Longitudinal relationships between Internet use and self-esteem among Korean adolescents: implications for effective public campaigns

1. Introduction

Recently, the percentage of government-driven public campaigns that utilize online channels is increasing rapidly. According to Korea Online E-Procurement System data for two years from 2015 to 2017, out of total 313 public campaigns, integrated marketing communication campaigns (including online campaign) were 198 (63.2%), and online-only public campaigns were 69 (22%). As such, public campaigns using online channels are moving beyond traditional media channels and shift to online-focused campaigns without traditional media (The PR magazine, 2017).

Previous research shows that public campaigns using online channels have the following advantages; high cost-effectiveness, high audience-reach, personalized messages, accumulation of campaign data, ease of engagement, induce campaign participation, and feasibility of pre-testing (Salmon & Atkin, 2003). There are more reasons why many public campaigns use online channels for adolescents. First, adolescents prefer online channels. Second, online campaigns can be divided by targeting adolescents into subgroups. Third, online campaigns allow adolescents to select campaign topics and format that can be of their cultural interest. Fourth, online campaigns can create a high level of consensus by utilizing a culture that is familiar to adolescents. For these reasons, it is not too much to say that almost all public campaigns targeting adolescents are using online channels in the Korean public campaign.

Despite these wide uses of the online channel, its use of public campaigns targeting

adolescents could create potential problems. The media effects research has been extensive on the subject of adolescents problematic Internet use (Bryant, & Oliver, 2009). The following are the research topics related to problematic Internet use: The digital divide of children and adolescents (Livingstone & Ellen, 2007), habitual and compulsive internet use (Pew Research Center, 2007), relational and psychological stressors of social network services (Fox & Moreland, 2015), online game addiction and aggressions (Mehroof & Griffiths, 2010), relations among loneliness, social anxiety, and problematic Internet use (Caplan, 2006), exposure to sexually explicit websites and adolescent sexual attitudes and behaviors (Braun-Courville & Rojas, 2009), de-individuation and group polarization in online discussion site (Spears, Lea, & Lee, 1990). However, in the field of PR research perspective on public campaigns, few of these problems are addressed with online channel utilization by teenagers. The subject of research in PR is focused only on the topic of achieving public campaign purpose (e.g., expanding awareness, changing attitude and/or behavior), because the tendency to view online channels only from an instrumental perspective is strong.

However, the use of online channels in the field of public campaigns may have a variety of potential side effects. First, it is a problem of indiscreet use of online channels, such as the phenomenon that public campaigns become *entertainmentization* (please see the reference on the relationship between political campaign and entertainment; Hollander, 2005). Even potentially harmful content formats tend to be used indiscriminately to simply enhance campaign awareness. For example, prize-giving campaigns could drive materialism among teenagers, and an online campaign using the format of a social dating app could be seen as societal support for online dating.

Second, unintentional use of online channels can cause *boomerang effects* to adolescents (Cho & Salmon, 2007). For example, a youth suicide prevention campaign may

lead to information about suicide, or an online prevention campaign for young female smokers may have the effect that female smoking is perceived as trend-setting. The priming effects of these online campaigns may be greater than those of traditional media campaign. Because online campaigns are intended to appeal to teenagers compared to the traditional media campaign, which is self-checked with journalistic values, the level of censorship may be very low or not at all.

Third, previous research on the relevant negative factors is not comprehensively considered in the campaign implementation process. Most adolescents behavioral change campaigns are mediated by positive psychological factors such as self-efficacy or self-esteem, and the excessive use of online media is known to be closely linked to negative psychological phenomena such as subjective well-being, self-control, depression, and stress. In other words, the high use of online channels in the implementation of public campaigns seeking personal and social changes can have unintended effects that cause negative psychological results among teenagers.

This study aims to explore the third unintended effect of using these online channels in terms of public campaigns. Specifically, I will explore the potential negative effects of online channel use on public campaigns through the relationship between self-efficacy and online use, which are representative variables of psychological phenomena closely related to public campaigns. Cross-sectional studies suggest that online use is closely associated with self-efficacy. Although recent literature using longitudinal data suggest that adolescent inclining experience the excessive use of the internet with low self-efficacy, little is known about the longitudinal relationship between internet use and self-efficacy. Using latent growth curve analysis and modeling the trajectories of both internet use and self-efficacy simultaneously, this study examines the longitudinal relationships between internet use and

self-efficacy among adolescents who participated in the Korea Welfare Panel Study (KoWePS) – 759 at wave 1 (2009), 612 at wave 2 (2012), 521 at wave 3 (2015).

2. Literature Review

1) Relationship between Internet use and self-esteem

Significant portions of adolescents are estimated to be a compulsive or habitual use of the Internet (Pew Research Center, 2007). The problem is that the prevalence of Internet addiction among adolescents continues to increase each year and that excessive use of the Internet is related to the quality of adolescent's life such as school maladaptation, low academic achievement, delinquency, family conflict, and even mental disorder (Young, 1998). In a similar vein, an adolescent with excessive Internet use is more vulnerable to low self-esteem, low self-control, loneliness, depression, daily stress than with moderate Internet use. As a consequence of the high prevalence of negative psychological impact among adolescent with excessive Internet use, these individuals are likely to suffer from interpersonal problems as well as to lower self-esteem.

