

A Study on Smartphone Addiction, Mental health and Impulsiveness For High School Students at Korea

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고등학생의 스마트폰 중독과 정신건강, 충동성에 관한 연구

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Abstract The purpose of this study is to verify the causal relationship between the smartphone addiction proneness, mental health, and impulsiveness of high school students in Korea. 804 first and second year high school students participated in the survey that included the Smartphone addiction scale, Korean Brief Mental Diagnosis Exam - the highest 25% of total score (Addictive SmartPhone Use Group : ASPUG 213 persons), the lowest 25% of total score(Non-Addictive SmartPhone Use Group : NASPUG 204 persons), BIS-II Impulsiveness Scale and additional questions asking for demographical characteristics. The outcomes of this study were as follows. First, sex, grade of high school, academic accomplishment, student's satisfaction with school life, monthly allowance, the level of parental respect, having a opposite sex friend were related to smartphone addiction and impulsiveness. Second, ASPUG had worse mental health and impulsiveness than NASPUG, and the difference was statistically significant. Third, Students showed higher levels of mental health 9 subareas - anxiety, depression, phobic anxiety, Somatization, obsessive compulsive, interpersonal sensitivity, hostility, Paranoid ideation, Psychosis as their smartphone use increased.

Key Words : smartphone, addiction, mental health, impulsiveness

요약 본 연구는 일부 고등학생의 스마트폰 이용실태를 파악하고, 스마트폰 중독정도에 따른 정신건강 및 충동성의 차이 및 스마트폰 중독과 정신건강 및 충동성과의 관계를 파악하기 위해 시도되었다. 고등학교 1, 2학년 804명의 자료를 최종 분석하였으며 중독 척도 총점 상위 25%를 중독점수가 높은 집단(213명)으로, 하위 25%를 중독점수가 낮은 집단(204명)으로 정의하였다. 학생들은 성별, 학년, 학습성취, 학교생활 만족, 용돈, 부모의 신뢰 수준, 이성 친구 유무에 따라 유의한 차이가 있었다. 스마트폰 중독은 정신건강과 유의한 순 상관관계를 보였으며 정신건강 하부 요인인 불안, 우울, 신체화, 강박, 대인민감성, 적대감, 편집성에서 모두 유의한 정적상관을 보였고 그 중 불안이 가장 높은 상관관계를 보였다. 또한 스마트폰 중독은 충동성에서도 유의한 상관이 있는 것으로 나타났으며 정신건강과 충동성의 관계에서도 정적상관이 있는 것으로 확인되었다.

주제어 : 스마트폰, 중독, 정신건강, 충동성

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1. INTRODUCTION

The use of smartphone has become a necessity and makes our lives more convenient, but it also causes problem such as a smartphone addiction during adolescence. Adolescence is a transitional period of development involving rapid psycho-social and physical changes[1]. Among adolescence, 16~19 years of age is 91.73%. The survey of 1,088 middle and high school students reported that 46.3% sent text messages during the class and 38.2% sent more than 1000 text messages per month. They were more likely to send a text message than make a phone call. smartphones are attractive as a tool for communication and interpersonal interaction, there has been an increased risk in its problematic use[2][3]. Adolescents in Taiwan use smartphones to call others, to send text messages, to play electronic games, to take pictures, and to access the internet, and problematic use of smartphone use could be considered as one form of technological addiction[5]. Research shows that many adolescents used their smartphone addictively. The students used smartphone even while riding their bicycles[6].

Adolescents use their smartphone more addictively if they have an impulsive personality[7]. Those who use smartphone problematically exhibit a bias toward extroversions, and low-self esteem but not neuroticism. Also, smartphone use is an important part of life for many adolescents, but problematic smartphone use may complicate physiological and psychological problems. [4]. Yang et al(2010) reported that there were positive associations between problematic smartphone use and aggression, insomnia, smoking cigarettes, suicidal tendencies, and low self-esteem in all groups with different sexes and age[8]. An addictive person tend to feel depressed, lost, and isolated without a smartphone [9]. Of the students studied, 89.7% were found to use smartphones at school, and impulsiveness, anxiety, and stress were significant discriminating factors on smartphone use between addictive and normal groups

of middle school student in South Korea[7]. Sánchez-Martínez & Otero(2009)[10] reported that 96.5% of the subjects of high school students had their own smartphone(80.5%), and 15.9% had two or more. And 54.8% of the students take it to school and 46.1% keep it on during classes; 41.7% use it intensively. Intensive smartphone use was also associated with females, rural school location, good family income, smokers, excessive alcohol consumption, depression, smartphone dependence, and school failure[10].

