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Korean adolescents' longitudinal change of intrinsic motivation in learning English and mathematics during secondary school years: Focusing on gender difference and school characteristics

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ABSTRACT

The purpose of the study was to investigate adolescents' longitudinal development of intrinsic motivation in learning English and mathematics, focusing on gender differences and school characteristics. We used the five-year panel data of the Korea Education Longitudinal Study (KELS) from middle school 7th grade to high school 11th grade. English intrinsic motivation decreased during the middle school years but increased during high school years whereas math intrinsic motivation continually decreased across the whole of the years. Gender differences by subject existed in intrinsic motivations: girls' higher intrinsic motivation in English and boys' higher intrinsic motivation in math; boys' faster decrease in intrinsic motivations during middle school years; boys' slower increase in English intrinsic motivation during high school years. School characteristics only had an effect on intrinsic motivations for high school students: higher math intrinsic motivation of high schools in small-medium cities; higher intrinsic motivations of students on elite academic tracks.

1. Introduction

During adolescence, middle and high school students undergo important developmental changes in multiple aspects. In particular, motivational development in adolescence critically influences students' future learning and career decisions for adulthood since adolescents tend to make their educational and vocational plans based on their intrinsic motivation.

A large body of research on motivation accumulated in the field of education has reported the positive relation of intrinsic motivation with achievement, task value, and task enjoyment (e.g. Barrett, Barile, Malm, & Weaver, 2012; Eccles & Wigfield, 1995; Gottfried, 1985). However, a relatively few longitudinal studies have been conducted with regard to adolescents' motivational development in different academic subjects (Brockelman, 2009; Deci, Vallerand, Pelletier, & Ryan, 1991; Otis, Grouzet, & Pelletier, 2005). Moreover, the few existing longitudinal studies on motivation were based on small samples from Western cultures, making it hard to generalize their findings to Asian students. In order to overcome the limits of previous studies, the current study conducted a longitudinal investigation of developmental trends in intrinsic motivation for different subjects during secondary school years, using a large national representative sample of adolescents in Korea. More specifically, this study sought to chart the changes in motivation that occur over time for English and math and for gender with considering various school characteristics, and explain the changes based on the cultural context of Korea.

1.1. Cultural aspects and intrinsic motivation

The cultural context has been suggested as an important factor in understanding students' learning and motivation. For example, even though Asian students have shown high academic achievement in international academic assessments such as PISA (Programmed for International Student Assessment) and TIMMS (the Trends in International Mathematics and Science Study), their level of intrinsic motivations appeared to be significantly lower than students from Western countries (Mullis, Martin, & Foy, 2012; OECD, 2007, 2013). This phenomenon of Asian students' low intrinsic motivation but high achievement is remarkable because research on motivation has suggested that higher intrinsic motivation leads to higher achievement (Schiefele, Krapp, & Winteler, 1992; Schunk, Pintrich, & Meece, 2008).

These differences may be due to the very competitive educational atmosphere and strict norm-based evaluation in Korean and Japanese schools where students' academic performance, especially in math, science, and English, is the most important factor for college entrance and employment after graduation (Hyun, Lee, & Lee, 2000; Rohlen, 1983; Stevenson & Baker, 1992). Such school environment makes students study and achieve more for extrinsic reason such as future success (Tauer & Harackiewicz, 1999; Tyler, Wade Boykin, & Walton, 2006)

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but simultaneously lowers students' intrinsic motivation (Schunk et al., 2008). This cultural difference calls for a separate investigation into Asian students' unique pattern of intrinsic motivation.

1.2. Changes in intrinsic motivation during adolescence

Previous studies consistently reported that intrinsic motivation, academic interest and positive self-concept decline for most students as they advance through elementary and secondary school years in various cultures such as in North America (Gottfried, Fleming, & Gottfried, 2001; Harter, 1981; Otis et al., 2005), Germany (Baumert & Köller, 1998; Frenzel, Goetz, Pekrun, & Watt, 2010), China (Shi et al., 2001; Wang & Pomerantz, 2009), and Korea (Lee, Kim, & Boo, 2007; Lee, Kwon, & Shin, 2013). The decline of motivation has been explained by the transitions to middle and high school (Anderman & Maehr, 1994; Eccles, 2004; Lee & Smith, 2001). As students' grade level goes up, secondary schools become larger and more bureaucratic, place a greater emphasis on performance goals rather than mastery goals, have stricter grading criteria using norm referred tests, and see a decrease in interaction and feedback between teachers and students. All these factors in turn lead to the decline in students' motivation (Leaper, Farkas, & Brown, 2012; Stoyanova & Hope, 2012; Thompson, Woodward, & Stanton, 2011).

Many researchers agree that interest and self-efficacy related to intrinsic motivation are domain-specific constructs (Marsh, 1992; Schiefele, 1991; Schunk & Zimmerman, 2006). In other words, the overall level and the development pattern of interest and motivation will be different depending on the subject. For instance, Wolters and Pintrich (1998) found that 7th and 8th graders tend to place greater value in math than English and social science. Another study reported that children's perceived value of language arts rapidly declines during the elementary school years and their perceived value of mathematics declines during the high school years (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002). In many Asian countries including Korea, both of English and math are important subjects for students' successful college entrance (Choi & Kim, 2013). However, students also learn English as second language for leisure goals such as traveling abroad and communicating with people from different cultures (Gardner, 2010). Due to such additional instrumental value of learning English for leisure, English intrinsic motivation could decrease less compared to math intrinsic motivation.