In general, adolescent Internet use literature shows that negative consequences of excessive Internet use encompass the increased risks of adolescent psychological conditions and subjective well-being, which are frequently accompanied by increased educational costs and lowered academic productivity. However, the longitudinal relationship between Internet use and psychological condition in an adolescent is still unknown. Thus, it is not clear yet whether the status of Internet use is more influential to the change in self-esteem or whether the level of self-esteem is more influential to the change in Internet use (c.f., Kim, LaRose, and Peng, 2009). Further, much less is known about predictive factors of the trajectories of

Internet use and self-esteem. In order to provide practical implications for effective media policy for adolescents, it is meaningful to examine predictive factors of both Internet use and self-esteem early in a lifetime.

There are not many studies focused on the longitudinal relationship between Internet use and self-esteem among adolescents. However, available literature suggest that excessive Internet use is closely related to broader psychological conditions among adolescents, supporting the notion that Internet use is associated with self-esteem. A report from the Pew Research Center (2007) shows that excessive Internet use is associated with psychological well-being, such as the prevalence of loneliness and depressions. Supporting this notion, previous studies report significant correlations between excessive Internet use and loneliness, depression, anxiety, shyness, aggression, introversion, and social skill deficits. The cognitive-behavioral model of problematic Internet use (Davis, 2001) suggests that individuals who suffer from psychological problems are more likely to develop problematic Internet use.

Empirical studies show that negative consequences of excessive Internet use encompass the decrease of self-esteem, which often associated with increased adolescent delinquency and mental health. There are a few limitations in previous literature. Previous studies have not adequately addressed the relationship between the changes of Internet use and self-esteem among adolescent simultaneously. Specifically, the cross-sectional studies are limited in examining the relationship between the within-person changes in Internet use and self-esteem. Further most previous studies were interested in the influence of Internet use on self-esteem in their cross-sectional relationship. Few studies examined the influence of self-esteem on Internet use simultaneously. Although little empirical evidence is available, these evidences suggest that increase or decrease in self-esteem are associated with the changes in Internet use given that self-esteem is negatively associated with excessive Internet use.

2) Factors associated with Internet use and self-esteem

In addition to Internet use (Davis, 2002), previous literatures suggest that socio-demographic characteristics, such as age, gender, and socioeconomic status as well as psychological factors and environmental factors are associated with self-esteem. In order to address the relationships between the trajectories of Internet use and self-esteem, I need to consider the influence of these factors.

(1) Factors associated with Internet use

Regarding the relationship between age and Internet use, Pew Research Center (2007) suggest that about 40% to 60% of adolescent are estimated to have at least some excessive Internet use behavior. Further, some literature found to be one of the leading causes of school delinquency, which are often accompanied by increased social maladaptation of children. In summary, Internet use have been found to be one of the most significant risk factors for the prevalence of adolescents delinquency, suggesting that excessive Internet use is significantly related to age (Pew Research Center, 2007).

Demographic factors such as race and gender are associated with Internet use. Kraut et al. (2000) found that blacks and males tend to present more Internet Use than their counterparts. Probably due to the higher exposure environment of Internet use, male and black adolescent have been identified as more vulnerable to addictive behavior than their counterpart females.

Adolescent's socioeconomic factors such as household income and parent education have been found to be associated with their Internet use. Literature suggests that higher socioeconomic status (SES) is associated with less excessive Internet use. Specifically, parent with more years of education and higher income tend to present less excessive Internet use.

Supporting this notion, Willoughby (2008) found that adolescents with more years of parent education are less likely to suffer from problematic Internet use

(2) Factors associated with self-esteem

Significant portion of literature suggest that self-esteem varies by socio-demographic and environmental factors (e.g., family, friends, school life). Regarding the relationship between gender and Internet use, related literature provide evidence that male adolescent score higher on self-esteem than females adolescent, but the difference is small (Baumeister, 1993). This gender-difference assumed to be caused by perceived physical attractiveness. Baumeister et al. (2001) found that adolescent were less likely to have lower self-esteem compared to those aged 30 and over. This study further found that non-blacks and individuals with higher education were less likely to have lower self-esteem compared to their counterparts.

With regard to the relationship between self-esteem and socio-demographic factors, the similar study found that low self-esteem adolescents were in negative environment

As reviewed in previous section, literature suggests that household income, school grade, family and friend relationship inversely related to self-esteem (Baumeister, 1993; Davis, 2002; Kraut et al., 2002). However, the relationship between self-esteem and various socio-demographic factors has not been clearly documented in existing literature. It is probably because there is weak relationship between self-esteem and socio-demographic factors.