Therefore, it is found to be necessary to identify the differences between addictive and non-addictive smartphone use groups. This goal of this study is to provide the basis for developing health education materials that promote appropriate smartphone use and to prevent smartphone addiction-related problems. To this end, the study identified the differences between smartphone use among high school students and the effects of smartphone addiction on students' mental health and impulsiveness.

2. METHODS

850 first and second year high school students participated in the survey and 804 were used for final analysis. A survey was conducted for about two weeks from May 20th, 2008 to June 3rd, 2008. In order to distribute and collect the surveys, an indirect questionnaire method involving the school nurse and homeroom teachers of each school was applied.

2.1 Measurements

Researcher's Operational definition : the number of students whose total score of smartphone addiction belongs to the highest 25% (addictive smartphone use group -ASPUG) was 213 and the lowest 25% (non-addictive smartphone use group- NASPUG) was 204.

The variables were smartphone addiction, mental health, and impulsiveness.

2.1.1 smartphone addiction

There were 20 questions that examined smartphone addiction: intolerance/dependency (5items), attachment (5 items), life dysfunction (5 items), and compulsion (5 items). Possible response of each item ranged from 1 (strongly disagree) to 5 (strongly agree). This Korean smartphone addiction scale was developed by Han and Huh (2004) and adjusted for middle school students by Lee (2006). Addictive group means upper 25% of smartphone addiction score of participants and non-addictive group means lower 25% of smartphone addiction score of participants. Cronbach’s α of this scale in this study was .913. The higher the score on the scale means stronger addiction. In this study the addictive smartphone use group means upper 25% group and non-addictive group means lower 25% group of the summed scores of this scale(Table 1).

2.1.2 Mental health

The standardized ‘Korean Brief Mental Diagnosis Exam; SCL-90-R’ was used to examine mental health, and this scale consisted of 90 items that asked about the s symptom experiences during the previous week. There were 9 sub-scales that consisted of somatization, obsessive compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation and psychosis. Possible response of 1 item ranged from 1 (never experienced) to 4 (severe). This scale was developed by Kim, Won & Kim(1978)[13]. Cronbach’s α of this scale in this study was .979. Higher the score of this scale means lower mental health.

2.1.3 Impulsiveness

The Barrett Impulsiveness Scale II [14] which was adjusted for Korean by Lee(1992)[10] was used to examine impulsiveness and this scale had 23 items that consisted of cognitive impulsiveness (6 items), motor impulsiveness (8items) and non-planning impulsiveness (9 items). Possible response of 1 item ranged from 1

(very disagree) to 4 (very agree). Cronbach’s α of this scale in this study was .810. Higher the score of this scale means higher impulsiveness.

<Table 1> The addictive group and the non-addictive group by smartphone addiction scores and %

Category	n	Range %	smartphone addiction score
Addictive group	213	upper 25%	54~89
Non-addictive group	204	lower 25%	20~33
Middle group	387	middle 50%	34~53
Total	804	100%	

Data analysis

With regard to data analysis, reliability analysis, frequency analysis, χ^2 -test, t-test, were performed using SPSS WIN 12.0 program.

3. RESULTS

3.1 Differences of demographic variables by groups

There were significant differences in gender, type of high school, academic accomplishment, the level of a student’s satisfaction with school life, whether or not a student has a friend of the opposite sex, spending money per month, and the level of parents’ respect for a student between non-addictive mobiles use group and addictive use group(Table 2). This results means that female students were more addictive than male students and vocational high school students were more addictive than academic high school students. Besides, addictive group had more poor academic accomplishments, lower satisfaction with school life, more having an opposite sex friend, more spending money per month, and lower parents’ respect for student.