1.3. Gender differences and changes in intrinsic motivation

A large body of studies has reported that motivation level changes do vary with gender. For example, recent studies based on Singaporean students reported that girls' intrinsic motivation decreased more rapidly as they got older compared to boys (Price & Yates, 2010; Yeung, Lau, & Nie, 2011). Other studies found that the intrinsic motivation related variables such as self-efficacy, self-esteem, and self-concepts also decreased rapidly for North American girls as they grew older (Eccles et al., 1983). These differences in motivational development trends by subjects may be further magnified by gender, especially in the specific gender dominant domains such as language and math. The gender differences in motivation are affected by the various socialization processes and learning environments that imply specific subjects are masculine or feminine, which could discourage students from engaging in opposite sex domains (Aronson & Steele, 2005; Kahle & Meece, 1994; Ullman, 2010). In fact, as adolescents get older and gain a clearer concept of gender roles, their interest in different subjects is affected by their perceived gender role. For example, girls tend to have lower levels of intrinsic motivation in STEM (Science, Technology, Engineering, and Mathematics), whereas they tend to show a higher level of interest in language compared to boys (Fouad et al., 2010; MacCallum & Kim, 2000; Meece, Glienke, & Burg, 2006).

These phenomena have also been reported in different cultures such as Germany (Marsh, Trautwein, Ludtke, Koller, & Baumert, 2005), Australia (Watt et al., 2012), and Korea (Lee et al., 2007). These differences in specific gender-dominant subjects could be especially greater in Asian cultures where traditional Confucian beliefs emphasize the distinct gender roles (Watson, Quatman, & Edler, 2002). In sum, it seems necessary to investigate the changes in intrinsic motivation during adolescence with both gender and subject simultaneously considered with cultural peculiarities within the international context.

1.4. Intrinsic motivation and school characteristics

Adolescents' intrinsic motivation is also affected by various school characteristics such as urbanity (central city, small-medium city, rural area), funding type (public, private), targeted gender (single-sex, coeducation), and curriculum track (academic, vocational track). Regarding school urbanity, schools located in central cities and rural areas showed higher dropout rates and lower achievement due to low academic motivation, which is associated with income inequality and poverty (Jargowsky, 1997; Seo et al., 2007). For funding type, it was found that the school dropout rate was lower and achievement level was higher for Catholic private high schools compared to the other school types (Coleman & Hoffer, 1987; Rumberger & Thomas, 2000). In Korea, national schools are a special subtype of public schools and each national school is affiliated with a college of education in a national university. Thus, the curriculum and teacher qualification are usually better regulated, which may have a positive influence on students' motivation.

Whether the school is single-sex or coed may also influence students' motivational development. Since adolescence is an important period of gender role socialization, the gender stereotype threat could be moderated when students study among students of same gender. In other words, the gender differences in intrinsic motivations of gender-dominant subjects, such as language, math, and science, may be smaller for single-sex schools than coeducational schools. In fact, a large body of studies reported that single-sex schools benefit students in terms of academic achievement, motivation, leadership, and self-esteem in math and science (e.g., Hoffman, Badgett, & Parker, 2008; Lee & Bryk, 1986; Streitmatter, 1997). Some studies also suggested that single-sex schools have a positive effect on both girls and boys since they provide a stronger academic atmosphere and reduce non-academic distraction (Datnow, Hubbard, & Conchas, 2001; Hoffman et al., 2008; Lee & Bryk, 1986).

High school curriculum tracks with different educational and career path goals, may be another factor that could affect students' motivation. The representative categories of school curriculum tracks are academic and vocational tracks. Several research studies showed that students on a vocational track tend to have lower academic motivation, self-esteem and achievement as well as higher school dropout rates and school maladjustment compared to students on general academic school track (Korean Educational Development Institute, 2011; Lee & Kim, 2012; Van Houtte, Demanet, & Stevens, 2012). Also, elite academic high schools that focus on specific academic areas (i.e. foreign languages or science) and select qualified students by entrance examination tend to have a low school dropout ratio and high level of motivation and achievement (Lee & Kim, 2012).

Another important school characteristic in Korea is the student selection equalization status. Some regions that implement the school equalization policy assign students to schools within their residential area on the basis of a random computerized lottery. It has been debated whether or not the random school assignment policy affects educational outcomes in terms of student achievement, and research has shown mixed evidence (Goldhaber, 1999; Tooley, Bao, Dixon, & Merrifield, 2011). Some research showed that the school equalization policy decreased the achievement gap among schools (Kim, Lee, & Lee, 2008) whereas other research reported a slightly higher level of achievement in equalization regions (Kang et al., 2005) or no significant differences in achievement between school equalization regions and non-school equalization regions (Kim, Kim, & Ryu, 2009). As such, since previous studies on the effect of school characteristics have focused on students' achievement rather than motivation, it would be meaningful to examine whether differences exist in intrinsic motivation as well.

