RESEARCH ARTICLE

A Comparative Study of Mobile Internet Usage between the U.S. and Korea

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The introduction of smartphones illuminated mobile internet prevalence, highlighting nomophobia. This study explored the mobile internet usage dependency of Korean and U.S. mobile users and investigated the severity of such usage dependency and the factors involved. In the combined data set, it was found that Korean users have higher usage dependency levels than US users and that students, unemployed users, and younger generations are more susceptible to mobile internet usage dependency. When comparing the two countries as separate data sets Korean females present as having higher usage dependency levels. In the U.S., it is students and younger generation groups who present with higher usage dependency levels. Regression analysis found that frequency of access has higher associations with mobile internet usage dependency than usage length. country of origin and age are significantly associated with mobile internet usage dependency.

Keywords: mobile internet; smartphone; nomophobia

A recent study by Kung (2012) shows that 66% of mobile phone users suffer from 'nomophobia' : severe anxiety and panic due to being without a mobile phone. Since the introduction of Apple's iPhone in 2007, mobile phones are being gradually replaced by smartphones. A smartphone is not just a calling device but a unique device with multiple functions, such as an internet browser, music player, GPS navigator, mobile TV, alarm clock, watch, and camera. According to a survey (The Telegraph, 2012) from a U.K mobile network operator (O2) internet browsing is the number one usage for smartphones. Making a phone call is only the fifth most popular reported use for smartphones. The most popular smartphone features are based on internet connection and include internet browsing, social networking services, GPS map services, and TV and radio services. Internet phone calls and internet text messaging are replacing traditional phone calls and messaging services. In addition, with the development of wireless broadband technologies such as 3G/4G and WiFi, smartphone users have moved from internet banking to mobile banking (Zhou, Lu, and Wang, 2010). As Internet banking users use personal computers for transactions, mobile banking users use smartphones. Smartphones with banking capabilities can offer users dramatic conveniences but, at the same time, can encourage greater dependency on the smartphone.

According to the Cellular Telecommunications & Internet Association's (CTIA) wireless industry statistics (2012), the number of mobile phone subscribers in the United States (U.S.) is estimated to be over 322.8 million as of June 2011. Since the U.S. population is estimated at around 313 million as of February 2011 (U.S. Census Bureau, 2011), the market penetration rate of the mobile phone industry is therefore over 100%. As such, this has highlighted the level of demand on the mobile communication market.

According to the ComScore Reports (2012), 114 million people in the U.S. owned smartphones in June 2012, which means that approximately one third of U.S. mobile phone users have smartphones. A report from the International Data Corporation (2012) said that the U.S. accounts for 21.3% of the global market share of smartphones, which was the largest smartphone market as of 2011. As smartphone penetration rates increase, so does mobile internet dependency, because people depend more on the various functions of their smartphones (Lee, Chang, Lin, and Cheng, 2014).

According to the Organization for Economic Co-operation and Development's (OECD) statistics for information and communication technology (2012), among the 34 OECD countries, Korea is number one in terms of the wireless broadband subscriber ratio (99.3 users / 100 inhabitants) as of June 2011. This means that most Koreans have internet accessible mobile devices, since wireless broadband is used through mobile phones or mobile computing devices such as tablets or netbooks. The Korea Communications Commission's statistics (2012) reported that the number of mobile subscriptions in Korea is close to 54 million. Based on Korea's population of 50 million, the mobile service penetration rate is expected to be over 108%, according to the OECD's 2012 statistics. This is possible due to some people having more

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than one mobile subscription. In addition, the number of smartphone subscriptions is 24.8 million, which means almost half of the people in Korea have smartphones (Korea Communications Commission, 2012).