3.2 Differences of smartphone use by groups

Addictive group students used their smartphone for a longer period, more use per day, more spending smartphone fee per month, more experienced of being scold for inappropriate smartphone, more disagreed school's regulation for cellular use, more use of text messages, more use during classes and less satisfaction with their current smartphones. Addictive group used their smartphone more frequently as a communication tool with others. And these differences were statistically significant(Table 3).

3.3 Differences of mental health by groups

With regard to the difference of the index of students' mental health according to their scores of

smartphone addiction, the average score of the group with higher addiction score was higher than that of the group with lower score. In addition, in all of nine sub-areas the average scores of the two groups were significantly different(Table 4).

3.4 Differences of Impulsiveness by groups

In respect to the difference of students' impulsiveness according to their scores of smartphone addiction, the addictive group displayed higher average score than the group with lower score. Besides, in all of three sub-areas, the two groups showed significant difference in their average scores(Table 5).

<Table 2> Differences of demographic variables by groups (n=417)

Variables		Non-addictive group(n=204)	Addictive group (n=213)	Total (%)	x ² (df)	p
		Freq.(%)	Freq.(%)			
Gender	Male	107(52.5)	84(39.4)	191(45.8)	7.110 (1)	.008**
	Female	97(47.5)	129(60.6)	226(54.2)		
Type of high school	Academic high school	111(54.4)	92(43.2)	203(48.7)	5.250 (1)	.024*
	Vocational high school	93(45.6)	121(56.8)	214(51.3)		
Academic accomplishments	Excellent	20(9.8)	12(5.6)	32(7.7)	26.199 (4)	.000***
	Good	62(30.4)	35(16.4)	97(23.3)		
	Fair	82(40.2)	83(39.0)	165(39.6)		
	Poor	32(15.7)	56(26.3)	88(21.1)		
Satisfaction with school life	Very poor	8(3.9)	27(12.7)	35(8.4)	13.305 (4)	.010**
	Very satisfaction	8(3.9)	7(3.3)	15(3.6)		
	Satisfaction	76(37.3)	48(22.5)	124(29.7)		
	Mean	88(43.1)	109(51.2)	197(47.2)		
	Unsatisfaction	23(11.3)	29(13.6)	52(12.5)		
Having an opposite sex friend	Very unsatisfaction	9(4.4)	20(9.4)	29(7.0)	29.228 (1)	.000***
	yes	27(13.2)	77(36.2)	104(24.9)		
Spending money per month(Won)	no	177(86.8)	136(63.8)	313(75.1)	10.630 (4)	.031*
	Below 40,000	103(50.5)	81(38.0)	184(44.1)		
	40,000~60,000	53(26.0)	57(26.8)	110(26.4)		
	60,000~80,000	18(8.8)	32(15.0)	50(12.0)		
	80,000~100,000	13(6.4)	12(5.6)	25(6.0)		
Parents' respect for student	Above 100,000	17(8.3)	31(14.6)	48(11.5)	21.322* (4)	.000***
	Very much	57(27.9)	32(15.0)	89(21.3)		
	Much	110(53.9)	104(48.8)	214(51.3)		
	Mean	30(14.7)	61(28.6)	91(21.8)		
	Less	5(2.5)	13(6.1)	18(4.3)		
	Few	2(1.0)	3(1.4)	5(1.2)		