1.5. Current research goal and hypotheses

Our research goal was threefold: we wanted to explore (1) how intrinsic motivation in English and math changed across the middle and high school period, (2) whether gender differences exist in the mean and change rate of intrinsic motivations in English and math, (3) how different school characteristics affect intrinsic motivations in English and math.

Based on these research goals, we formulated the following hypotheses: (1) intrinsic motivation in English would decrease more slowly than math because of instrumental value of English in Korea, (2) girls' intrinsic motivation in English would be higher, and decrease more slowly than boys, whereas boys' intrinsic motivation in math decrease more slowly than girls as in various previous research, (3) the intrinsic motivation would be the highest among students at (a) elite academic schools, followed by general academic schools and then vocational schools; (b) small-medium city than large city; (c) national schools than private schools; (d) single sex schools than coed schools. However, we do not have a determined hypothesis about the influence of school equalization, because there have been mixed results about it.

2. Method

2.1. Sample

Data from five waves (7th–11th grade) of the 2005–2009 Korean Education Longitudinal Study (KELS) was used in this study. KELS was conducted by the Korean Educational Development Institute which is regulated by the Korean government. KELS provides a nationally representative stratified-cluster longitudinal sample of a group of 6908 7th graders starting from 2005 until they reach the age of 30. Due to attrition, this study contained a total sample of 5545 cases.

2.2. Measures

2.2.1. Intrinsic motivations in English and math

Three items were used for measuring each subject's intrinsic motivation which reflected the degree of 'engagement in the subject', 'view on importance of the subject', and 'interest in the subject'. This scale was adopted from the Education Longitudinal Study of 2002 (Ingels, Pratt, Rogers, Siegel, & Stutts, 2005). For each item, participants responded to a 4-point Likert-type scale (1 = strongly disagree, 4 = strongly agree). The reliability coefficients (Cronbach's α) of the scales according to waves ranged from .821 to .848 for English, and from .792 to .858 for math.

2.2.2. School characteristics

For school characteristics, we used the information about school urbanity (Seoul the capital city of Korea, other large cities, medium-small cities, and rural areas), funding type (public, national, private),[1] equalization region status (random school assignment or not), curriculum track (general, elite academic, vocational, art and sports), and targeted gender (boys, girls, coeducation).

2.3. Data analyses

To examine the longitudinal change in motivation, the three-level cross-classified Hierarchical Linear Model (HLM) was used. First, in the analyses, the base (null) models were specified to look at the relative sizes of variances existing in student and school levels. Then, we considered the explanatory (conditional) model to examine the effect of gender and various school characteristics on intrinsic motivations in English and math. The null model was of the following form:

Level-1 or "within student" model. We began at level 1 with each individual's growth in intrinsic motivation in both English and math. The level 1 model portrayed each individual's motivation over 5 years.

$$Y_{tijk} = \pi_{0ijk} + \pi_{1ijk}\cdot Year1_{tijk} + \pi_{2ijk}\cdot Inc.Int_{tijk} + \pi_{3ijk}\cdot Year2_{tijk} + e_{tijk}, e_{tijk} \sim N\left(0, \sigma^2\right) \quad (1)$$

In Eq. (1), Y_{tijk} is the outcome (intrinsic motivation in each subject) at time t of student i in middle school j and high school k. To explore the longitudinal change of intrinsic motivation from middle school to high school years, we specified the time-series coefficients – slope and intercept – separately by school levels. $Year1_t$ and $Year2_t$ are coded to represent a two piece model of middle school years (*Year1*) and high school years (*Year2*). In addition, for examining the effect of transition to high school, we made 9th grade (the last year of middle school) as the baseline and coded it as 0. Therefore, $Year1_t$ is coded as −2, −1, 0, 0, 0 for representing 7th–9th grade, and $Year2_t$ is coded as 0, 0, 0, 0, 1 for representing 10th–11th grade.[2] *Icn.Int* represents the incremental gain when students go from middle school to high school. The π_{0i} parameter (intercept) is an individual's outcome score at 9th grade, the last year of middle school. The π_{1i} and π_{3i} parameter (slope) is the individual's expected change (growth rate) in outcome scores of *Year1* and *Year2*, respectively. π_{2i} is the individuals' expected increment in outcome scores when they enter high school. The random error term, e_{tijk}, refers to deviations from expected values for individual student *ijk* at time interval *t*.

Level-2 or "between students or within school" model. We formulate a level-2 model to show how the growth parameters vary among students.

$$\begin{aligned}\pi_{0ijk} &= \beta_{00jk} + r_{0ijk}\\ \pi_{1ijk} &= \beta_{10jk} + r_{1ijk}\\ \pi_{2ijk} &= \beta_{20jk} + r_{2ijk}\\ \pi_{3ijk} &= \beta_{30jk} + r_{3ijk}\end{aligned}$$

$$\begin{pmatrix} r_{0ijk}\\ r_{1ijk}\\ r_{2ijk}\\ r_{3ijk}\end{pmatrix} = N\left[\begin{pmatrix}0\\0\\0\\0\end{pmatrix}, \begin{pmatrix}\tau_{00} & \tau_{11,00} & \tau_{22,00} & \tau_{33,00}\\ \tau_{00,11} & \tau_{11} & \tau_{22,11} & \tau_{33,11}\\ \tau_{00,22} & \tau_{11,22} & \tau_{22} & \tau_{33,22}\\ \tau_{00,33} & \tau_{11,33} & \tau_{22,33} & \tau_{33}\end{pmatrix}\right] \quad (2)$$

β_{00jk} is the mean outcome score in school j and k at the 9th grade and $\beta_{10\ jk}$ is the mean growth rate during Year1. β_{20jk} is the mean growth rate after they enter high school. $\beta_{30\ jk}$ is the mean growth rate during *Year2*. γ_{0ijk} coefficient is a random 'student effect', that is, the deviation of individual student *ijk*' s score from the school mean.

