youth Policy Institute,

2009). Most of the adolescents, thus, spend their little free time on a smartphone, because there are not many leisure activities to relieve stress and have fun. In this environment, promoting smartphone use with the inability to control their smartphone use despite negative consequences could lead to addiction. The high prevalence of smartphone addiction in Korean adolescents should, thus, be interpreted considering the social environment.

Contrary to our hypothesis, the two groups showed no differences in life and relationship satisfaction. Life satisfaction is partly related with social ties (Kahneman and Krueger, 2006), and frequent social communication has been found to exert a positive influence on life satisfaction (Diener et al., 1991). Internet users have fewer face-to-face interactions like heavy television watchers do (Nie, 2001). Smartphone addicts who spend a lot of time on their phone are forced to reduce their face-to-face contact time. Therefore, smartphone addiction is considered to be related with loneliness and shyness (Bian and Leung, 2014). Specifically, the higher one scores on shyness and loneliness, the higher is the likelihood that one would be addicted to a smartphone. In this sense, we hypothesized that the risk group for smartphone addiction will have lower interpersonal and life satisfaction than the normal user group would. However, the risk group merely showed a tendency to exhibit lower life satisfaction as compared with the normal user group. Our result suggested that life and interpersonal

satisfaction levels could not explain the addictive use of smartphone alone. Samaha and Hawi (2016) reported that smartphone addiction is not directly linked to life satisfaction, but it is via perceived stress and academic performance. Satisfaction with life should be explained by many other factors such as family support, doing what they want to do, personality, positive thinking, and so on. Future studies should investigate the relationship of smartphone addiction with life satisfaction and other related variables to identify the extent to which smartphone addiction can be explained by life satisfaction, and to reveal the path of the influence of life satisfaction on smartphone addiction. However, the satisfaction of the online interpersonal relationships in the risk group for smartphone addiction may have offset the low satisfaction with their offline interpersonal relationships. To further examine the relationship between interpersonal satisfaction and smartphone addiction, future studies should examine the effects of both online and offline relationships.

Consistent with other studies (Alijomaa et al., 2016; Torrecillas, 2007), we found that the risk group for smartphone addiction spent more time on the smartphone, mobile messenger, and SNSs than the normal user group did. Specifically, the risk group spent 5.2 hours while the normal user group 4.6 hours. Oulasvirta et al. (2012) reported that though smartphone addicts used a smartphone more frequently and for a shorter duration as compared with nonaddicts, the sum of the duration of use in a day was longer for addicts as compared with that for nonaddicts. Another study that analyzed a large data set on actual smartphone usage revealed that the users typically spent almost 1 hour per day on the smartphone, but the duration was less than 1 minute at each instance of use (Boehmer et al., 2011). This study reported also the differences in app usage duration. News apps were accessed most frequently in the morning, whereas communication apps were used throughout the day. Using a data set on smartphone use, Lee et al. (2012) showed that a risk group for smartphone addiction spent more time on smartphone use per day as compared with the nonrisk group, and their use was greater in the morning and evening. The usage sessions initiated by the push notifications were longer for the risk group, which demonstrated that notifications acted as external cues related to problematic usage patterns. In addition, the risk group consumed significantly more online content that can provide instant gratification (e.g. pass time, entertainment, and information seeking).

The multiple linear regression analysis revealed that the daily use duration of a smartphone and SNS, and the awareness of game overuse predicted smartphone addiction. As expected, longer daily use duration of a smartphone predicted higher scores on the smartphone addiction scale, but the awareness of game overuse predicted lower scores on the smartphone addiction scale. Surprisingly, the shorter daily use duration of SNS negatively predicted smartphone addiction, which was contrary to our hypothesis and that of other studies. Roberts et al. (2014) found that, among college undergraduates, one of the predictors of mobile phone addiction was time spent on SNSs. In a European cross-sectional study, Lopez-Fernandez et al. (2017) reported that daily use of a mobile phone, increased social networking, female gender, not necessarily monthly payment as type of contract, online shopping, viewing TV shows, downloading-related activities, and messaging and chatting predicted mobile phone dependence in young adults. However, the above studies focused on young adults, and we could not find any studies on SNS use duration in adolescents aged 13–15 years. This study showed that the long SNS use duration



was not related to smartphone addiction in adolescents because the Pearson's correlation coefficient of SNS use duration with the smartphone addiction score was not significant ( $r=0.012$ ,  $p=0.604$ ). However, the SNS use duration could function as a protective factor in combination with other variables. That is, when adolescents use a smartphone daily for a long duration, using SNS could protect them from smartphone addiction by engaging in the use of mobile messengers or gaming apps. It seems that using SNS has a positive function of preventing smartphone addiction. This result must however be verified in a future study.

## **Limitations**

While this study provides new insights into the smartphone usage pattern of middle school students in Korea, who are in a specific social environment, and the different usage patterns of the addiction and normal user groups, this study has some limitations.

First, this survey was conducted using face-to-face interviews. Therefore, social desirability may have influenced the adolescents' responses. Intentionally or unintentionally, they might not have been frank about the use duration and content used on a smartphone. Lin et al. (2015) revealed a significant discrepancy in self-reported and in-application recorded smartphone use duration. Often, smartphone users underestimate the use duration, and this underestimation is greater in more frequent users than in nonfrequent users. To improve the awareness of smartphone use, future studies should investigate the difference between self-reported and technological records of smartphone use. Self-reported data and actual smartphone use data could provide a comprehensive explanation about smartphone usage patterns.

Second, some variables were measured subjectively, using simple questions rather than standardized scales. For instance, life and interpersonal relationship satisfaction, and health and psychological problems were based on subjective evaluations. Therefore, to obtain objective data on these variables, it is necessary to use standardized assessment scales and diagnostic interviews conducted by a psychological or psychiatric professional.

Third, the prevalence of smartphone addiction was high in this study as compared with that observed in other countries, but the prevalence could not be compared with other studies because each study used different scales to assess smartphone addiction. Cross-country studies need to be conducted to using a common smartphone addiction scale to enable comparisons and interchange of strategies for preventing and treating smartphone addiction.

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