In summary, it is hypothesized that self-esteem varies by socio-demographic characteristics such as family status, number of friends, quality of school life and self-esteem of adolescents, indicating that socio-demographic characteristics are associated with self-esteem. However, little is known about the trajectory of self-esteem among adolescents. Further, the cross-

sectional studies cannot tell whether the background characteristics are associated with the rate of changes in self-esteem over time.

2) Limitations in the literatures

There are several limitations in the previous literature. Although there is signature Home-Net Study on the relationship between the within-person changes in Internet use and self-esteem (e.g., Kraut et al., 1998; Kraut et al., 2002), previous studies have not adequately addressed the possible longitudinal relationships between the two trajectories. Most previous studies were interested in the influence of Internet use on self-esteem in their cross-sectional relationship. It is hypothesized that increase or decrease in the Internet use are associated with the changes in self-esteem given that excessive Internet use is negatively associated with self-esteem. In a similar vein, changes in social network services (e.g., Facebook, MySpace) are also hypothesized to be associated with change in self-esteem. Although Steinfield, Ellison, and Lampe (2008) is examined both directions of relationship using cross-lagged correlation analysis (CLCA), the findings could not show whether the influence of the Facebook use at Wave 1 on the rate of change in self-esteem over time is stronger (or weaker) than the influence of self-esteem on the trajectory of the Facebook use. It is because a CLCA cannot simultaneously test the relationship between the Facebook use trajectory and self-esteem trajectory in one model. Further, regardless of the cross-sectional findings about the significant relationships between the reviewed covariates (e.g., socio-demographic, socioeconomic, and school and family behavior variables) and the Internet use or self-esteem, it is still unknown whether the rate of changes in the Internet use or self-esteem by the review covariates among adolescents.

3) Research Question

The current study proposes to address the limitations of previous research. Through Latent Growth Curve Modeling (LGCM) analyses, this study aims to examine (1) the trajectories of Internet use and self-esteem, (2) the relationships between Internet use and self-esteem trajectories, and (3) the influences of the socio-demographic, socioeconomic, social-psychological variables on these trajectories among adolescents who participated in the longitudinal Korea Welfare Panel Study (KoWePS).

In order to examine longitudinal relationships between adolescent's Internet use and self-esteem, this study examines both the influence of initial levels of Internet use on the rate of changes in self-esteem and the influence of initial self-esteem on Internet use trajectory over time simultaneously using LGCM. Specifically, the proposed study aims to answer these research questions.

RQ1. What are the trajectories of Internet use and self-esteem among adolescents?

RQ2. What are the relationships between the Internet use and self-esteem trajectory?

RQ1. What are the predictive factors of the Internet use and self-esteem trajectories?

3. Method

1) Sample

Data were taken from Korea Welfare Panel Study (KoWePS), which was conducted by the Korean Institute of Social and Health Affairs in conjunction with the Social Welfare Research Institute of Seoul National University. The study was designed to obtain nationally representative information on household financial status, housing, pension funds, employment histories, use of welfare services, health conditions and more, since the year

2009. The panel sample consisted of 14469 individuals from a national probability sample of 7072 households. The sampling frame was based on the Survey of Least Living Expenditure including 30000 households, which were selected by a two-phase sampling from 2005 census data. With the sampling design of a stratified systematic two-phase sampling, the panel sample was selected from the Survey of Least Living Expenditures on the basis of income levels, such that 3500 of the households sampled were low-income households under 60% of median income. The sample distribution according to income included 3789 (53.6%) participants over 60% of median income and 3283 (46.4%) participants under 60% of that. More detailed information on KoWePS data and research design can be found elsewhere (Kim, Shin, & Lee, 2011).

The first, fourth, and seventh waves of KoWePS data were utilized. The first wave of KoWePS and child supplemental study was conducted with 4~6th graders in elementary schools in 2009. Therefore, combination of first, fourth, and seventh wave data can cover elementary, middle, high school period of adolescent. The final sample consists of N = 759 at W1, N = 612 at W4, N = 521 at W7. The sample size of 759 (even 612 or 521) is sufficient for using multivariate latent-variable structural equation modeling to address the research questions.

2) Measures

In the aforementioned KoWePs data, Internet use was measured by self-reported daily time spent on the Internet. The responses were recoded into minutes.

Self-esteem was measured using thirteen items from the Rosenberg Self-esteem Scale (Rosenberg, 1989). Responses were reported 4-point Likert scale with a higher score indicating higher self-esteem (1 = strongly disagree; 4 = strongly agree). The five items were

reverse-coded before averaging the scores of the items of the scale.

School grade was measured with three items assessing the self-reported academic performance of Korean, math, and English grade. The responses were measured on a five-point scale ranging from 1=very bad to 5=very good.

