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THE IMPACT USING OF MOBILE PHONES WITH FAMILY AND OBSERVANCE OF SCHOOL RULES ON SUCCESSFUL LEARNING: A LONGITUDINAL STUDY USING A LATENT GROWTH MODEL

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Abstract

The study verified longitudinal impact the use of mobile phones with family members and school rule compliance on successful learning activities. This study used the data of Korean Children Youth Panel Survey by National Youth Policy Institute. The data from 1th to 6th was used. The results were as follows. First, it was found that students who use mobile phones more frequently to communicate with their families in the first grade of middle school tended to follow school rules better and perform learning activities more successfully at the same time. This showed that the degree of compliance with school rules mediated the relationship between degree of mobile use for communication with family and successful learning activities. Second, as the use of mobile phones with family members increased, compliance with school rules increased; and successful learning activities increased more significantly. And as the compliance with school rules increased, successful learning activities increased more significantly as well. Based on the results of this study, the following suggestions were made. Parents should encourage their middle school children to use their mobile phones for communication with their families, and teachers should instruct first grade middle school students to comply with school rules. In addition, both parents and teachers should encourage students to use mobile phones to communicate with their families from the second grade of middle school to the third grade of high school to help them better in complying with school rules and perform more successful learning activities every year.

Keywords: Longitudinal Impact, Latent Growth Model, Using of Mobile Phone with Family, Observance of School Rules, Successful Learning

1. Introduction

As children in Korea spend a lot of time in school, school adaptability, such as adhering to the rules at school and successfully performing their studies, has great influence on the satisfaction and happiness of the adolescent's life [1, 2]. And, analyzing the factors that influence successful learning activities at school is a necessity in order to improve the quality of life for young people. Because of this, many studies have continued to focus on the learning activities of Korean adolescents [3-5].

However, previous studies have three limitations. First, most studies made were cross-sectional studies. As a result, there is a lack of empirical research on how learning activities change as grade levels increase, and what variables continuously influence them. Adolescence is a period of rapid physical and psychological changes, and the factors related to youth learning activities may have different effects at different periods. In addition, it can be predicted that the learning activities will be different due to changes in the learning environment, increased difficulty of study, and increased burden on admission examination, etc. in the lives of middle and high school students [6]. It is, therefore, necessary to study how the learning activities change as the grade level increases, and what variables continuously influence them.

Second, several studies analyzing the changes by grade level have been conducted, but accurate analyses of data are limited because the comparisons for the regression coefficients were mostly separated for each group, or the difference test of group means did not correctly estimate measurement errors. In order to

better understand the activities of adolescents, it is necessary to analyze each grade level in middle school and high school in a single research model and analyze it through potential variables that take measurement errors into consideration. Thus, the study of adolescents' learning activities will be a good resource for understanding youth development processes and supporting their learning activities for a long-term perspective [7].

Third, previous research analyzed various variables that affect learning activities, including mobile phone use and the degree of mobile phone addiction. However, the purpose of the mobile phone use was not included in the analysis. The impact of cell phone use and the adolescents' dependence can vary depending on the purpose of using the mobile device [8]. These studies also have difficulties in analyzing recent trends because pre-2011 survey data were used. In addition, it is imperative to examine whether compliance to the school rules is a mediation factor for learning activities because as a pro-social behavior, school rule compliance is an important variable of school adjustment [9].

It is important to understand how mobile phone use, school rule compliance, and learning activities change from first grade of middle school to third grade of high school. Also, there is a need to analyze how initial value and change rate of mobile phone use among adolescents impact on initial value and change rate of learning activities, through the mediation of initial value and change rate of school rule compliance. The results will provide a basis for making a personalized prescription for the right use of mobile phones that leads to successful learning activities and provide support for asserting the need for compliance with school rules.

2. Theoretical Background

2.1 Successful Learning Activities

Adolescents' academic activity is a very important factor in adapting to school life. Learning activities mainly include the contents of the whole curriculum throughout school life, and school rule compliance does not refer to only high academic achievement. Rather, learning activity adaptation refers to the change of various environments encountered in learning activities [10, 11].

