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# The trajectory of learning-centered English class and its instructional effectiveness: Using a curve-of-factors model

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## Abstract

This study investigated the instructional effectiveness of a learning-centered English class (LCEC) that embodies the classroom innovation of the school reform movement in South Korea from a longitudinal perspective. Using panel data from 938 participants (507 male, 431 female), a curve-of-factors model was employed to explore the trajectory and effectiveness of the LCEC, including cognitive, affective, and behavioral domains. The results indicate that the LCEC was well implemented in the first year and increased slightly throughout innovative middle school. The LCEC improved English self-efficacy, achievement, and interest, as well as attitude, comprehension, and participation in English class. Furthermore, it ameliorated classroom disengagement and enhanced students' school satisfaction. Based on the results, educational policy and intervention programs for the development of LCEC are suggested.

*Keywords:* innovative school, learning-centered class (LCC), learning-centered English class (LCEC), instructional effectiveness, higher-order latent growth curve model

## Introduction

The intensive competition in secondary school in Korea has caused inequality in education, particularly in classroom engagement, in ways that are detrimental to learning (Son, 2004). This polarization of classroom engagement resembles what Sato (2011) labels as “the phenomenon of escaping from learning.” To date, many attempts have been made to ameliorate classroom disengagement. However, top-down school reform projects have repeatedly failed, demonstrating that this is not a feasible model for school change. According to school reform studies (Fullan, 1993; Hargreaves, 1994), only bottom-up change from the educational community enables teachers to implement the desired pedagogical practices for students’ genuine growth and happiness.

The “learning-centered class” (LCC) has attracted educators’ attention to pursuing classroom learning as the essence of school reform. As part of the new teaching and learning innovation policy, the LCC refers to a class in which individual differences are respected, and all students have equal opportunities for learning through self-directed, collaborative, and participatory learning activities (Nam et al., 2014). Many studies have reported LCC’s potential to ensure quality teaching, recognition of dedicated teachers, reconstruction of the curriculum, collaborative learning, process-focused performance assessment, and students’ active engagement (Chung & Hwang, 2011; S. Kim, 2009, 2011; J. Lee & Lee, 2015; Sung & Lee, 2011).

However, the existing research on the instructional effectiveness of innovative schools has not reached consistent conclusions due to differences in research methods, subjects, and variables. There is insufficient research to explore students’ development in the course of LCC practice. Recently, latent growth curve modeling (LGCM) has become a powerful method for understanding longitudinal processes in education by exploring the trajectories of latent constructs (Marsh & Hau, 2007). However, conventional first-order LGCM with a composite score has some limitations (Biemer et al., 2009). To address these issues, such as measurement invariance, partitioning of time-specific and item-residual variance, and parsing out varying item-residual covariance patterns (Bishop et al., 2015), a higher-order growth model with multiple indicator items for each latent construct, specifically a curve-of-factors model (CFM), is introduced (McArdle, 1988).

Therefore, this study attempts to overcome these limitations by applying a higher-order longitudinal research approach to analyze LCEC’s instructional effectiveness at innovative schools. Research that analyzes LCC’s instructional effectiveness comprehensively will help researchers and educators understand LCC practices and provide implications for innovative school policy. Considering its status as the global official language, English has become essential for life as a global citizen. The revised 2015 national curriculum, called the competency-centered curriculum in South Korea, emphasizes the development of communicative competence (i.e., communicating with people worldwide, learning about different cultures, and introducing Korean culture to the world). LCC is in line with the revised curriculum’s educational goal. Thus, English lessons should follow an LCC practice that encourages students’ communicative competence in English.

Although LCC is widely discussed as the value of education and numerous reports on LCC’s educational outcomes (B. Chung & Hwang, 2011; S. Kim, 2009; J. Lee & Lee, 2015), its effectiveness for English instruction remains unverified. Furthermore, little research has been conducted on English teaching effectiveness from multiple angles, including cognitive,

affective, and behavioral aspects in a single model. Besides, methodologically, the introduction of a higher-order latent growth curve model with longitudinal panel data makes it possible to analyze the growth of a latent construct over time (Marsh & Hau, 2007). Thus, this study investigates the innovative school movement's pedagogical practices in the English classroom, longitudinally and empirically.