This discrepancy between Korean and U.S. users results from differing viewpoints regarding the phenomena of mobile internet dependency, which some have called mobile internet addiction (Wang, 2001). There has been controversy about the term "internet addiction". Even though the term internet addiction is frequently used in the public domain, it is not listed in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-V), which was published by the American Psychiatric Association (Pies, 2009). While gambling addiction is the only behavioral addiction included in DSM-V, internet addiction is listed in the appendix as a disorder requiring further study (Block, 2008). There are similar circumstances regarding TV addiction, which is widely accepted but has not been listed in the DSM-IV. Both internet addiction and TV addiction are characterised as compulsive behaviours. In an editorial paper by Block (2008) about the issues involved in internet addiction he states that whilst Korea considers internet addiction as one of the most serious public health issues, the U.S. consider it a comorbidity with other addiction disorders such as gambling and pornography. Dr. Ronald Pies (2009) argued that the medical term addiction should not be applied to anything other than drugs and gambling. Regardless of whether there is general consensus about internet addiction being a mental disorder or not, it has become an increasingly problematic concept and as such presents itself as a global phenomenon (White, 2011).

In this study, the author developed a survey of 19 mobile internet usage questions with yes/no responses and analysed the mobile internet dependency behaviours of U.S. and Korean mobile users based on access time, usage hours, student status, age group, employment, and gender. The Mobile Internet Usage Index (MIUI), formulated by the author and computed by summing all 'yes' responses to the 19-item scale was used as an indicator of mobile internet dependency. Following this, regression analyses were presented for the relation between usage pattern and MIUI.

Questionnaire Development

The word, 'addiction', is defined by characteristics such as "inability to consistently abstain, impairment in behavioural control, craving, diminished recognition of significant problems with one's behaviours and interpersonal relationships, and a dysfunctional emotional response" (American Society of Addiction Medicine, 2011). Kandell (1998) defined internet addiction as "a psychological dependence on the Internet." By applying this definition, mobile internet dependency can be defined as a strong need for mobile internet usage and unstable emotional status when without a mobile phone, which has been called nomophobia by the media.

The difference between dependency and addiction is that addiction implies negative effects due to a lack of or an excess of the object of said addiction (Wang, 2001). The Internet is merely a medium for content that people seek. It could be said then, that people are not addicted to the Internet, but rather to the content gained through the Internet. This content then, be it news, television, or games, is what people may be addicted to (Weinstain, Feder, Rosenberg, and Dannon, 2014). For instance, an addiction to online gaming can be considered as a manifestation of gaming addiction, rather than solely internet addiction. People are dependent on the Internet to access this content, but there is no true addiction to the Internet itself (Pies, 2009). In the past, the academic community has deemed excessive use of the Internet as internet addiction; however, after more than two decades of existence, the Internet is now an integral part of modern society and is a medium for everyday facets of life, such as multimedia entertainment (Weinstain et al., 2014). Thus, the labelling of internet usage has also changed.

The first internet addiction study was carried out by Young (1998). In her research report, internet addiction is considered similar to compulsive gambling, smoking, and alcoholism and common signs of internet addiction are said to be (1) compulsive checking of e-mails, (2) anticipating the next session of internet usage, and (3) others complaining about one spending time and money on internet activity (Egger, 1996). Young (1998) developed the Internet Addiction Diagnostic Questionnaire (IADQ). It is a 20-question self-evaluation survey that measures the level of internet addiction. She uses a 6-point scale (labelled 0–5, 0: Not applicable, 1: rarely, 2: occasionally, 3: frequently, 4: often, 5: always) as a means of response and adds up the response numbers of each participant (minimum score = 0, maximum score =100). Young's IADQ has been validated by many researchers in recent years and is a commonly used questionnaire (Weinstain et al., 2014).

Widyanto and McMurran (2004) developed the Internet Addiction Test (IAT), a modified questionnaire based on Young's previous work in this field. Both questionnaires used the Likert scale, but Widyanto and McMurran's asks participants questions regarding the severity of their internet interaction whereas Young's is in relation to the frequency of internet interactions.

Leung (2007) developed the mobile phone addiction index (MPAI), which is based on 17 items categorised into four groups: inability to control craving, anxiety and feeling lost, withdrawal and escape, and productivity loss. Casey (2012) developed the smart phone addiction index (SPAI), which is based on Leung's survey. 13.5% of Chinese students were classified as smart phone addicts in Casey's 2012 study. Dixit et al (2010) surveyed mobile phone dependency of medical college students in India and found 18.5% of respondents to be nomophobic.