In this regard, it is more important to have a long-term learning habit from middle school to high school, instead of a short term learning ability. Learning activities are not only helpful for adolescents to adapt positively to their current school life [12-15], but it can also serve as motivation for students to actively participate in activities in the higher grade levels [16]. In contrast, if a student experiences difficulty in learning activities at a certain point in time, he / she will be negative towards learning activities at a later point in time [17-18]. In fact, learning, which is an interaction with the outside world, takes place continuously with the learners' consciousness and forms positive or negative learning attitudes and habits through continuous learning. Learning attitudes refer to beliefs, evaluations, and behavioral tendencies in learning, thus positively or negatively affecting subsequent learning [19].

Studies have revealed that adolescents who go through elementary, middle and high schools experience difficulty in learning activities as the grade level rises [20]. For this reason, it is necessary to show and analyze the developmental trajectories of learning activities of Korean youth according to each grade level in middle school and high school so that appropriate intervention can be suggested using the variables that affect learning activities.

2.2 Factors Affecting Learning Activities

There are a number of factors affecting learning activities, such as mobile phone use and addiction [21-23]. This is a very timely approach, considering the rapidly increasing use of mobile phones by young people. However, the data on the purpose of the mobile phone is not included in the analysis. The impact of cell phone use and dependence of adolescents can vary according to the purpose of using this mobile device [24]. The use of mobile phones for games and entertainment may have a negative impact on adolescents [25], because it reduces the opportunities to interact with and communicate with friends [26-28]; but mobile phones can also have a positive effect on improving the relationship among friends.

The extent to which a cell phone is used for family relationships is also related to family health outcomes. The quality of learning activities was influenced by personal variables and peer relationships, but family health variable was excluded [29]. However, family health affects learning activities as shown through a study on the impact of mixed individual and environmental variables on school adjustment [30-32]. Also, studies on variables that increase learning immersion [33], and family health influences on learning activities substantiate the importance of the family health variable [34].

The effect of mobile phone use on learning activities for 'relational use with family' can be mediated by school rule compliance. Adaptation and successful learning activities at school are continuous concepts that include compliance with school norms; and compliance with school rules as a pro-social behavior is an important variable in school adjustment [35, 36]. However, excessive family rules may lower the happiness of the youth [37, 38], and the excessive regulation and norms at school will likely lower their satisfaction. A study revealed that a classroom climate supporting autonomy has a direct effect on the academic performance of middle school students and is an important variable for promoting psychological wellbeing [39]. However, adolescents' adherence to school rules and learning activities are closely related to self-control, which suggests that adherence to school rules is a factor affecting learning activities.

3. Research Contents And Methods

3.1 Research Model

In this study, the basic hypothesis proposed was initial value and change rate of successful learning activities will increase with initial value and change rate of mobile phone use with family will increase through mediation of increased initial value and change rate of school rule compliance. The structural equation model was verified in Figure 1.

Figure 1 Basic Model
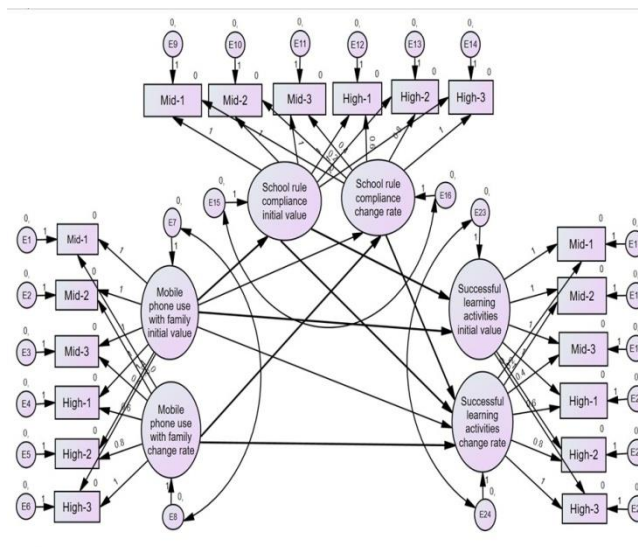
3.2 Subject

This study used the Korean Children & Youth Panel Survey collected by the National Youth Policy Institute for middle school students in Korea. To explore the change over a period of time, the sample used annual data from the 2010 survey data, which was the first grade (middle school) to the 2015 survey data, which was the third grade (sixth grade) of high school. The size of the panel sample is 2,351, and the number and ratio of students participating in the survey by order are shown in <Table 1>.