Level-3 or "between school" model (Cross-classified model): In addition, to reflect the characteristics of cross-classified data of middle schools and high schools, the between school level 3 is modeled as follows.

$$\begin{aligned}\beta_{00jk} &= \gamma_{00} + b_{000j}\\ \beta_{10jk} &= \gamma_{10} + b_{100j}\\ \beta_{20jk} &= \gamma_{20} + c_{200k}\\ \beta_{30jk} &= \gamma_{30} + c_{300k}\end{aligned}$$

$$\begin{aligned}\begin{pmatrix} b_{000j}\\ b_{100j}\end{pmatrix} &= N\left[\begin{pmatrix}0\\0\end{pmatrix}, \begin{pmatrix}\tau_{b000} & \tau_{b000,100}\\ \tau_{b100,000} & \tau_{b100}\end{pmatrix}\right], \begin{pmatrix} c_{200k}\\ c_{300k}\end{pmatrix}\\ &= N\left[\begin{pmatrix}0\\0\end{pmatrix}, \begin{pmatrix}\tau_{c200} & \tau_{c200,300}\\ \tau_{c300,200} & \tau_{c300}\end{pmatrix}\right]\end{aligned} \quad (3)$$

In Eq. (3), γ_{00} represents the grand mean outcome score in the 9th grade. γ_{10} and γ_{30} represent the grand mean growth rate during middle school years and high school years, respectively. γ_{20} is the grand mean change when they enter high school.

[1] For middle school, school funding type is categorized by public, and private school.

[2] Korea has a 6-3-3 education system which consists of elementary school (Grades 1–6), middle school (Grades 7–9), and high school (Grades 10–12).

b_{000j} and b_{100j} are random "middle school effect". That is the deviation of middle school j's mean from the grand mean of intercept and slope, respectively. c_{000j} and c_{100j} are random "high school effect". That is the deviation of high school k's mean from the grand mean of intercept and slope, respectively. Therefore, at the within student level 1, all the coefficients during middle school reflect only random "middle school effect" whereas all the coefficients during high school reflect only random "high school effect".

After examining the null model, we model gender as a predictor of the level-2 model that represents the variation between students, and various school characteristics as predictors of the level-3 model that represents the variation between schools as a conditional model. School characteristics were put into the conditional model according to middle or high school. Specifically, for both middle and high schools, school characteristics included school urbanity, school equalization region, school funding type, and gender schooling. Only for high school, school curriculum track was included. School curriculum track was classified as either elite academic track or vocational track. Science, foreign language, and global competency high schools were categorized as having elite academic track, while home management, technical, agricultural, commercial, fisheries, general vocational, comprehensive, maritime high schools were classified as having vocational track. For all the predictors, random effects were not allowed. The conditional model was of the following form:

Level-1 :

$$Y_{tijk} = \pi_{0ijk} + \pi_{1ijk} \cdot Year1_{tijk} + \pi_{2ijk} \cdot Inc.Int_{tijk} + \pi_{3ijk} \cdot Year2_{tijk} + e_{tijk}, e_{tijk} \sim N\left(0, \sigma^2\right) \quad (4)$$

Level-2 :

$$\begin{aligned} \pi_{0ijk} &= \beta_{00jk} + \beta_{01jk}(\text{Gender}) + r_{0ijk} \\ \pi_{1ijk} &= \beta_{10jk} + \beta_{11jk}(Gender) + +r_{1ijk} \\ \pi_{2ijk} &= \beta_{20jk} + \beta_{21jk}(Gender) + +r_{2ijk} \\ \pi_{3ijk} &= \beta_{30jk} + \beta_{31jk}(Gender) + +r_{3ijk} \end{aligned}$$

$$\begin{pmatrix} r_{0ijk} \\ r_{1ijk} \\ r_{2ijk} \\ r_{3ijk} \end{pmatrix} = N\left[\begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \tau_{00} & \tau_{11,00} & \tau_{22,00} & \tau_{33,00} \\ \tau_{00,11} & \tau_{11} & \tau_{22,11} & \tau_{33,11} \\ \tau_{00,22} & \tau_{11,22} & \tau_{22} & \tau_{33,22} \\ \tau_{00,33} & \tau_{11,33} & \tau_{22,33} & \tau_{33} \end{pmatrix}\right] \quad (5)$$