*Fisher's Exact Test

4. DISCUSSION

4.1 Differences of demographic variables by groups

Many studies reported that female students were more addictive than male students. Female students were tend to react more emotionally and talk with others was one of the coping strategies for them, so they would more prefer to use smartphone than male students[3, 5, 21]. This study also shows that female students were more addictive than male students and this difference was statistically significant. Girls, children with no siblings, children who were members of a sport club, and children who played computer games daily were more likely to own and use smartphones regularly[16]. In the case of internet addiction study, Lam et al[17] also reported that their results suggested a 50% increased odds for males to be addicted to the Internet (OR = 1.5, 95% CI = 1.1-2.2) when compared to females. According to the results of this study, teachers should have more consideration on gender differences. Girls, children with no siblings, children who were members of a sport club, and children who played computer games daily were more likely to own and use smartphones regularly [16]. In the case of internet addiction study, Lam et al[17] also reported that their results suggested a 50% increased odds for males to be addicted to the Internet (OR = 1.5, 95% CI = 1.1-2.2) when compared to females. According to the results of this study, teachers should have more consideration on gender differences. Vocational high school students were more addictive than academic high school and this difference was statistically significant. This result were same as Yang (2002)'s study[8]. Addictive group had lower academic accomplishment. It showed that addictive smartphone use could affect on academic accomplishment like in other studies[18]. It means that education of right use of smartphone for students was needed. Addictive group showed more dissatisfaction with school life, and

this results assisted the result of the study that intensive smartphone use was associated with school failure[10]. 36.2% of addictive group had an opposite sex friend while 13.2% of non-addictive group had an opposite sex friend. This means that the students who had opposite sex friend wanted to communicate with each other. A survey reported that the people who live with their family, friends, or colleagues used smartphone more frequently than people who live alone. The unmarried rather than the married, and people who have many intimate friends or colleagues than people who have a few friends or colleagues have much amount of smartphone used[3]. Addictive group spent more money per month. Addictive group should pay higher smartphone use fee, so this result was natural.

Addictive group had lower parents' respect for student, this means that the communications between addictive group students and their parents were poor. Poor communication with parents made them more to use smartphone. Lam et al[17] reported that one of the potential risk factors on the internet addiction of adolescents was family dissatisfaction (OR = 2.4, 95% CI = 1.3-4.3). And clinicians need to be aware of potential comorbidities of other problems such as stress and family dissatisfaction among adolescent internet addiction patients. Therefore, the communication between students and parents is important to control addictive use of smartphone.

4.2 Differences of smartphone use by groups

There were significant differences between ASPUG and NASPUG. More ASPUG students(35.2%) have used their smartphone above 4 years, it means that they used smartphone during a longer period than NASPUG students (21.1%), and more ASPUG students (45.1%) have possessed smartphones since they were freshman of middle school (7th grade) than NASPUG students (35.8%). The rate of possession increased with

<Table 3> Differences of Smartphone use between Non-addictive group and Addictive group