However, those surveys allowed for the participants to evaluate themselves in terms of their internet usage experience, i.e. allowing participants to define for themselves what the word 'frequently' meant in the context of the survey. Therefore, each participant was allowed to choose based on his or her own subjective criteria. For example,

Number	Questions	US	Korea
Q1	Do you feel that the amount of time spent on the Internet has increased since you got your mobile device?	77.4%	76.8%
Q2	Do you feel the "frequency of internet usage" has increased since you got your mobile device?	81.6%	89.8%
Q3	Have you repeatedly made unsuccessful efforts to control, cut back, or stop using the internet connection with your mobile device?	23.3%	35.4%
Q4	When your mobile device is not working properly to the Internet, do you feel depressed, isolated, or bored?	38.2%	53.2%
Q5	Does your job and/or school work suffer from the amount of time you spend on the Internet with your mobile device?	13.1%	61.1%
Q6	Do others in your life complain about the amount of time you spend on the Internet with your mobile device?	17.3%	36.3%
Q7	Have you ever accessed the Internet with your mobile device during a time you were asked not to (school, work, church, theatre, etc.)?	50.2%	80.6%
Q8	Do you find that you stay connected to the Internet with your mobile device longer than intended?	50.2%	86.9%
Q9	Do you lose sleep due to late night mobile device internet activity at least once a week?	24.4%	64.0%
Q10	Do you watch online videos (YouTube, Netflix, TV Networks) on your mobile device at least once a week?	56.5%	74.5%
Q11	Do you spend free time for playing games on your mobile device at least once a day?	51.9%	60.2%
Q12	Do you prefer communicating through your mobile device over face-to-face communication?	36.0%	12.1%
Q13	At home, do you carry your mobile device into every room with you (even the restroom and bedroom)?	55.5%	79.9%
Q14	Do you often go over your monthly data plan with your mobile device?	20.1%	23.9%
Q15	When you receive a notification alert, do you immediately check your mobile device?	60.1%	72.3%
Q16	Do you purchase a digital product (music, video, book, or app) with your mobile device at least once a month?	32.9%	42.4%
Q17	Do you have any experience using your mobile device as a navigational device instead of asking others for directions?	79.2%	85.4%
Q18	Do you check for real time online information using your Mobile device (Stock prices, sports scores, or online auction) at least once a day?	53.0%	51.6%
Q19	Do you check your online accounts with your mobile device (email, voice mail, or social networking) at least several times a day?	63.6%	80.3%

Table 1: Mobile Internet Usage Survey Questions and Percentage of 'Yes' Responses.

participants A and B could both access the internet five times a day but they might choose different responses by their own interpretations of the word 'frequently'.

The mobile internet usage survey in this paper is based on Widyanto and McMurran's 2004 IAT but modified to focus on mobile internet and mobile internet services that promote dependency. It is a nineteen-question survey of yes/no responses (see **Table 1**) that is used to determine the level of mobile internet dependency. There are four subscales: excessive use (Q1, Q2, Q13–Q15), neglect of work and social life (Q5, Q7, Q8, Q12), lack of self-control (Q3, Q4, Q6, Q9), and use of mobile internet for other reasons than calling (Q10–Q11, Q16–Q19). The survey presented in this study is designed to overcome the flaws of vague wording and subjective responses as seen in previous studies of similar context (Young, 1998; Widyanto and McMurran, 2004). The wording of the questions is considered more specific and the participants are asked yes or no questions, which allows for more definite answers.

Research Hypotheses

The main research question looks at the differences in mobile usage behaviours in two countries: the U.S. and Korea. First of all, the author compares the mean value MIUI of the two countries. In addition, mean values of MIUI of each category, such as gender, student, age group, and usage pattern, are compared. The next two research questions look at which factors best explain the MIUI values and what the strength of the linear relationship between the MIUI and the factors is.