This study explored the growth pattern of LCC in the English classroom, that is LCEC, based on panel data from the Gyeonggi Education Panel Study (GEPS) 1st-3rd year (2012-2014). To that end, we first explored the growth trajectory of LCEC during grades 7-9 in secondary innovation schools. We then examined the comprehensive effect of LCEC on educational effectiveness, including cognitive domains (students' English self-efficacy and achievement), affective domains (English class interest, attitude, and school satisfaction), and behavioral domains (class disengagement, English class comprehension, and participation). The research questions are as follows:

- RQ1. What is the growth trajectory of the LCEC at the innovative middle school?
- RQ2. What is the instructional effectiveness of the LCEC at the innovative middle school?
  - 2-1. What are the cognitive, affective, and behavioral domains of the instructional effectiveness of the LCEC in the first grade?
  - 2-2. How does the rate of change of the LCEC during middle school affect the cognitive, affective, and behavioral domains of instructional effectiveness?

## Literature review

The school innovation movement in South Korea began to resolve the substantial educational polarization phenomenon, namely, to provide all students with a sense that they deserve respect, recognition, and the right to learn. Similar to a charter school in the U.S., this school reform project is called the "Hyukshin school" (HS) policy and was first introduced in 2009 by Gyeonggi Province Office of Education in South Korea.

In the HS, changes in classroom teaching practices commenced with the educational community for learning. A "Learning Community" refers to an intellectual community in which dynamic participation occurs among members for genuine learning through cooperative teaching and learning practices (Jang & Kim, 2011). Sato (2006) describes the learning community as a school where people learn, cooperate, and grow together through daily learning-centered lessons. Namely, LCC has evolved with the idea of the learning community (Gill et al., 2013; W. Son, 2004).

Under the educational philosophy of "learning for all," HS teachers emphasize "classroom lesson innovation" (CLI), which pursues a shift from lecture-based instruction to student-centered learning (Ro, 2015; Sung & Lee, 2011). The CLI approach places classroom lessons at the center of school reform to link to other aspects of school change, such as ensuring all students a quality education, giving students a voice, facilitating genuine intellectual development, and enhancing teachers' professional development (H. K. Lee et al., 2020; Suh & Son, 2014). Among those, teachers' professional capital to lead the new teaching practices is the most crucial CLI effort (Kang, 2013).

At the heart of CLI is the concept of LCC (Suh & Son, 2014). HS teachers who strive to build a more learning-friendly classroom embraced LCC to increase students' motivation, engagement, and achievement (Granger et al., 2012). LCC connects classroom lessons with

students' life, and the cooperative lessons of teacher-student and teacher-teacher are essential for successful CLI. According to Sato (2011), LCC is an ongoing process in which teachers and students work together to create new knowledge by establishing a learning community. LCC is embodied in daily classroom practices of CLI, not as a fixed lesson model (Y. Lee & Park, 2010; W. Son, 2004; Sung & Lee, 2014; Yoo, 2006).

### Learner-centered instruction (LCI) and learning-centered class (LCC)

In contrast to conventional teacher-centered teaching practices, learner-centered instruction (LCI) maximizes students' engagement and learning experiences through mutual respect between teachers and learners (Lea et al., 2003; McCombs et al., 2008). LCI is theoretically rooted in constructivism, in which knowledge emerges from interaction among learners and reflection on their learning experience, not just the transmission of knowledge from teachers (Vavrus et al., 2011). As constructivism gained interest, pedagogies emphasized learning more than teaching, and LCI emerged as a practical approach to increase instructional effectiveness and student learning outcomes (Y. Chung & Lee 2010; J. Lee & Ha, 2016).

On the other hand, the LCC approach, introduced by the CLI project in South Korea, shares much in common with LCI, in that the student is at the center of teaching and learning. However, it differs in that the teacher's role is to take the initiative in the classroom (Gyeonggi Provincial Office of Education, 2011). Namely, LCC focuses on the role of the teachers who design lessons and lead the process of creating and forming knowledge through ongoing interaction and communication (S. Lee, 2012; Min, 2013). The main criticism of the LCI approach is the seemingly disordered classrooms due to *laissez-faire* teaching practices based on students' autonomy. On the other hand, teachers' active roles as class designers and facilitators in the LCC differ totally from the LCI practice.