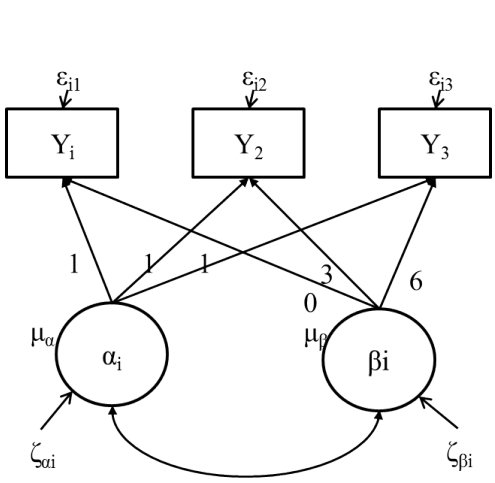
Family communication was measured with single items assessing the frequency with which respondents talk with their parents. The item was adapted from the measure of Seoul child development and welfare status research (Seoul Child Panel, 2005). The responses were measured on a five-point scale ranging from 1=never to 5=always.

Friend attachment was measured with four items assessing the relationship between respondents and their friends. The responses were measured on a five-point scale ranging from 1=never to 5=always. The items included: 'I want to be a friend with him (her) for a long time', 'I am happy to be with my friends', 'I am trying to have similar thought and feeling with my friends', 'I am trying to talk about each other's problems with my friends'.

3) Analysis Plan

In order to answer the proposed research questions, data will be analyzed using latent growth curve methods in Mplus 6.12, because it allows me to examine individual differences in trajectory over time and explore the predictors of these individual differences (Cheong, MacKinnon, & Khoo, 2003; Duncan, Duncan, Strycker, Li, & Alert, 1999). Specifically, for the first research question, unconditional models will be developed to estimate a univariate growth curve for each dependent variable (i.e., Internet use and self-esteem). Two conditional models will be estimated for the second and third research question: (1) one examines the relationship between Internet use trajectory and self-esteem trajectory simultaneously without covariates (for the second research question) and (2) the other examines the relationship

between Internet use trajectory and self-esteem trajectory simultaneously with covariates (for the third research question). The fit of models will be examined using a few indicators and thresholds recommended by Kline (2011), including model χ^2 and its p-value, close p-value, GFI (goodness-of-fit index), CFI (comparative fit index), RMSEA (root mean squared error of the approximation) and its 90% CI, and SRMR (standardized root mean squared residual).



Notes:

Y_{it} represents the repeated measures of the variable Y for individual i at time t

α_i is the intercept of the repeated measure for individual i

β_i is the slope of the repeated measures for individual i

λ_t is the latent factor representing the growth parameter at time t

ε_{it} is the measurement errors for individual i at time t

μ_α is the mean of intercepts across individuals

$\zeta_{\alpha i}$ is the error (uniqueness) in intercept for individual i

μ_β is the mean of slopes across individuals

$\zeta_{\beta i}$ is the error (uniqueness) in slope for individual i.

Level-1:

$Y_{it} = \alpha_i + \beta_i\lambda_t + \varepsilon_{it}$

Level-2:

$\alpha_i = \mu_\alpha + \zeta_{\alpha i}$

$\beta_i = \mu_\beta + \zeta_{\beta i}$

Figure 1. A Graphic Description of Unconditional Model

Figure 1 shows a graphic description of an unconditional model. In order to estimate the rate of change in both Internet use and self-esteem, two unconditional models are developed. The level 1 model for the growth curve of a repeatedly measured variable can be expressed as follows:

$$Y_{it} = \alpha_i + \beta_i\lambda_t + \varepsilon_{it} \quad (1)$$

Where Y_{it} represents the repeated measures of the variable Y for individual i at time t, α_i is the intercept of the repeated measure for individual i, β_i is the slope of the repeated

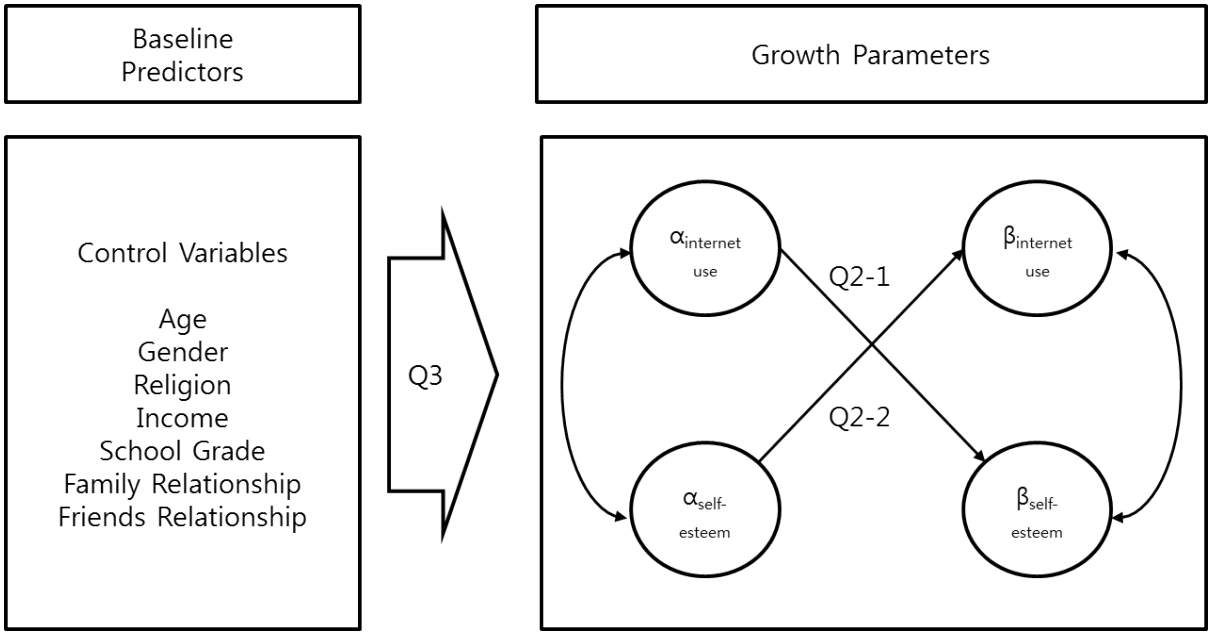
measures for individual i, λ_t is the latent factor representing the growth parameter at time t, and ε_{it} is the measurement errors for individual i at time t. The level 2 model can be expressed as follows:

$$\alpha_i = \mu_\alpha + \zeta_{\alpha i} \quad (2)$$

$$\beta_i = \mu_\beta + \zeta_{\beta i} \quad (3)$$

Where α_i is the intercept of the repeated measure for individual i, μ_α is the mean of intercepts across individuals, $\zeta_{\alpha i}$ is the error (uniqueness) in intercept for individual i, β_i is the slope of the repeated measure for individual i. μ_β is the mean of slopes across individuals, $\zeta_{\beta i}$ is the error (uniqueness) in slope for individual i. In order for an intercept or a slope to be modeled as an endogenous variable in a conditional model, variances in the individual uniqueness parameters (e.g., $\zeta_{\alpha i}$ or $\zeta_{\beta i}$) should be significant.

Figure 2 shows a graphic description of the conditional models for the second and third questions. This model examines the effect of the intercept of Internet use on the rate of change in self-esteem and the effect of the intercept of self-esteem on the rate of change in Internet use separately (Q2). This model further examines the effect of hypothesized covariates on the growth parameters of Internet use and self-esteem (Q3).



Notes:

$\alpha_{internet\ use}$: Initial Internet use.

$\beta_{internet\ use}$: Internet use Slope – The rate of changes in Internet use over time

$\alpha_{self\text{-}esteem}$: Initial Internet use

$\beta_{self\text{-}esteem}$: Self-esteem Slope – The rate of changes in self-esteem over time

Figure 2. A Graphic Description of Conditional Model

4. Results

1) Descriptive Statistics

Table 1 summarizes the descriptive statistics of variables included in the analysis. Continuous variables show mean (M), standard deviation (SD), and median (Mdn). Categorical variables show number (N) and percentage (%). At Wave 1, most participant's age was around 11-13, and about 42.7% of the participants were female. The average household income was about 30,323 dollars (applying Korean Won into Dollar currency).

Table 1. Descriptive Statistics

	Wave1 (2009)			Wave2 (2012)			Wave3 (2015)		
	M	SD N	Mdn %	M	SD	Mdn	M	SD	Mdn
Time-Varying Dependent Variables									
Internet Use (hour)	1.54	1	1.37	1.61	1.5	1.23	1.45	1.0	1.24
Self-esteem	2.80	.33	2.76	2.81	.37	2.84	2.77	.37	2.77
Time-Invariant Independent Variables									
Age group									
10		14	1.8						
11		224	29.5						
12		239	31.5						
13		253	33.3						
14		29	3.8						
Sex									
Male		401	52.8						
Female		358	47.2						
Religion									
Yes		358	47.2						
No		400	52.7						
Household gross income (10000 kr. Won)	3190	2477	2539						
Low income house									
Low income house		254	66.5						
Rest of house		505	33.5						
School Grade (1 = bad)	3.47	.89	3.00						
Family Relationship (1 = not talk)	2.67	.87	3.00						
Friend Relationship (1 = low)	1.35	.85	1.00						

2) Results of Unconditional Models (Question 1)

As summarized in Table 2, the unconditional models showed generally adequate fit to the data and in each case, showed over all decline over time. In addition, Internet use variances for intercepts and slopes were significant, indicating that individuals differed significantly on both initial and over time trajectories for the dependent measures. Self-esteem variance for intercepts was significant; however, variance for slope was insignificant. These significant variances of Internet use associated with intercept and slope in the unconditional model allow me to examine predictive factors associated with the variances using a conditional model.

With regard to Internet use, indices indicated adequate model fit – $\chi^2(3) = 3.32$ ($p < .05$), CFI = .964, RMSEA = .027. On average, Internet use increased across the three time points (mean slope = -.012, $p < .05$) and the rate of change varied significantly between adolescents (Var = .013, $p < .01$). This finding indicates that study participants experienced decreasing numbers of Internet use over time and the increase rates varied between individuals.