Whang, Lee, & Chang (2003), Yoo et al. (2004), and Jang, Hwang, & Choi (2008) argue that Korea has a severe internet addiction problem. Whang et al. (20-03) investigated internet users in Korea in terms of internet overuse and the psychological profiles of those users. They found that 3.5% of the sample had been diagnosed as internet addicts and 18.4% of them were considered possible internet addicts; a combined total of 21.9%. Yoo et al. (2004) studied the internet addiction of elementary students in Korea and found that 0.9% met the criteria for definite internet addiction and 14% were classified as probable internet addicts. Jang et al. (2008) studied the factors associated with internet addiction in junior high and high school students in Korea. They found 30% and 4.3% to be classified, respectively, with intermittent internet addiction and internet addiction. In addition, the male gender and longer periods of internet usage were significantly associated with internet addiction.

In hypothesis 1 (H_1), the author suggests that Korean mobile users will have more severe mobile internet dependency than U.S. users.

H_1 *A Korean mobile user shows stronger signs of mobile internet dependency than an American mobile user does.*

Yoo et al. (2004) and Jang et al. (2008) also argued that the younger generation had a higher percentage of internet addiction and that their symptoms were more severe. From a survey by SecureEnvoy, Kung (2012) argued that the younger generation received more stress from mobile phone addiction. In hypothesis 2 (H_2), the author suggests that the younger generation, that is, those under 30 years of age, will be more susceptible to mobile internet dependency.

H_2 *A younger mobile user (under 30 years of age) shows stronger signs of mobile internet dependency than an older mobile user does.*

Leung (2007) argued that males within the younger generation showed lower mobile phone addiction rates than females. However, most of the recent studies in this area indicate that males are more severely affected by internet addiction than females (White, 2011). Mythily, Qiu, and Winslow (2008) define criteria for excessive internet usage as more than 5 hours every day. They found that young males in Singapore have a higher percentage of internet usage based on this criteria than females do. Zhang et al. (2008) found significant differences in internet addiction severity in American and Chinese college students. They found that male college students had a higher rate of internet addiction than female college students in both the U.S. and China. In hypothesis 3 (H_3), the author makes suggests that male mobile users have more severe mobile internet dependency than female users.

H_3 *A male user shows stronger signs of mobile internet dependency than a female does.*

Most research articles about internet addiction have college student participants, as indicated by those referenced above. Zhang et al. (2008), Dixit et al. (2010), Christakis et al. (2011), and Casey (2012) all studied internet addiction in college students. In hypothesis 4 (H_4), the author suggests that college student mobile users have more severe mobile internet dependency than non-student users.

H_4 *A student user shows stronger signs of mobile internet dependency than a non-student does.*

There are no studies on whether job status affects internet dependency. In hypothesis 5 (H_5), author suggests that unemployed users have more time to use mobile internet and as such is more likely to show mobile dependency.

H_5 *An unemployed user shows stronger signs of mobile dependency than an employed user does.*

Zhang et al. (2008) found that both usage hours and access frequency of the internet are associated with internet addiction in China and the U.S. There is a significant relationship between usage hours and internet addiction. In hypothesis 6 (H_6), the author suggests that mobile internet dependency is explained by age as well as usage hours and access frequency.

H_6 *There is a significant linear relationship between MIUI and mobile internet usage hours, mobile internet access time, and age together.*

Method
Participants
The online survey site has been active for two months from March 2012 to May 2012. Two universities (one in a metro area and the other in a small city) in each country were selected and email invitations were sent to students of those four universities. Student participation was voluntary and anonymous, and the participants were also able to invite others to take part in the survey. Via social networking sites such as www.facebook.com. This is the reason that the survey subject could be a student or a non-student. The author excluded participants under the age of 18. The surveys for both Korea and the U.S. were identical, except for the language in which the survey was written. The participants who either did not own/use a mobile internet device or did not complete the survey were excluded. There were 283 valid participants for the U.S. survey and 314 valid participants for the Korean survey. The total number of participants in this survey is 597, Of this number, 85.8% have smartphones (U.S.: 76.7%, Korea: 93.9%) and 51.3% have more than two mobile devices such as a smartphone, mobile internet accessible phone, smartpad, or netbook.