Table 1. Number and Percentage of Research Subjects by Grade

	Mobile Phone use with Family		School Rule Compliance		Successful Learning Activities	
	Inclusion N(%)	Except N(%)	Inclusion N(%)	Except N(%)	Inclusion N (%)	Except N(%)
Mid-1	2159(91.8)	192(8.2)	2351(100.0)	0(0.0)	2351(100.0)	0(0.0)
Mid-2	2158(91.8)	193(8.2)	2280(97.0)	71(3.0)	2280(97.0)	71(3.0)
Mid-3	2162(92.0)	189(8.0)	2257(96.0)	94(4.0)	2257(96.0)	94(4.0)
High-1	2027(86.2)	324(13.8)	2080(88.5)	271(11.5)	2080(88.5)	271(11.5)
High-2	2022(86.0)	329(14.0)	2052(87.3)	299(12.7)	2052(87.3)	299(12.7)
Hight-3	2015(85.7)	336(14.3)	2014(85.7)	337(14.3)	2015(85.7)	336(14.3)

3.3 Research Instruments

3.2.1. Mobile Phone Use with Family

The average value of the two items asking about the degree of using the mobile phone with the family for 'conversation with family' and 'text message with family' was averaged. The 4-point scale was scored backwards, so the larger the number, the higher the intimacy with the family means. Factor analysis showed that the approximate chi-squared value was 2550.947 (df = 36, p = .000), and that the KMO test for

standard formation appropriateness was .609 (p = .000). Therefore, one factor was extracted by extracting factors with an eigenvalue of 1 or more, and it was found that 60.9% of all variants could be explained by one principal component. The results of the rotated component matrix and the reliability are shown in Table 2.

Table 2. Factor Analysis Results and Reliability on the Members

Items	Components			Re-name	Reliability
	1	2	3		
Text message with family	.081	.042	.861	use of mobile phone with family	.853
Conversation with family	-.029	.105	.861		

3.2.2. School Rule Compliance

As a result of the factor analysis of the five items measuring school rule compliance, five items were grouped into one factor and the average value of five items was used. As the score was scored on a 4-point scale, the larger the number, the better the school rule compliance. Factor analysis showed that the approximate chi-squared value was 1888.632 (df = 10, p = .000), and the KMO test value of the standard formation appropriateness was .784 (p = .000). Therefore, two factors were extracted by extracting factors with an eigenvalue of 1 or more, and it was found that 46.45% of all variations were explained by two main components. The results of the rotated component matrix and the reliability are shown in Table 3.

Table 3. Factor Analysis and Reliability of School Rule Compliance

Items	Components	Re-name	Reliability
	1		
I use school stuff like my own.	.768	School rule compliance	.798
I keep my turn in the bathroom and the food room.	.701		
When I discard trash or garbage, I throw it in the trash bin.	.696		
I walk quietly without running when I go through the corridors and stairs.	.659		
I work hard in activities such as duty and one role of each person etc.	.568		

3.2.3. Learning Activities

Successful learning activities used five items that measure learning activities from the School Adaptation scale produced by Min Byung-soo (1991). As a result of factor analysis, 5 items were grouped into one factor and the mean value of 5 items was used. Factor analysis showed that the approximate chi-squared value was 2107.981 (df = 10, p = .000) and that the KMO test for standard formation appropriateness was

.785 (p = .000). Therefore, two factors were extracted by extracting factors with an eigenvalue of 1 or more, and it was found that 47.85% of the total variations can be explained by two main components. The results and reliability of the rotated component matrix are shown in Table 4.