Variables		Non-addictive group (n=204)	Addictive group (n=213)	Total (%)	x ² (df)	p
		Freq.(%)	Frequ.(%)			
First use (since)	Before Middle school	23(11.3)	46(21.6)	69(16.5)	20.005 (4)	.000***
	Middle school 1	73(35.8)	96(45.1)	169(40.5)		
	Middle school 2	36(17.6)	17(8.0)	53(12.7)		
	Middle school 3	38(18.6)	28(13.1)	66(15.8)		
	High school 1	34(16.7)	26(12.2)	60(14.4)		
Duration of smartphone use	Below 6 months	16(7.8)	16(7.5)	32(7.7)	25.788 (5)	.000***
	6 month~1 year	20(9.8)	21(9.9)	41(9.8)		
	1 year~2 years	48(23.5)	37(17.4)	85(20.4)		
	2 years~3년 years	44(21.6)	16(7.5)	60(14.4)		
	3 years~4 years	33(16.2)	48(22.5)	81(19.4)		
	Above 4 years	43(21.1)	75(35.2)	118(28.3)		
using time per day	below 30 min.	53(26.0)	9(4.2)	62(14.9)	129.537 (5)	.000***
	31~1 hour	61(29.9)	10(4.7)	71(17.0)		
	1 hour~2 hours	29(14.2)	31(14.6)	60(14.4)		
	2 hours~3 hours	21(10.3)	18(8.5)	39(9.4)		
	3 hours~4 hours	11(5.4)	23(10.8)	34(8.2)		
	Above 4 hours	29(14.2)	122(57.3)	151(36.2)		
the number of text messages used per day	Below 30	92(45.1)	25(11.7)	117(28.1)	85.543 (5)	.000***
	31~60	46(22.5)	35(16.4)	81(19.4)		
	61~100	32(15.7)	37(17.4)	69(16.5)		
	101~150	16(7.8)	44(20.7)	60(14.4)		
	151~200	9(4.4)	35(16.4)	44(10.6)		
	Above 200	9(4.4)	37(17.4)	46(11.0)		
Monthly smartphone fee (Won)	Below 20,000	42(20.6)	17(8.0)	59(14.1)	48.247 (4)	.000***
	20,000~30,000	102(50.0)	63(29.6)	165(39.6)		
	30,000~50,000	47(23.0)	95(44.6)	142(34.1)		
	50,000~70,000	10(4.9)	27(12.7)	37(8.9)		
	Above 70,000	3(1.5)	11(5.2)	14(3.4)		
experience of being scold for inappropriate smartphone use	None	110(53.9)	23(10.8)	133(31.9)	102.496 (2)	.000***
	Sometimes	91(44.6)	151(70.9)	242(58.0)		
	Very often	3(1.5)	39(18.3)	42(10.1)		
school's regulation for smartphone use	Agree	111(54.4)	71(33.3)	182(43.6)	18.823 (1)	.000***
	Disagree	93(45.6)	142(66.7)	235(56.4)		
use a smartphone during class	None	112(54.9)	35(16.4)	147(35.3)	67.688 (2)	.000***
	Sometimes(text)	70(34.3)	139(65.3)	209(50.1)		
	Very often	22(10.8)	39(18.3)	61(14.6)		
satisfaction with his/her current smartphone	Satisfaction	100(49.0)	77(36.2)	177(42.4)	9.114 (2)	.010**
	Average satisfaction	64(31.4)	71(33.3)	135(32.4)		
	dissatisfaction	40(19.6)	65(30.5)	105(25.2)		
most frequently used smartphone function	Communicate with others	145(71.1)	175(82.2)	320(76.7)	11.338 [†] (3)	.007**
	Searching internet	5(2.5)	1(0.5)	6(1.4)		
	Entertainment	52(25.5)	32(15.0)	84(20.1)		
	Photographing	2(1.0)	5(2.3)	7(1.7)		
Acknowledge of problems of smartphone overuse	Yes	38(18.6)	122(57.3)	160(38.4)	65.824 (1)	.000***
	No	166(81.4)	91(42.7)	257(61.6)		

[†]Fisher's Exact Test

<Table 4> Differences of Mental health by groups

	Non-addictive group (n=204)		Addictive group (n=213)		t	p
	Mean	SD	Mean	SD		
Somatization	6.01	5.56	13.65	9.62	-9.969	.000***
Obsessive compulsive	8.34	6.13	15.81	8.00	-10.725	.000***
Interpersonal sensitivity	7.94	6.16	13.47	7.33	-8.345	.000***
Depression	9.31	8.51	18.59	11.45	-9.411	.000***
Anxiety	4.15	5.29	11.38	8.66	-10.329	.000***
Hostility	3.57	3.84	7.79	5.41	-9.204	.000***
Phobic anxiety	1.80	3.41	4.80	4.71	-7.474	.000***
Paranoid ideation	3.32	4.24	6.88	5.32	-7.563	.000***
Psychosis	3.85	5.08	9.90	8.11	-9.153	.000***
Total	51.27	43.58	109.53	65.22	-10.764	.000***

<Table 5> Differences of Impulsiveness by groups

	Non-Addictive Group (n=204)		Addictive Group (n=213)		t	p
	M	SD	M	SD		
Cognitive Compulsiveness	15.28	2.70	16.72	2.76	-5.372	.000***
Motor Compulsiveness	16.21	3.66	20.28	3.72	-11.243	.000***
Non-Planning Impulsiveness	21.07	3.57	23.74	3.30	-7.915	.000***
total	52.57	8.23	60.74	7.95	-10.313	.000***

year in Japanese school; 39.6% of 7th graders, 50.2% of 8th graders and 59.3% of 9th graders possessed smartphone[23]. Song(2006) [18] reported that most of the subjects of high school student used smartphone since 9th grade. These results mean that our adolescents tend to use their smartphones earlier than before. The earlier the adolescents begin to use smartphone the more they need to learn the appropriate using. More ASPUG students (57.3%) used their smartphone above 4hours per day than NASPUG students (14.2%) and ASPUG students spend more smartphone use fee than NASPUG students. According to the result of this study, we can predict that the students can become addictive if they if they used smartphone longer.