Level-3:

$$\begin{aligned} \beta_{00jk} = {} & \gamma_{000} + \gamma_{001}(\text{MiddleUrb\_Lar}) + \gamma_{002}(\text{MiddleUrb\_Mid}) \\ & + \gamma_{003}(\text{MiddlUrb\_Rur}) + \gamma_{004}(\text{MiddleEqua}) \\ & + \gamma_{005}(\text{MiddleFund}) + \gamma_{006}(\text{MiddleGirl}) + \gamma_{007}(\text{MiddleCoed}) \\ & + b_{000j} \end{aligned}$$

$$\beta_{10jk} = \gamma_{100} + b_{100j}$$

$$\begin{aligned} \beta_{20jk} = {} & \gamma_{200} + \gamma_{201}(\text{HighUrb\_Lare}) + \gamma_{202}(\text{HighUrb\_Mid}) \\ & + \gamma_{203}(\text{highUrb\_Rur}) + \gamma_{204}(\text{HighEqua}) + \gamma_{205}(\text{HighFund\_Pub}) \\ & + \gamma_{206}(\text{HighFund\_Nat}) + \gamma_{207}(\text{HighGender\_Girl}) \\ & + \gamma_{208}(\text{HighGender\_Coed}) + \gamma_{209}(\text{HighCur\_Home}) \\ & + + \gamma_{210}(\text{HighCur\_Tech}) + \gamma_{211}(\text{HighCur\_Agr}) \\ & + \gamma_{212}(\text{HighCur\_Com}) + \gamma_{213}(\text{HighCur\_Fish}) \\ & + \gamma_{214}(\text{HighCur\_Gvoc}) + \gamma_{215}(\text{HighCur\_Com}) \\ & + \gamma_{216}(\text{HighCur\_Mar}) + \gamma_{217}(\text{HighCur\_Art}) \\ & + \gamma_{218}(\text{HighCur\_Home}) + \gamma_{219}(\text{HighCur\_Sport}) \\ & + \gamma_{220}(\text{HighCur\_Sci}) + \gamma_{221}(\text{HighCur\_Glob}) \\ & + \gamma_{222}(\text{HighCur\_Fore}) + c_{200k} \end{aligned}$$

$$\beta_{30jk} = \gamma_{300} + c_{300k}$$

$$\begin{aligned} \begin{pmatrix} b_{000j} \\ b_{100j} \end{pmatrix} &= N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \tau_{b000} & \tau_{b000,100} \\ \tau_{b100,000} & \tau_{b100} \end{pmatrix}\right], \begin{pmatrix} c_{200k} \\ c_{300k} \end{pmatrix} \\ &= N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \tau_{c200} & \tau_{c200,300} \\ \tau_{c300,200} & \tau_{c300} \end{pmatrix}\right], \end{aligned} \quad (6)$$

3. Results

3.1. Descriptive statistics and correlation

Descriptive statistics for each wave are presented in Table 1, showing means and standard deviations for intrinsic motivation in English and math. Students' intrinsic motivations in both subjects continually decreased during middle school but began to show different change patterns according to subject upon high school entrance. Specifically, intrinsic motivation in English increased while intrinsic motivation in math continued to decrease. Therefore, the change rates for middle school and high school must be modeled differently with piecewise modeling. Significant correlations were found among research variables.

3.2. Change of intrinsic motivation in English and math

We investigated the change of intrinsic motivation in specific subjects separately using HLM analysis. The result of the null model is presented in Table 2. Intrinsic motivation in English decreased during middle school years, but it increased after students entered high school.

Contrary to intrinsic motivations in English, intrinsic motivation in math showed a continuous decrease across secondary school without differences between middle and high school years. In addition, the incremental intercept coefficient of math motivation was not significant. Thus, significant differences didn't exist in the mean intrinsic motivation in math between 9th grade (the last year of middle school) and 10th grade (the first year of high school).

3.3. Gender differences in the change of intrinsic motivation

The results of the HLM analysis with the full research models were shown in Table 2. The effect of gender on the mean level of intrinsic motivations at 9th grade and the change rate of intrinsic motivations were examined. For English intrinsic motivation, girls' motivation was higher at 9th grade, decreased more slowly during middle school, and increased at a faster rate during high school years compared to boys.

Math intrinsic motivation was higher for 9th grade boys than girls. However, boys' math intrinsic motivation decreased faster in middle school compared to girls, and there were no significant gender differences in incremental intercept and change rate during high school.

3.4. School characteristics and intrinsic motivation

The differences in intrinsic motivations were examined according to school characteristics. As seen in Table 2, school urbanity was not a significant predictor of intrinsic motivations for middle school. For high school, school urbanity was a significant predictor in intrinsic motivation in math but not in English intrinsic motivation. Specifically, math intrinsic motivation for high schools that were located in medium-small cities was higher than the other schools.

School funding type was not a predictor of intrinsic motivation for middle schools but it was for high schools. National high schools showed higher English intrinsic motivation compared to private high schools. School equalization region status didn't affect motivation for both middle and high schools. Gender schooling didn't affect intrinsic motivations either for middle school or for high school. High school curriculum track was a significant predictor for intrinsic motivations.

Table 1
Descriptive statistics and correlations of intrinsic motivations in English and math by grade.