Table 4. Factor Analysis and Reliability for Successful Learning Activity Items

Items	Components	Re-name	Reliability
	1		
I know what I learned in class.	.791	Successful learning activities	.722
I do not miss school homework.	.717		
The school class is fun.	.684		
When there is something I do not know, I ask another person (parents, teachers, or friends).	.631		
I do something else in my study time.	.620		

3.4 Analysis Method

A latent growth modeling method LGM) was applied to estimate the change in each variable, and estimate the relevance of the change in the variables in order to see the relevance between mobile phone use with family, school rule compliance, and successful learning activities. To analyze the latent growth model, AMOS 22.0, a statistical program for structural equation modeling, was used and the maximum likelihood (ML) was used as the model estimation method. For the evaluation of the model, TLI, CFI, and RMSEA fitness index were used. In the case of TLI and CFI, fitness of the model is considered good if the value is better than .90, and in the case of the RMSEA value, it is good if it is less than .05. If value is between .05 and .08, it is appropriated, and if it is more than .10, it is not an appropriate model.

4. Research Results

4.1 Characteristice of Key Variables

4.1.1. Description of Key Variables

Table 5 shows the descriptive statistics of the main variables used in this study. In the structural equation model, if the normal distribution condition of each variable is not satisfied, a distorted result can be derived. Considering the normal distribution condition in the structural equation model (skewness<2, kurtosis <4), it can be seen that the skewness and kurtosis of the variables used in this study satisfied the normal distribution conditions necessary for applying the structural equation model (Kline, 2010; Soo-Kyung Son, Lee Hyun-jung, and Hong Se-hee, 2017).

Table 5. Mean and Standard Deviation, Skewness, Kurtosis

	Mobile Phone use with Family			School Rule Compliance			Successful Learning Activities		
	M (SD)	Skewness	Kurtosis	M (SD)	Skewness	Kurtosis	M (SD)	Skewness	Kurtosis
Mid-1	3.22 (.65)	-.546	-.225	2.76 (.49)	-.135	.612	2.73 (.50)	-.235	.449
Mid-2	3.25 (.63)	-.508	-.201	2.79 (.56)	-.119	.638	2.73 (.52)	-.243	.445
Mid-3	3.28 (.63)	-.549	-.066	2.86 (.54)	-.130	.847	2.74 (.53)	-.299	.542
High-1	3.28 (.63)	-.634	.305	2.94 (.49)	-.052	.801	2.78 (.49)	-.209	.798
High-2	3.31 (.61)	-.581	.124	3.00 (.46)	-.203	1.462	2.75 (.51)	-.461	1.207
High-3	3.37 (.62)	-.731	.174	3.03 (.49)	-.198	1.198	2.72 (.54)	-.224	.838

4.1.2. Correlation between Key Variables

Table 6 shows the results of the correlation analysis between independent variables. The correlation coefficient for the analysis is less than 0.8 (Grewal, Cote, & Baumgartner, 2004), and the correlation coefficients between the independent variables of this study ranged from r = - 167 to .495, so multi-collinearity conditions were found to be met.

Table 6. Correlation among Independent Variables

	Mobile phone use with Family	School rule Compliance	Successful Learning Activities
Mobile phone use with Family	1		
School Rule Compliance	.167***	1	
Successful learning activities	.230***	.495***	1
* p<.05 ** p<.01 *** p<.001			

4.2 Measurement Model Verification

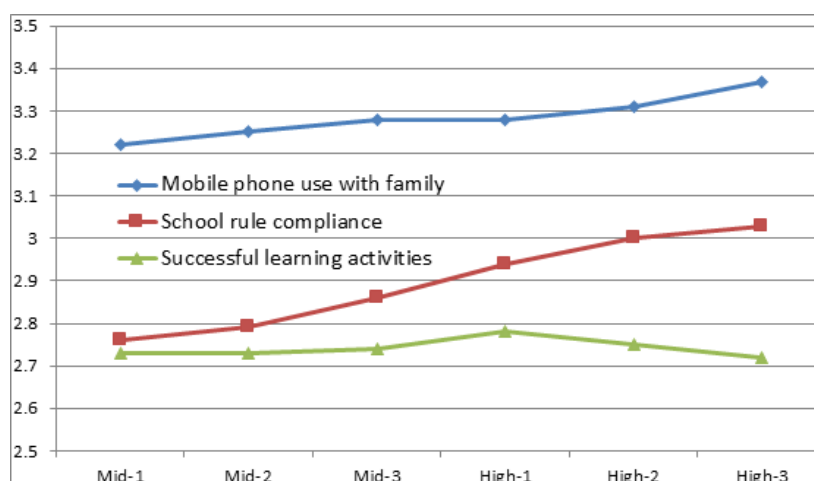### 4.2.1. Analysis of Change in Variables