More ASPUG students (54.5%) used text messages above 100 than NASPUG students (16.6%) and 83.6% of ASPUG students used smartphone during the classes. 89.2% of ASPUG students experienced of

being scold for inappropriate smartphone use. A survey reported that teens usually use SNS while over thirties usually use speaking call. In the twenties, the group of collage students use SNS mostly and business group use speaking call mainly [3]. This results mean that addictive smartphone use group students could not focus on their class appropriately their classes due to using smartphone, and they might be scolded for inappropriate smartphone use by teachers. therefore the students need to educate the right use of smartphone. Smart-phone addiction had a significant influence on sociality development in negative way[18].

More ASPUG students (30.5%) disagreed about school’s regulation for cellular use, and More ASPUG students (30.5%) did not satisfied with their school life. Also, ASPUG used their smartphone more as communicating means with others than searching informations or entertainments. Since students use smartphones for more than communication with their

friends, various measures should be sought to lead students to the appropriate use of smartphones rather than unconditionally regulating students' smartphone use. Teachers and parents should have some educational materials that they can help adolescents to satisfy school life.

Much students of ASPUG were not satisfied their owned smartphone and wanted to change their phone with a new one. Adolescents have a need to express themselves and smartphone can be a mean for expression. Thus, the students of ASPUG might be more sensitive on newer designs and functions of smartphones. Over half students of ASPUG (57.3%) acknowledged their problematic use of smartphones, so they can use their smartphone rightly, if they could have a good education for right smartphone use.

4.3 Differences of mental health by groups

In ASPUG, the means of somatization, obsessive-compulsive, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychosis were higher than in NASPUG. This result means that ASPUG had worse mental health than NASPUG. There were significant differences in the mental health between ASPUG and NASPUG.

Song (2006), Shin et al(2011) reported that the higher in smartphone addiction score, somatization, depression, anxiety, hostility, psychosis were higher[19, 20]. These findings suggest that problems with smartphone e-mail may have a considerable effect on the emotional status of young teens. Massive smartphone e-mail stress should be a new focus of mental health intervention in young people in Japan. The findings of this study align with suggestion that problematic or excessive smartphone use may lead to worse mental health. Keum(2013) also reported the causal relationship between smartphone addiction proneness and mental problem of youth in Korea[21]. From treatment perspective, we feel that future research should focus on which changes in smartphone

use can be most safely and effectively targeted by school and social interventions.

4.4 Differences of Impulsiveness by groups

Since the Barrett Impulsiveness Scale II is considered more of a trait measure of impulsiveness, the result of this study that showed higher impulsiveness in ASPUG, suggested that impulsiveness is an important risk factor for the development smartphone addiction. Lee et al(2007)[7] reported that impulsiveness was a significant discriminating factor on smartphone use between addictive group and normal group of middle schooler in South Korea. Adolescents would use smartphone more addictively if they have an impulsive personality. Habitual use of smartphone can make adolescents to be addictive user because they have relatively lower control and higher impulsiveness than adults. Thus, various interventions are needed to help those adolescents to use smartphone rightly and to reduce impulsiveness.

5. Conclusion

In conclusion, this study is significant in that it compared smartphone use, mental health, and impulsiveness between ASPUG and NASPUG. This study results are expected to provide basic materials for the development of a program that helps to recognize both physical and mental problems related to addictive use of smartphones and to educate students on mediation and prevention methods. Recently, smartphones are being popularized quickly with the rapid expansion of the mobile market. Smartphones are very addictive-with more than double the addictiveness of the Internet- and have a better accessibility than computers[22]. Especially, it is recognized that many students have problems with smartphone use, and thus aggressive measures should be taken to prevent them from being addicted to smartphones. Besides, considering that the age of children first using

smartphones is going down, It is important to educate smartphone use at elementary school. As smartphones mean more than the tools of communication for many students, various measures should be sought to lead students to the appropriate use of smartphones rather than unconditionally regulate students' smartphone use.

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