Mobile Internet Usage Index
The Mobile Internet Usage Index (MIUI) is a measurement to estimate the level of mobile internet dependency. Each participant's MIUI is determined by adding the total number of 'yes' responses out of 19 survey questions. The minimum score is 0, and the maximum score is 19. If there are at least 16 yes responses (80% of responses are yes), then the participant is considered to have severe mobile internet dependency, as depicted by Young's (2008) guidelines.

Table 2 presents the distribution and statistics of MIUI. The mean value is 10.33, the median value is 9, and the mode value is 12. Standard deviation is 3.94. The percentage of severe mobile internet dependent users is 8.88%. While the percentage of Korean dependent users is 11.15%, that of those in the U.S. is 6.36%. When comparing the z-scores of MIUI value of 15, the z-score for the U.S. is 1.47 and that of Korea is 1.06, i.e., $P(Z_{US} \leq 1.47) = 0.93$ and $P(Z_{Korea} \leq 1.06) = 0.85$. Therefore, the percentages of

	Minimum	Maximum	Mean	St. Dev	80% or Higher
All	0	19	10.33	3.94	8.88%
USA	0	19	8.85	4.19	6.36%
Korea	3	19	11.66	3.17	11.15%

Table 2: Statics of Mobile Internet Usage Index (MIUI).

Type	Questions	Choices	All	U.S.	Korea
Usage Pattern	Average daily mobile Internet access time	< 10 times	41.2%	45.6%	37.3%
		< 20 times	27.3%	24.4%	29.9%
		< 30 times	22.6%	22.3%	32.8%
		≥ 30 times	8.9%	18.7%	0.00%
	Average daily mobile Internet usage hours	< 1 hour	25.0%	26.1%	23.9%
		< 2 hours	39.5%	36.0%	42.7%
		<3 hours	17.8%	20.1%	15.6%
		≥ 3 hours	17.8%	17.7%	17.8%
Demographic	Age	< 20 years old	4.5%	8.5%	1.0%
		< 30 years old	59.8%	36.4%	80.9%
		< 40 years old	15.6%	24.0%	8.00%
		≥ 40 years old	20.1%	31.1%	10.2%
	Student	Yes	71.2%	60.1%	81.2%
		No	28.8%	39.9%	18.8%
	Gender	Female	59.6%	53.4%	65.3%
		Male	40.4%	46.6%	34.7%
	Employment	Unemployed	53.8%	26.5%	78.3%
		Employed	46.2%	73.5%	21.7%

Table 3: Frequency for Usage Pattern and Demographic Data.

80% or higher of yes responses based on Z-score are 0.07, $P(Z_{US} > 1.47)$ for the U.S. and 0.15, $P(Z_{Korea} > 1.06)$ for Korea. Korea has a much higher percentage than the U.S.

As well as the 19 yes/no questions, there are also mobile internet usage pattern questions and demographic questions, which are used as control variables. Mobile internet usage pattern is composed of the average daily number of mobile internet access times and usage hours. While the typical Korean respondent is a female student in her twenties with no job, a typical U.S. respondent is a female student in her twenties with a job. In Korea, it is a well known social convention that college students usually obtain jobs after their graduation and the college students' ages are very homogeneous. Therefore, in the Korean data, college students and unemployed users are strongly associated with ages twenty to twenty-nine. **Table 3** shows the distribution of demographic and usage pattern data.

Results
ANOVA Tests
One-way ANOVA tests are used for the 5 hypotheses. These groups are categorised by (1) country, (2) age, (3) gender, (4) student status, and (5) employment status.

The ANOVA tests were run twice: once with all data sets and secondly with the data sets divided by country of origin. When all data sets were used without country distinction, hypotheses H_1 through H_5 were tested. When country discriminate data sets were used, H_2 through H_5 were tested. **Table 4** summarises the description of MIUI in each category.