Table 7 shows the results of exploring how school-based rules and successful learning activities change over time. In order to apply the latent growth model that estimates the relevance of mobile phone use to family, school rule compliance, and successful learning activities, appropriate change functions were determined for each factor in advance. Based on the changes in the mean of the six points in Table 7, we examined the fit of the model to determine whether it is a changeless or linear change model.

The fit of the changeless models of all three variables was not good. On the other hand, the fit of the model was found to be satisfactory as a result of applying the data to the linear change model. Through this, it can be seen that the use of mobile phones with family members, compliance with school rules, and successful learning activities change linearly with statistical significance over time. In addition, since the variance of the initial value and the rate of change are statistically significant in all three variables, individual differences exist in the initial values and the rate of change of the three variables. <Figure 2> is a graph of the linear change model of each variable.

Table 7. Analysis of Change in Each Variable

		χ^2	df	TLI	CFI	RMSEA	Initial Value		Change Rate	
							Mean	Variance	Mean	Variance
Mobile Phone use with Family	changeless	328.671***	19	.860	.873	.083	3.283*** (.009)	.137*** (.006)		
	Linear	57.629***	16	.978	.983	.033	3.216*** (.012)	.193*** (.010)	.135*** (.016)	.213*** (.019)
School rule Compliance	changeless	1048.537***	19	.632	.667	.152	2.900*** (.007)	.099*** (.004)		
	Linear	97.215***	16	.966	.974	.046	2.756*** (.009)	.130*** (.006)	.282*** (.012)	.133*** (.011)
Successful Learning Activities	changeless	535.844***	19	.875	.886	.108	2.740*** (.008)	.128*** (.005)		
	Linear	150.712***	16	.961	.970	.060	2.739*** (.010)	.157*** (.007)	.001*** (.012)	.169*** (.011)

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

Figure 2 Change in each Variable

4.2.2. Longitudinal Model Analysis

Based on the latent growth model of each variable, the multivariate latent growth model was verified to grasp the structural relationship of mobile phone use with family, school rule compliance, and successful learning activities. The research model, the fitness, and the significant path coefficients are shown in <Table 8> and <Figure 3>. In the first grade of middle school, students who use mobile phones to communicate with their family observe the school rules better, and at the same time, learn to perform their learning activities more successfully. However, it has been found that there is no significant effect on the rate of change of successful school activities and compliance with school rules from the second grade of middle school to the third grade of high school.