With regard to self-esteem, indices indicated adequate model fit – $\chi^2(3) = 4.76$ ($p = .19$), CFI = .959, RMSEA = .054. On average, self-esteem have not been changed across the three time points (mean slope = -.004, $p = .000$) and the rate of change not varied between adolescents (Var=.003, $p = .000$). This finding indicates that study participants have stable self-esteem over time and the increase rates not varied between individuals.

Table 2. Unconditional Models

		Intercept	Int-Var	Slope	Slp-Var	Cov	CFI	RMSEA
Internet	M	1.57***	.618***	-.012ns	.013*	.064**	.964	.027
use	SD	.047	.109	.012	.007	.022		
Self-	M	2.81***	.034***	-.004ns	000ns	ns	.959	.054
esteem	SD	.012	.007	.003	000			

Notes:

Int-var: Variance of intercept

Slp-var: Variance of slope

CFI: Comparative Fit Index

RMSEA: Root Mean Squared Error of Approximation

3) The Relationship between Internet Use and Self-esteem (Question 2)

Figure 3 summarizes the relationship between Internet use and self-esteem trajectory without covariate control variables. Standardized coefficients are reported. Fit indices indicated adequate model fit – $\chi^2(12) = 890.725$ (p <. 05), CFI = 0, RMSEA = .302. The negative correlation between Internet use intercept and self-esteem intercept (r = -.036, p = <.05) indicates that adolescent with higher Internet use have less self-esteem at Wave 1. The no correlation between Internet use slope and self-esteem slope (r = .001, n.s.) The negative correlation between Internet use intercept and slope (r = -.174, p = <.001) indicates that adolescent who initially have lower Internet use at Wave 1 tend to show faster increasing rate of change in Internet use over time. The positive correlation between self-esteem intercept and slope (r = .087, p = <.001) indicates that those who initially have higher self-esteem are likely to experience faster inclining rate of change in self-esteem over time.

With regard to the second research question, the path coefficient of Internet use intercept on self-esteem was significant (b = .009, p < .01), indicating that adolescents who had more Internet use at Wave 1 presented much faster declining rate of change in self-esteem over time. By contrast, the path coefficient of self-esteem intercept on Internet use slope was insignificant (b = .002, n.s.); indicating that initial self-esteem status is not much influential to the rate of change in Internet use over time. Taken together, these findings suggest that the effect of initial Internet use on self-esteem trajectory is more influential than the effect of initial self-esteem on Internet use trajectory.

Table 4. Conditional Model

	Self-esteem Int	**Self-esteem Slp**	**Internet Use Int**	**Internet Use Slp**
R^2	-.049	-.008	.08	.047
Age			-.231***	.04***
Sex			-.279**	
Religion				
Income				
Grade	.119***	-.011**	-.12*	
Family	.058***		-.145*	
Friend	.055**			

Notes:

* p < .05, ** p < .01, *** p < .001

Chi-Square = 937.256, df = 26, P<.001

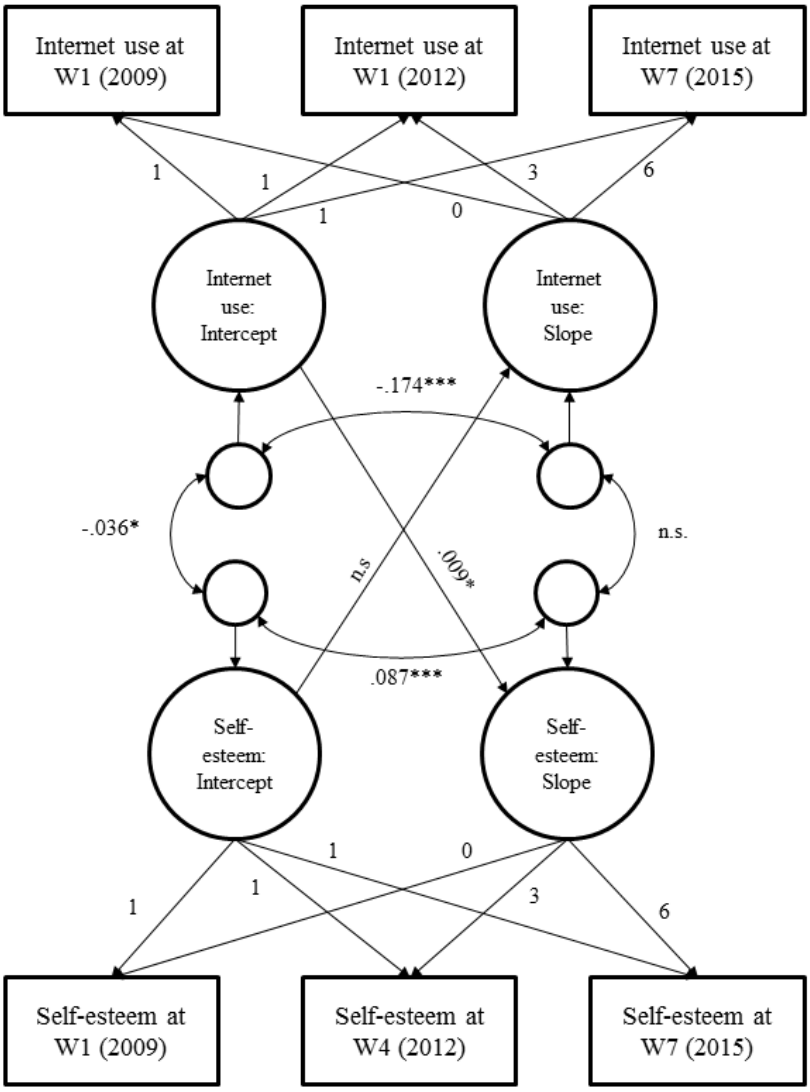


Figure 3. Relationship between Internet use and self-esteem trajectory

4) Results of Conditional Model (Question 3)