		Intrinsic motivation in English					Intrinsic motivation in Math				
		1	2	3	4	5	6	7	8	9	10
Intrinsic motivation in English	1. Year 1 (7th G)										
	2. Year 2 (8th G)	.527**									
	3. Year 3 (9th G)	.474**	.551**								
	4. Year 4 (10th G)	.409**	.482**	.567**							
	5. Year 5 (11th G)	.360**	.422**	.499**	.579**						
Intrinsic motivation in Math	6. Year 1 (7th G)	.335**	.234**	.224**	.187**	.160**					
	7. Year 2 (8th G)	.181**	.381**	.249**	.204**	.188**	.547**				
	8. Year 3 (9th G)	.159**	.245**	.379**	.242**	.226**	.481**	.593**			
	9. Year 4 (10th G)	.151**	.222**	.274**	.354**	.243**	.429**	.511**	.624**		
	10. Year 5 (11th G)	.157**	.226**	.271**	.266**	.365**	.376**	.450**	.528**	.648**	
	M	2.670	2.562	2.553	2.648	2.715	2.643	2.573	2.584	2.565	2.534
	SD	.713	.697	.714	.662	.677	.664	.669	.704	.704	.764
	N	5472	5302	5402	5542	5525	5474	5303	5399	5544	5533
	Min	1	1	1	1	1	1	1	1	1	1
	Max	4	4	4	4	4	4	4	4	4	4

Note. $^{**}p < .01$).

Specifically, elite academic schools focusing on specific domains, such as science, foreign language, and global competency, showed higher intrinsic motivations compared to general academic high schools. First, English intrinsic motivation was higher for foreign language and global competency high schools compared to general academic high schools. Second, math intrinsic motivation was higher for all forms of elite academic schools than other types of schools. Among the rest, vocational high schools except fisheries and maritime high schools showed lower intrinsic motivation in English and math, and art high schools showed lower math intrinsic motivation compared to general academic high schools

4. Discussion

The present study has examined the change trends of intrinsic motivations in English and math during secondary school years through the three level cross-classified HLM analyzing Korean national sampling data of KELS. In addition, the study investigated into possible differences in the motivational development trends according to gender and school characteristics.

4.1. Developmental trends in subject specific intrinsic motivation

The findings of the study clearly confirmed that intrinsic motivational development is subject-specific. Specifically, intrinsic motivations in English and math decreased during middle school years from 7th to 9th grades, but each subject showed a different developmental pattern during high school years from 10th to 11th grades. English intrinsic motivation decreased during middle school years and increased during high school years, even after controlling for gender and various school characteristics. However, math intrinsic motivation decreased continually across the entire secondary school years. This result is in line with research that showed intrinsic motivation to be a domain-specific construct by reporting a continuous faster decline of intrinsic motivation in math and science than in English and social studies during secondary school (e.g. Gottfried et al., 2001; Jacobs et al., 2002).

However, the increase of English intrinsic motivation in high school years found in this study was noteworthy. The previous research has consistently reported a continuous decrease in intrinsic motivations across various subjects including English during the secondary school years (e.g., Harter, 1981; Otis et al., 2005). One possible explanation is that most previous studies were on relatively small samples of American and European students whereas the present study targeted a large sample of Korean students. In addition, previous research examined the motivational change until 10th grade and found a continuous motivational decrease while this study extended the age span to 11th grade and found an increase from 10th to 11th grade. In line with this study, Gottfried et al. (2001) found a slight increase in intrinsic motivation from ages 16 (11th grade) to 17 (12th grade). Moreover, there are differences in the school system between Western countries and Korea. Western students usually transition from elementary school to middle school at 6th grade and transition from middle school to high school at 9th grade whereas Korean students transition to middle school at 7th and transition to high school at 10th grade. Thus, the difference in the transition ages could lead to different patterns in motivation development.

As another possible explanations for the increase in English intrinsic motivation in Korea contrary to other countries, Korean students perceive English to be extremely important for their college admission as well as for various life goals (Choi & Kim, 2013). For example, English is a major subject on the college entrance exam and English skills are generally required for high paying jobs in Korea (Song & Kim, 2013). In addition, Korean students' motivation to learn English as a foreign language is affected by other instrumental purposes such as pursuing their leisure goals of travel abroad, enjoying music and movies, and communicating with people from different cultures (Gardner, 2010). These instrumental values may bring the increase of English motivation.

4.2. Gender differences in intrinsic motivational development

It was confirmed that gender differences existed in intrinsic motivational development according to school subject. These results are in line with the previous research that showed gender differences exist in gender role related subjects such as language (Kahle & Meece, 1994; Ullman, 2010).

For English, girls' intrinsic motivation was higher at 9th grade and decreased more slowly during middle school and increased at a faster rate during high school when compared to boys. For math, boys had a higher level of intrinsic motivation at 9th grade, but showed a faster decrease in middle school than girls. These results are supported by previous studies that reported girls' advantage in language, and boys' advantage in math and science in terms of self-efficacy, interest and achievement (e.g., Fernandez, Quiroga, del Olmo, Aroztegui, & Martin, 2011; Fouad et al., 2010; Meece et al., 2006). Contrary to our hypothesis and previous research that reported a more gradual decrease in math intrinsic motivation among adolescent boys than girls (Levant, 2011; MacCallum & Kim, 2000), the boys in this study seemed to experience a faster decrease in math intrinsic motivation. Considering that intrinsic motivation is closely tied with achievement, these results may reflect

Table 2
Effects of gender, school years, and school characteristics on intrinsic motivation of English and Math.

