

## Second-Order Latent Growth Modeling of Relationships between Developmental Changes in Mobile Phone Dependency, Self-Esteem, and Depression among Korean Adolescents

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### 1. Introduction

Mobile phone use is very common now; the number of adolescent users, especially, has rapidly increased, and the increasing pattern is similar across cultures. It was reported that over 80% of Korean adolescents use mobile phones [1], and a similar pattern was also observed in Germany and Japan [2-3]. Studies revealed that frequent and problematic mobile phone use may increase mental health problems [4]. Relevant research has focused on the predictors and negative effects of problematic mobile phone use such as mobile phone dependency (MPD) to prevent a myriad of psychosocial problems and to promote adjustments in adolescence. Depression, one of the mental health problems with which MPD may associate [5], is a serious problem and has been a major focus for adolescent mental health literature. In addition, previous studies examined the psychological antecedents of MPD, and some of those studies found that self-esteem was related to MPD [6]. Considering the rapid increasing mobile phone users and the negative effects of mobile phone use, this study is to examine the effects of self-esteem on MPD and the effects of MPD on depression to enhance our understanding of the dynamic mechanism for MPD. Specifically, developmental changes in MPD over time and the longitudinal relationships among self-esteem, MPD, and depression are to be examined.

### 2. Methods

The sample used for this study was obtained from larger datasets, Grade 7 student panel of Korea Children and Youth Panel Survey (KCYPS). Grade 7 student panel survey was implemented over three years, from 2010 to 2012. The final samples were composed of 2,351 Grade 7 students. Among the 2,351 Grade 7 participants, 50.0% were male and 50.0% were female. The average age of the participants was 13.8 years. MPD was measured using 7 items developed by Lee et al. [7], and internal consistency (Cronbach's  $\alpha$ ) ranged from .854 to .898 from Wave 1 to Wave 3. Self-esteem was measured using Rosenberg Self-Esteem Scale (RSE), and internal consistency (Cronbach's  $\alpha$ ) at Wave 1 was .839. Depression was measured using 10 items of SCL (Symptom Checklist)-90-R, and internal consistency (Cronbach's  $\alpha$ ) at Wave 3 was .906. In this study, second-order latent growth modeling was applied to examine the changes in MPD over time and relationships between self-esteem at Wave 1, MPD changes, and depression at Wave 3. AMOS 20.0 was used in the latent growth analyses, and missing values were estimated with the Full Information Maximum Likelihood (FIML) approach for model estimation.

### 3. Results

First, we estimated an unconditional linear growth model to assess how MPD changes over time, and developed and compared four models to find the best fit model. Model A is a base model, and Model B is a model in which factor loadings of the latent variables of MPD over time were constrained to be equal. In Model C, error covariances of the indicators of the repeated latent variables were specified among identical items across time. Finally, we developed Model D, in which error covariances were constrained to be equal across time to achieve the parsimony of the model, and the model fit indexes improved from Model A to Model D. As presented in Table 1, we concluded that Model D was the best fitting among the alternative models. The means of the intercept (initial status) and slope (growth rate) factors estimated in Model D are presented in Table 2. The results indicated that MPD increased linearly during the three years.

[Table 1] Fit indexes for unconditional latent growth models of MPD

	$\chi^2$	<i>df</i>	<i>P</i>	<i>TLI</i>	<i>RMSEA</i> (90% CI)
Model A(base model)	959.152	52	.000	.912	.086(.081,.091)
Model B(equal factor loadings)	980.919	58	.000	.920	.082(.078,.087)
Model C(error covariances)	593.432	50	.000	.945	.068(.063,.073)
Model D(equal error covariances )	<b>596.208</b>	54	.000	<b>.950</b>	<b>.065(.061,.070)</b>

Note. CI = confidence interval.

[Table 2] Latent growth model of MPD-parameter estimates

Parameter	Estimate
Mean of intercept	2.455 <sup>***</sup>
Mean of slope	.119 <sup>***</sup>
Covariance of intercept-slope	-.026 <sup>***</sup>

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

Next, we developed a conditional model to test the effects of self-esteem at Wave 1 on MPD (both initial status and growth) and the effects of MPD changes on depression at Wave 3, controlling gender, family income, and mother’s education level. As shown in Table 3, the fit of this conditional model was also acceptable. Self-esteem at Wave 1 significantly predicted the intercept and slope of MPD. In addition, it was found that the intercept and slope of MPD had significant positive effects on depression at Wave 3 respectively. Finally, self-esteem at Wave 1 was found to have negative effects on depression at Wave 3 (See Table 3).

[Table 3] Results of conditional model analyses

	b	$\beta$	S.E.	t
Self-Esteem(Wave 1) → MPD intercept	-.195 <sup>***</sup>	-.233	.023	-8.497
Self-Esteem(Wave 1) → MPD slope	.045 <sup>***</sup>	.125	.014	3.288
MPD intercept → Depression(Wave 3)	.216 <sup>***</sup>	.196	.031	6.858
MPD slope → Depression( Wave 3)	.676 <sup>***</sup>	.262	.117	5.758
Self-Esteem(Wave 1) → Depression(Wave 3)	-.328 <sup>***</sup>	-.356	.024	-13.836

$\chi^2(df; p)=1570.005(260;.000)$  TLI=.941 RMSEA=.046(.044, .049)

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

#### 4. Conclusion

The results of this study not only advance the knowledge base on Korean adolescents’ MPD, but also provide important information on associated psychological characteristics including its predictors and consequences. This study found that adolescents with lower self-esteem had higher levels of MPD. This is consistent with the results of previous research asserting that low self-esteem predicts problematic mobile phone use [8-9]. This study also revealed that adolescents with higher levels and rapid increase in MPD had more severe depression. These results suggest that the self-esteem may prevent MPD and depression, while MPD may lead to depression. Given these results, self-esteem improvement is emphasized to prevent and alleviate both MPD and depression in adolescence.

#### 5. References

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