In order to examine whether the findings without covariates are replicated with control covariates as well as to examine the associations between the growth parameters (i.e., the trajectories of Internet use and self-esteem) and initial characteristics of adolescents (i.e.,

socio-demographic, socioeconomic, and school behaviors), a conditional model described in Figure 2 was tested. Table 3 summarizes the significant standardized path coefficients at p = .05 presented in the final full path model. Fit indices indicate that the model fit the data optimally - $\chi^2(26) = 937.256$; CFI = 0, RMSEA = .209 (.198 < CI <.22).

(1) Predictors of Internet use trajectory

As summarized in the Table 3 in the row of R^2, the conditional model explained 8% of the variance in initial (intercept) levels of Internet use and 5% of the variance in rate of change over time (slope) in Internet use. The intercept of Internet use was associated with six predictive variables. The intercept of Internet use was associated with four predictive variables. As expected, age variable was negatively associated with initial levels of Internet use conditions (b = -.231, p<.001), suggesting that younger adolescents had more numbers of Internet use at Wave1. Sex was negatively associated with the intercept of Internet use (b=-.279, p<.001), indicating that male adolescent presented more Internet use than female adolescent counterparts. Religion and income was not significantly associated with the intercept of Internet use. Consistent with previous findings, adolescent with lower grade presented higher number of Internet use (b = -.12, p < .05). Adolescent who had more talk presented less Internet use than their counterparts by presenting more Internet use (b = -.145, p < .05)

Only one baseline predictors was associated with the rate of change in Internet use. Older adolescent was positively associated with the slope of Internet use (b = .04, p < .001), indicating that older adolescents presented much faster increases of Internet use over time. For appropriate interpretation for this finding, it is important to remember the finding that older adolescents presented fewer Internet use at Wave1. Taken together, the rapidly increasing Internet use among younger adolescents indicate that younger adolescents have

less Internet use at Wave1 but tend to increase Internet use more rapidly than their older adolescents.

(2) Predictors of self-esteem trajectory

The conditional model explained 8% of the variance in initial (intercept) self-esteem and 4.7% of the variance in rate of change over time (slope) in self-esteem. With regard to the intercept of self-esteem, three variables were significantly associated with initial self-esteem. Grade was positively associated with self-esteem ($b = .119$, $p < .001$), indicating that high in grade tend to have higher level of self-esteem early in adolescence. Family communication was positively related to initial self-esteem ($b = .058$, $p < .001$), suggesting that adolescent who talk with family more presented higher level of self-esteem at Wave1. With regard to the relationship between friends communication and self-esteem, the adolescent who talk with friends more presented higher level of self-esteem at Wave 1 ($b = .055$, $p < .001$).

With regard to the factors associated with the rate of change in self-esteem, grade was negatively associated with the slope of self-esteem ($b = -.011$, $p < .01$), indicating that the adolescent with low grade are likely to experience much faster declining self-esteem than the adolescent with high grade.

As summarized in the third section of the results, without control variables, the current study found that the effect of initial Internet use on the rate of self-esteem change was significant, whereas the effect of initial self-esteem on the rate of Internet use was not. In the analysis of current conditional model, the same finding was replicated controlling for socio-demographic, socioeconomic, and school behavior variables. Specifically, although the effect of initial self-esteem on Internet use change was not significant, the effect of initial Internet use on self-esteem change was significant even with control variables ($b = .009$, $p<.05$). This

finding reconfirmed that Internet use is more influential than self-esteem in the simultaneous longitudinal relationship between Internet use trajectory and self-esteem trajectory.

5. Discussion

It has been a general notion that excessive Internet use is closely associated with self-esteem. As only few studies examined the relationship among adolescents in general, however, very little is known about the relationship among each adolescents over time. Further, as most previous studies were cross-sectional (e.g., Kim, LaRose, and Peng, 2009), much less is known about the longitudinal relationship between Internet use and self-esteem among adolescents. As cross-sectional only show associations between variables, it cannot show if one factor is more influential than the other. Modeling both Internet use trajectory and self-esteem trajectory simultaneously using LGCM, this study aimed the address the limitation in the literature. In order to achieve this goal, this study specifically examined (1) the trajectory of Internet use and self-esteem, (2) the relationship between Internet use and self-esteem trajectories with and without control variables, and (3) predictive factors of Internet use and self-esteem trajectories. With regard to the first goal, this study replicated the findings of recent study (van der Aa et al., 2009), showing that adolescents experience declining Internet use and stabilizing self-esteem with age. The main contribution of the current study to the literature is its simultaneous examinations between Internet use and self-esteem trajectories and its inclusion of socio-economic status variables in relation to the trajectories.