In the first run, all null hypotheses except H_3 are rejected at a significant level of 1%. In each hypothesis, Korean mobile internet users, younger generation, students, and unemployed users have significantly higher MIUI mean values. However, in the case of H_3, the p-value was 0.01, which is also the alpha value; therefore, it can neither be rejected nor accepted. **Table 5** summarises the result of the ANOVA tests for the combined U.S. and Korean data set.

Comparing the two country's average MIUI values in the factors such as age, gender, student, and employment, the Korean female group had significantly higher mean MIUI values. The younger generation and student groups of the U.S. mobile users have significantly higher mean MIUI values. **Table 6** summarises the result of the country distinct data set of ANOVA tests.

Factor	Category	N	M	S.D.
Country	USA	283	8.845	4.188
	Korea	314	11.666	3.157
Age	Young	384	11.117	3.604
	Old	213	8.906	4.126
Gender	Female	356	10.671	3.961
	Male	241	9.822	3.862
Student	Non-Student	172	9.227	4.090
	Student	425	10.774	3.793
Employment	Unemployed	321	11.243	3.641
	Employed	276	9.264	4.013

Table 4: MIUI Descriptive.

Hypothesis Number	Factor	Homogeneity of Variance	Mean Difference	F	P-value	Reject Ho	Higher MAI Group
H_1	Country	No	2.821	87.373	< 0.001	Yes	Korea
H_2	Age	Yes	2.211	46.439	< 0.001	Yes	Young
H_3	Gender	Yes	0.849	6.759	0.010	Y/N	None
H_4	Student	Yes	1.547	19.472	< 0.001	Yes	Student
H_5	Employment	Yes	1.979	39.863	< 0.001	Yes	Unemployed

Table 5: Result of ANOVA Tests with Combined Data Set (U.S. + Korea).

Hypothesis Number	Factor	Data Set	Mean Difference	F	P-value	Reject Ho	Higher MIUI Group
H_2	Age	USA	1.824	13.895	< 0.001	Yes	Young
		Korea	0.427	0.855	0.356	No	None
H_3	Gender	USA	0.192	0.702	0.702	No	None
		Korea	0.823	4.893	0.028	Yes	Female
H_4	Student	USA	1.008	3.974	0.047	Yes	Student
		Korea	0.673	2.189	0.140	No	None
H_5	Employment	USA	0.684	1.469	0.227	No	None
		Korea	0.718	2.772	0.097	No	None

Table 6: Result of ANOVA Tests with Country Data Sets.

Regression Analysis

In the ANOVA tests, there are five factors (country, age, gender, student status, employment status) that influence the mean value of MIUI. Jang et al. (2008) and Zhang et al. (2008) argue that as internet usage lengthens, the chance for internet addiction becomes greater. However, the author assumes that in the case of mobile internet, the number of access times due to the ease of access might be more influential to the MIUI than usage hours. The author chose the four independent variables: Country, Access Times, Usage Hours, and Age. The author estimated the following regression model:

$$MIUI_i = \beta_0 + \beta_1 {}^*Country_i + \beta_2 {}^*AccessTimes_i + \beta_3 {}^*UsageHours_i + \beta_4 {}^*Age + \varepsilon_i \quad (1)$$

In the above regression model, the intercept dummy variable (Country) is introduced as an assumption that the Korean mobile internet users have a higher mobile internet usage than those in the U.S. If the country of origin is Korea, the variable 'Country' is coded '1' and otherwise, it is '0'. Therefore, for the U.S., the intercept is β_0 and for Korea, the intercept is $\beta_0 + \beta_1$. **Table 7** presents the regression results. Because there are differences in units of measurement between the dependent variable (MIUI) and the independent variables (Country, Access Times, Usage Hours, and Age), standardised coefficients are used. In the standardised estimated regression model, Korea (.352) has a higher intercept value than the U.S. (0.00), which means that Korean mobile users are more susceptible to mobile internet dependency when all other values of variables are

	Unstandardized β_i	Standardized β_i	P-value	VIF
Intercept	6.073		< 0.001	
Country	2.741	0.348	< 0.001	1.104
Access Times	0.944	0.161	< 0.001	1.397
Usage Hours	0.775	0.158	< 0.001	1.430
Age	-0.333	-0.073	0.05	1.165
F-stat	61.93		< 0.001	

Table 7: Result from Regression Analysis.