	Null model		Full model	
	English	Math	English	Math
Fixed effect				
Model for 9th grade status, π_{0jik}				
Model for mean status, β_{00jk}				
9th grade intercept, γ_{00}	2.535*** (0.012)	2.566*** (0.013)	2.691*** (0.054)	2.485*** (0.058)
Gender (boys), β_{01jk}			−0.103*** (0.025)	0.154*** (0.000)
School urbanity				
Large city, γ_{001}			0.001 (0.084)	−0.061 (0.087)
Medium-small city, γ_{002}			−0.054 (0.075)	−0.088 (0.078)
Rural area, γ_{003}			0.091 (0.085)	0.049 (0.089)
Equalization, γ_{004}			0.044 (0.039)	0.041 (0.042)
Public middle school, γ_{005}			−0.000 (0.024)	0.003 (0.027)
Gender schooling				
Girls' middle school, γ_{006}			−0.042 (0.035)	0.016 (0.038)
Coeducation school, γ_{007}			−0.027 (0.027)	−0.001 (0.029)
Model for 10th grade incremental status, $\pi 2_{jik}$				
Model for mean status, β_{20jk}				
10th grade incremental intercept, γ_{200}	0.108*** (0.009)	−0.002 (0.009)	0.103*** (0.013)	0.013 (0.013)
Gender (boys)			0.012 (0.018)	−0.025 (0.018)
School urbanity				
Large city, γ_{201}			−0.028 (0.082)	0.091 (0.084)
Medium-small city, γ_{202}			0.060 (0.072)	0.175* (0.074)
Rural area, γ_{203}			−0.071 (0.078)	0.045 (0.080)
Equalization, γ_{204}			−0.001 (0.036)	0.038 (0.037)
Funding type				
Public high school, γ_{205}			−0.032 (0.016)	−0.028 (0.016)
National high school, γ_{206}			0.170*** (0.075)	0.112 (0.076)
Gender schooling				
Girls' high school, γ_{207}			0.045 (0.029)	0.042 (0.029)
Coeducation high school, γ_{208}			0.003 (0.022)	0.007 (0.023)
Curriculum track				
Vocational high schools				
Home management high school, γ_{209}			−0.436** (0.122)	−0.282* (0.124)
Technical high School, γ_{210}			−0.381*** (0.028)	−0.450*** (0.029)
Agriculture high school, γ_{211}			−0.578*** (0.102)	−0.646*** (0.104)
Commercial high school, γ_{212}			−0.412*** (0.026)	−0.426*** (0.027)
Fisheries high school, γ_{213}			−0.274 (0.195)	−0.297 (0.200)
General vocational high school, γ_{214}			−0.372*** (0.062)	−0.362*** (0.063)
Comprehensive high school, γ_{215}			−0.23*** (0.032)	−0.224*** (0.033)
Maritime high school, γ_{216}			−0.253 (0.196)	−0.370 (0.199)
Art high school, γ_{217}			0.033 (0.095)	−0.469*** (0.096)
Sports high school, γ_{218}			−0.644 (0.354)	−0.640 (0.365)
Elite Academic high schools				
Science high school, γ_{219}			0.076 (0.150)	0.661*** (0.153)
Global competency high school, γ_{220}			1.006** (0.285)	1.014*** (0.290)
Foreign language high school, γ_{221}			0.518*** (0.069)	0.371*** (0.070)
Model for middle school change rate, π_{1jik}				
Model for mean rate, β_{10jk}				
Middle school slope, γ_{10}	−0.060** (0.007)	−0.031*** (0.006)	−0.045*** (0.009)	−0.018* (0.008)
Gender(boys), β_{11jk}			−0.023** (0.011)	−0.019* (0.010)
Model for high school change rate, π_{3jik}				
Model for mean rate, β_{10jk}				
High school slope, γ_{30}	0.065** (0.009)	−0.033**(0.009)	0.095*** (0.013)	−0.031* (0.013)
Gender(boys), β_{31jk}			−0.051** (0.018)	0.001 (0.018)
Random effect				
Level-1 variance, β_{31jk}	0.198	0.174	0.198	0.174
Level 2 variance : students within school				
9th grade intercept, r_{0ijk}	0.304	0.316	0.261	0.267
Middle school change rate, r_{1ijk}	0.032	0.033	0.032	0.034
High school change rate, r_{3ijk}	0.010	0.039	0.011	0.040
10th grade incremental intercept, r_{2ijk}	0.038	0.043	0.040	0.043
Level-3 variance: between middle schools				
9th grade intercept, b_{000j}	0.009	0.012	0.001	0.004
Middle school change rate, b_{100j}	0.003	0.002	0.003	0.008
Level-3 variance: between high schools				
10th grade incremental intercept, c_{200k}	0.006	0.009	0.004	0.007
High school change rate, c_{300k}	0.002	0.005	0.003	0.002

Note. Gender code: girls = 0, boys = 1. School equalization code: not random = 0, random school assignment = 1. Reference categories: Seoul (for school urbanity), private school (for school funding type), boys school (for gender schooling), and general academic school (for school curriculum track).