1) The Relationship between IU and SW Trajectories

As previous studies examined either the effect of Internet use on self-esteem or the

effects of self-esteem on Internet use separately (e.g., Steinfield, Ellison, and Lampe, 2008), little is known about the simultaneous longitudinal relationship between Internet use and self-esteem trajectories that can provide me with a more rigorous relationship between Internet use and self-esteem. That is, although we know that Internet use is closely related to self-esteem among adolescent, we do not know yet whether the close relationship between the two factors is due to the influence of Internet use to self-esteem, the influence of self-esteem to Internet use, or both. This study addressed this limitation in the literature. Modeling both Internet trajectory and self-esteem trajectory simultaneously, this study found that initial Internet use is critical to the rate of self-esteem change, whereas initial self-esteem is not that influential to the rate of Internet use change among adolescents aged 11 to 13. This finding suggests that the close relationship among adolescent presented in the literature is more likely to be influenced by internet use than by self-esteem.

This relationship between Internet use and self-esteem is worthy to remember when media policymakers plan intervention and services for adolescents. The findings of previous cross-sectional relationship between excessive Internet use and low self-esteem status suggest that increasing positive relationship of family and friend could be beneficial to enhance self-esteem among adolescents. However, the finding of this study implies that increasing positive relationship of friend would not be effective for Internet use. Instead, given that adolescents are likely to experience decreasing Internet use as a normal time allocating process due to the increase of school time.

2) Associated Factors of IU and SE Trajectories

Another objective of the study was to examine factors associated with the trajectories of Internet use and self-esteem among adolescents. With regard to the cross-sectional relationship of socio-demographic and socioeconomic status to the trajectories, most findings

of this study replicated the findings of previous studies, showing that more stressful socio-demographic and socioeconomic status are consistently associated with low self-esteem (Pew Internet Research center, 2007). Specifically, the adolescents who had higher grade presented lower self-esteem; adolescent who had good relationship with parent and peer group presented higher levels of self-esteem.

With regard to the longitudinal relationship of socio-demographic and socioeconomic status to the trajectories, this study found that age, sex, religion, income are not related to the rate of change in self-esteem. Specifically, being not consistent with the previous findings, this study found that male and those in low socioeconomic status present not different self-esteem at wave 1 thru 3. In summary, these findings provide me with new knowledge by showing that the difference in self-esteem by SES tends to become smaller with adolescent in longitudinal perspectives.

3) Study Limitations

There are a few limitations of the study to be addressed in future research. This study did not examine the relationships between self-esteem and the prevalence of a specific problematic Internet use per se (e.g., online game, social networking site, or pornographic site) but Internet use in general. Internet addicted behavior can be very different compared to usual behavior of everyday Internet use. Therefore future research may examine specific sample (e.g., adolescent panel data from addiction rehabilitation research center) to examine influence of Internet addiction. However, from the national representative data can have unique implication of how average adolescent usage of Internet use as well.

Another limitation is related to the single measurement of Internet use. Single items frequently lack variation across time, which often causes limitations in performing a LGCM

analysis. These limitations are not only because of the use of secondary data but also because of the ongoing debates on internet usage measurement. Future study may adopt advanced measurement method such as web-tracking or data-mining based Internet use to increase validity.

Finally, this study is based on data collected in the Korea, which may not directly reflect the relationship between Internet use and self-esteem in US. Therefore, we should be cautious in generalizing the finding to adolescent in every country. Future research should examine the relationship based on data collected in US or multi-national.

4) Implications for public campaign

Regardless of these limitations, this study broadened our understanding of both cross-sectional and longitudinal relationships between Internet use and self-esteem early in lifetime. One of the contributions is that this study adds the findings of longitudinal analyses to the literature, such as the relationships between the trajectories of Internet use and self-esteem trajectory among adolescents. Furthermore, the findings using LGCM analyses provided a clearer picture of the longitudinal relationship between Internet use and self-esteem, showing that Internet use is more influential than self-esteem to the close relationship between media use and psychological well-being identified in the previous literature. The longitudinal relationship provides public campaign professionals with a meaningful implication about the primary target areas of preventions and interventions concerning Internet use and self-esteem among adolescents. Specifically, the finding indicates that increasing self-esteem has limitations to prevent or treat addictive use of Internet for adolescents. With regard to the predictive factors of the trajectories, the findings of the study indicate that the intercepts and trajectories of negative psychological well-being (e.g., low self-esteem) are more likely to be associated with socioeconomic characteristic than school

and interpersonal behaviors (e.g., grade, family communication, and friend attachment) in early life. These findings reconfirm that continuous low-income household support programs are critical for adolescent to sustain their psychological well-being.

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