	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
All	9.2%	32.7%	27.8%	20.9%	9.4%
USA	10.2%	22.3%	23.0%	28.6%	15.9%
Korea	8.3%	42.0%	32.2%	14.0%	3.5%

Table 8: Distribution for Self-Perceived Mobile Internet Addiction (SPMIA).

zero. The standardised coefficient of Access Times (.238) is higher than that of Usage Hours (.200), which means that a change in Access Times has a greater effect on MIUI than does a change in Usage Hours. Therefore, unlike the previous studies, the frequency of mobile internet access is more important in mobile internet dependency than the length of mobile internet usage. The coefficient of Age is negative (-.083), which means that the younger the user is, the more effect there is on the MIUI. Even though the model ($F(4,592)$ = 61.93, $p < 0.001$) and its coefficients are significant at a level of 1% (Country, Access Times, and Usage Hours) or 5% (Age), the R^2 from this regression is relatively low (.295). Variance Inflation Factor (VIF) is a measure of multicolinearity. All the independent variables and the dummy variable are free from multicolinearity problems because the values of VIF are less than 5. One of the assumptions of this regression model was homoscedasticity, or equal statistical variance. The Breusch-Pagan (BP) test was used to test the homoscedasticity assumption by running a regression with the squared residuals as a single dependent variable. Because the *p-value* from the BP test was greater than 1% (0.01013), the null hypothesis of homoscedasticity was not rejected with a 1% significance level.

Discussion and Conclusion

Comparing the mobile internet dependency of these two countries gives insight to mobile internet usage trends and characteristics. Korea is a leading country in the mobile broadband market in terms of market penetration ratio and the U.S. is the number one country in the global smartphone market (International Data Corporation, 2012). According to the Time Mobility Poll (2012), the order of most important devices of Korean respondents is the smartphone or mobile phone (64%), home PC (19%), and laptop computer (8%). However, for U.S. respondents, the importance of the three devices are similar: home PC (33%), laptop computer (32%), smartphone or mobile phone (31%). The Time Mobility Poll survey shows that Koreans are more

dependent on smartphone or mobile phones. The percentage of Korean smartphone users (93.9%) in this survey is higher than that of U.S. users (76.7%). One of the reasons for this higher smartphone percentage in Korea is thought to be KaKao Talk, which has over 50 million subscribers as of June 2012 (Chosunilbo, 2012). KaKao Talk is a free mobile messaging app, which provides both text messaging and video messaging, as well as free mobile calls, similar to Skype. This is a good example of the network effect: the more people joining the Kakao service, the more valuable the smartphone is to each owner (Lee, 2012).

One interesting question in the author's survey is the self-perception of mobile internet addiction (SPMIA). It asks how you feel about the statement, "I consider myself addicted to mobile internet." The answer to this is on a five-point scale (1: strongly disagree and 5: strongly agree). **Table 8** shows distribution of SPMIA. While 10.2% of USA respondents chose "strongly agree', only 8.3% of Korean respondents chose that response. Comparing the result of the MIUI and SPMIA of two countries (**Figure 1**), 11.15% of Korean respondents were supposed to have severe mobile internet dependency, but only 8.3% of them considered themselves as mobile internet addicts. However, for the U.S. mobile users, the percentage of SPMIA (10.2%) is higher than that of the MIUI (6.36%). This shows the extent to which mobile devices are integrated into the lives of Korean mobile users, which appears to result in a lack of awareness of their own dependency to mobile devices. The 8.3% of Korean SPMIA is similar to the percentage of smartphone addicts depicted in a report from the Korean government agency (Ministry of Public Administration & Security): 7.7% of Koreans are thought to be internet addicts, which is more severe in younger generations and 8.4% of smartphone users in Korea are considered to be addicts (Lee, 2012).