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

the recent trend towards decreasing gender gap in math achievement. In fact, Korean students' gender gap in math significantly decreased recently, to the point where there was no statistically significant difference between the math scores for boys and girls (OECD, 2010).

4.3. Effects of school characteristics on motivation

School characteristics, such as urbanity, funding type, equalization region status, targeted gender, and curriculum track, did not affect intrinsic motivation in middle school years whereas they were significant predictors of level of motivation in high school years except for school equalization region.

Specifically, high schools located in medium-small cities showed higher math intrinsic motivation than the schools located in central and large cities, and rural areas. This result is in line with the previous research reported that schools located in medium-small cities showed lower dropout rates and higher achievement compared to central cities and rural areas (Jargowsky, 1997; Rumberger & Thomas, 2000). When considering the decreasing trend of math intrinsic motivation during secondary school years, the positive factors of medium-small city schools need to be examined. For example, compared to large and central cities, medium-small cities were less associated with income inequality and poverty that could lead to lower learning motivation (Gong, 2005; Jargowsky, 1997). In addition, the schools located in medium-small cities tend to be smaller, which induces a more favorable learning environment with better teacher-students relations (Lee & Burkam, 2003; Lee & Smith, 1997).

National high schools showed higher English intrinsic motivation compared to private high schools. Considering that almost all national high schools in Korea are affiliated with the education colleges at national universities, these schools may have higher quality curriculum and teacher qualification. In regards to gender schooling, there was no difference in intrinsic motivations among single-sex and coeducation schools. This was contrary to our hypothesis and the previous research that reported that single-sex schools benefit students in terms of academic achievement and motivation in specific gender-dominant subjects (e.g., Datnow et al., 2001; Hoffman et al., 2008; Lee & Bryk, 1986; Streitmatter, 1997). This result could be related to the fact that we considered various school characteristics simultaneously. Actually, a recent study found that the effects of schooling type (single-sex, coeducation) on achievement disappeared when controlling for school characteristics such as the student selection process and school equalization policy (Cho, 2009).

High school curriculum track was a significant predictor for motivation. Specifically, elite academic schools showed higher intrinsic motivation compared to general academic high schools whereas vocational high schools and art and sports high schools showed lower levels of intrinsic motivations in English and math. The possible explanation for motivation difference according to high school curriculum track could be found in the selection bias. In other words, elite academic high schools allow admission to outstanding students with high intrinsic motivation in English and math through entrance examinations, whereas such rigor in English and math is not required of students of vocational, art, and sports high schools. Thus future research is needed to investigate the effect of curriculum track on intrinsic motivation in English and math with the selection bias eliminated.

4.4. Implication for research

The present study contributes to the literature on motivation theory by identifying different changes in intrinsic motivations according to school level, specific subject, and gender during secondary school years in the Korean context. Specifically, it is noteworthy that intrinsic motivation in English as a foreign language increased during high school years even though it decreased during middle school years. In addition, intrinsic motivation in math decreased faster for boys in middle schools. Because these new findings of the study were found by employing longitudinal analysis of representative large scale data, the results could be used to draw firmer conclusions about developmental trends.

4.5. Implication for education

Educators should note that adolescents' intrinsic motivations in English and math may decrease in middle school. To prevent the possible negative middle school transition effects, educators could design a more stimulating secondary school environment with high-quality teacher-student relationships, appropriate feedback on students' academic performance, and an emphasis on mastery goals (Leaper et al., 2012; Stoyanova & Hope, 2012; Thompson et al., 2011).

Particularly, it need to exert more effort to motivate boys and to help them to value learning since they showed faster decrease in math motivation during middle school as well as slower increase in English motivation compared to girls. Finally, the results regarding the positive effects of several high school types on intrinsic motivation, such as national school, schools located in small-medium cities, and elite academic schools, imply to need for further examining the positive factor of these school type in order to improve the school environment.

4.6. Limitation and future direction

Although our longitudinal approach provided new insights regarding intrinsic motivational development, there are several limitations that need to be considered for future research. First, this investigation on intrinsic motivational development focused on secondary school years (from 7th to 11th grade) provided by secondary data. Thus intrinsic motivation needs to be examined with extending the development span from elementary school to early adulthood including the last year in high school (12th grade). Second, it is also worthwhile to consider how other psychological and environmental factors affect motivational development, factors such as social relations, environment, aspiration, academic achievement, and SES. Finally, since our sample was restricted to Korean students, future research must investigate whether these results could be generalized to other Asian countries, and identify the particularity and universality in motivational development across various cultures.

5. Conclusion

There has been a paucity of longitudinal studies tracking changes of intrinsic motivation according to different academic subjects across secondary school years, especially considering various predictors such as gender and school characteristics in Asian culture. Thus, the present study based a longitudinal data showed that English and math intrinsic motivation changed differently by school level and gender in Korea. In addition, various school characteristics appeared to affect students' levels of intrinsic motivations, especially during the high school years. These findings provide implication not only for researchers interested in intrinsic motivation, gender differences, and cultural comparisons, but also for the educators and educational administrators who hope to provide stimulating learning environments for their students.

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