In addition, we found that students who obey school rules more in the first grade of middle school perform their learning activities more successfully. This shows that the degree of compliance with school rules mediates the degree of mobile phone use for communication with the family and successful learning activities. In addition, it has a significant effect on the change rate of successful learning activities from the second grade of middle school to the third grade of high school. This means that the smaller the decrease in compliance with school rules in the period from the second year of middle school to the third grade of high school, the smaller the decrease in the performance of successful learning activities.
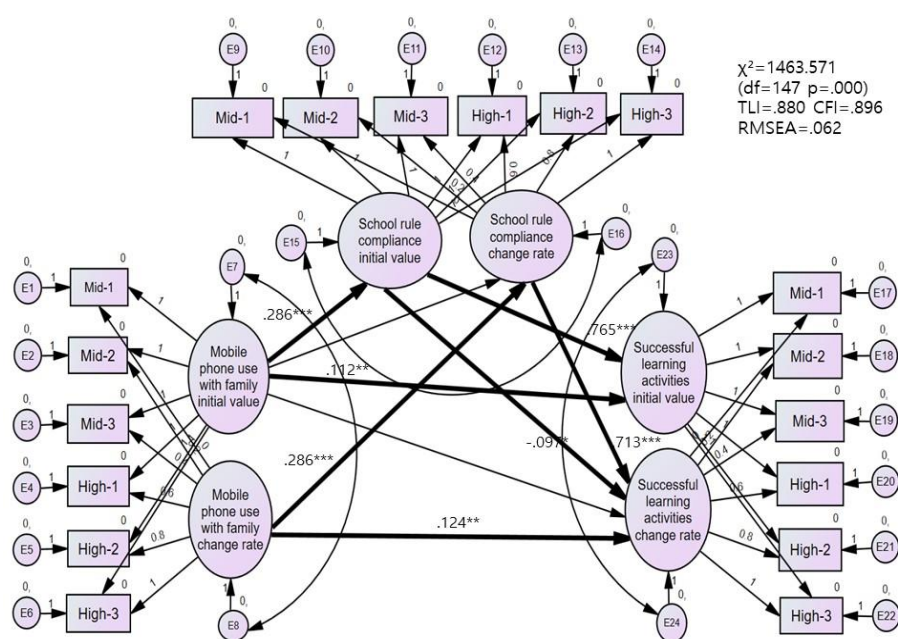
Also, the rate of change of mobile phone usage with family has a statistically significant effect on the rate of change of compliance with school rules and the rate of change of successful learning activities. In addition, the rate of change in compliance with school rules has a significant positive impact on the rate of change in successful learning activities. This implies that the greater the use of mobile phones with the family, the greater the adherence to school rules and successful learning activities; and the greater the compliance with school rules, the greater the success on learning activities.

Table 8. Estimates of Longitudinal Model

Path			B	ß	S.E.	C.R.
school rule compliance_ initial value	←	Mobile phone use with family _initial value	.236***	.286	.027	8.878
School rule compliance _change rate	←	Mobile phone use with family _initial value	-.046	-.054	.037	-1.259
School rule compliance _change rate	←	Mobile phone use with family _change rate	.232***	.286	.036	6.386
Successful learning activities _ initial value	←	Mobile phone use with family _initial value	.101***	.112	.026	3.938
Successful learning activities _change rate	←	Mobile phone use with family _initial value	.050	.054	.040	1.260
Successful learning activities _change rate	←	Mobile phone use with family _change rate	.107**	.124	.039	2.734
Successful learning activities _initial value	←	School rule compliance _initial value	.834***	.765	.032	25.770
Successful learning activities _change rate	←	School rule compliance _initial value	-.108*	-.097	.047	-2.282
Successful learning activities _change rate	←	School rule compliance _change rate	.761***	.713	.049	15.663

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

Figure 3 The Fit of the Modified Model and the Significant Path Coefficients

5. Conclusıons and Dıscussıons

This study verified the multivariate latent growth model to grasp the longitudinal structural relationship between the use of mobile phones with family members, compliance with school rules, and successful learning activities. The results of this study are as follows. First, students who use mobile phones more frequently to communicate with their families during the first grade of middle school are more likely to observe school rules more; at the same time, students who obey school rules will perform their learning activities more successfully. This shows that the degree of compliance with school rules mediates the relationship between degree of mobile use for communication with family and successful learning activities.

Second, the rate of change of mobile phone usage with family has a statistically significant effect on change rate of compliance with school rules and change rate of successful learning activities. In addition, the rate of change in compliance with school rules has a significant positive impact on the rate of change on successful learning activities. This means that the greater the use of mobile phones with family members, the greater the compliance with school rules and the greater the number of successful learning activities; and the greater the compliance with school rules, the greater the number of successful learning activities. Based on these results, parents should encourage their first grade children in middle school to use their cell phones for communication with their families, and teachers should instruct first grade middle school students to adhere to the school rules. In addition, both parents and teachers should encourage students to use their mobile phones to communicate with their family from the second grade of middle school to the third grade of high school to encourage greater compliance with school rules and perform more successful learning activities every year.

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