This paper investigates mobile internet user behaviours toward their mobile internet dependency. Stewart and Choi (2003) pointed out the cultural differences in
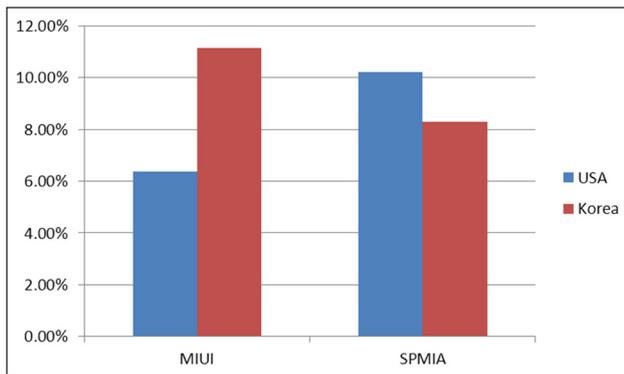
Figure 1: Bar Graph for MIUI and SPMIA. This figure explains the differences in MIUI and SPMIA values between U.S. and Korean participant samples.

the entertainment industries between Korea and North America. Whilst the North American entertainment industry is dependent on home entertainment systems such as home theatres and home video gaming consoles, the Korean entertainment industry thrives on the various "Bangs (rooms)" for the public outside of the home environment. One of the modern business types of Bang is PC-Bang (PC/Internet room), which provides high-speed internet access for a low usage fee. The PC-Bang is the most frequently used place for internet access for young Korean students. Because these PC-Bangs are operated for 24 hours a day, an addicted individual can have quick and easy access to online gaming and internet browsing (Hou, 2011).

The main reason Korean users are more dependent on mobile devices might be caused by population density and use of public transportation. According to the OECD broadband service reports (2008), Korea is the most densely populated country (485 inhabitants / Km^2), whereas the population density for the U.S. is 32 inhabitants / Km^2, 1/15 of the Korean population density. Because of Korea's limited land area and the high density of the population, Koreans are heavily dependent on public transportation such as trains, subways, and buses. According to the OECD's Family Database (2010), Korea is the number one ranking country in time spent travelling to and from work with the and U.S. coming fifth. The U.S. Census Bureau (2011) states that, in 2009, the mean travel time to work for U.S. commuters was 25.1 minutes with 86.1% of U.S. commuters using their own cars to go to work. U.S. commuters are not supposed to use mobile internet while driving. According to a survey conducted by the Korean government agency (Korea National Statistical Office, 2010), the average time spent going to work in Korea is 1 hour and 26 minutes. Only 34% of Korean commuters use their private cars meaning that most Korean commuters use public transportation and the travel time is three times longer than that of U.S commuters. In Korea, wireless communication infrastructures are well developed. Even in the underground subways, 3G/4G wireless internet are available. During the commuting hours, the smartphone often entertains the Korean commuters. Therefore, Korean commuters have the ability and the time to use their mobile internet on public transportation meaning that they are more

likely to use their smartphones for longer and more frequently. In addition, another possible reason that Korean users are dependent on their smartphones is due to the free mobile TV service, T-DMB (Terrestrial-Digital Mobile Broadcasting). Mobile operators in Korea also have T-DMB service. Mobile users can watch free TV on mobile phones equipped with the antennae attachment. Because of the above aforementioned factors such as population density, longer commuting hours in public transportation, and free mobile TV services, there is a strong bandwagon effect in the increasing smartphone adoption and mobile internet dependency in Korean society.

In the combined data analysis of both Korean and U.S., students, the unemployed and younger generations are more susceptible to mobile internet dependency. In separate analyses of each country, the percentage of severe mobile internet dependency of Korea is almost double of that of the U.S. percentage. Korea's severity of mobile internet dependency is prominent in the female group. In the U.S., students and younger generation groups show higher mobile internet dependency levels. In the regression analysis, even if the length of internet usage is the main factor for the internet addiction, frequent access to mobile internet is more influential to mobile internet dependency than longer usage hours.

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