Researchers define the characteristics of an LCC as follows (Chang & Lee, 2013; H. Kim, 2013; Nam et al., 2014). First, based on constructivism, knowledge is continually constructed and reconstructed; thus, acquiring knowledge means expanding human perception. Second, the LCC emphasizes how students restructure knowledge, not what content they learn. Thus, students establish their own logical and critical thinking by expanding their awareness level, which means authentic learning. Third, LCC does not refer to fixed teaching methods but instead applies any classroom practices that endorse "quality education for all."

Teachers working at the HS attempted to implement an LCC in which students learn autonomously while teachers participate in cooperative learning activities through questioning, conversation, and discussion. Through the LCC, authentic learning occurs spontaneously. Teachers design lesson plans carefully, and each lesson becomes an ongoing creational process in which knowledge newly emerges from a dynamic interaction between teachers and students, as well as teachers' reflection on their teaching experience.

In other words, a LCC is based on learners' self-directedness, with students continuously communicating with other students or teachers through classroom activities (Sung & Lee, 2014). In this process, teachers support students' learning and intellectual growth and pursue their own career development. Therefore, a well-designed LCC fosters mutual trust and growth among teachers and students (Chang & Lee, 2013).

Based on previous studies on LCC, this study conceptualizes LCEC as an English

subject version of an LCC. Namely, LCEC is an English lesson with several common characteristics, such as asking open-ended questions that stimulate students to develop creative thinking, problem-solving skills, and communicative competence. Another feature of LCEC is active participation in interactive discussions, self-regulated learning, and sharing ideas in small groups. In sum, an LCEC helps both teachers and students grow together through collaborative work in the daily English classroom.

### Instructional effectiveness of LCEC

An LCC lesson is well-designed so that students make meaningful relationships with things (textbooks) and persons (peers or teachers) in learning, rather than remaining passive learners. LCC practice is associated with numerous positive learning outcomes. In particular, previous research on the instructional effects of HS focused on the cognitive effect, that is, academic achievement (An & Park, 2019; Bae & Kim, 2016; Baek & Park, 2015; M. Kim & Park, 2019; C. Park & Kim, 2017; Seo & Chon, 2018). However, to evaluate the LCC goal that it is intended to facilitate a student's holistic growth, the instructional effectiveness of LCC should be considered from multi-dimensional perspectives in terms of students' cognitive, affective, and behavioral areas.

First, most research attention about the instructional effectiveness of LCCs on cognitive domains has been centered on academic achievement. An and Park (2019) investigated the difference in middle school students' academic achievement growth trajectory. They found that HSs, except for the first grade of the middle school period, showed higher academic achievement than common schools, and also positively affected the growth rate in academic development. Likewise, Seo and Chon (2018) revealed that HSs have a significant impact on improving the academic achievement of elementary school students (grades 5-6) and middle school students (grades 1-2). M. Kim and Park (2019) reported that in the case of elementary schools, HS did not have a significant effect on the initial value and rate of change in academic achievement, but in the middle school, HS had a positive effect on the growth rate of academic achievement. Baek and Park (2015) also found that HSs reduce the academic achievement gap in middle and high schools, and this effect size was large in middle schools.

More specifically, H. Oh (2016) investigated the impact of the LCEC on English listening skills for high school students and found that students in a lecture-type class scored high in listening to details and finding the gist, while those in the LCEC scored high on identifying contextual meaning and logical coherence. These results may imply that LCECs are more helpful for higher-order thinking skills, including understanding the contextual meaning and logical sequence of language that is challenging to acquire. Besides, relating to self-efficacy based on social cognitive theory (Bandura, 1986), H. J. Lee et al. (2013) reported a significant difference in academic self-efficacy between innovative schools and ordinary schools.

Turning next to the affective domain of LCCs' instructional effectiveness, a big problem in conventional teacher-oriented classes is that most students lose interest in learning and motivation to learn. However, in LCCs, students learn through group activities, and they experience knowledge sharing and a feeling of caring, thereby reducing disengagement from learning (Ryu & Kim, 2014). Ro (2015) reported that CLI ameliorated the loss of interest in innovation schools. C. Park and Kim (2017) found that HSs have higher school

satisfaction than ordinary schools. Jeong et al. (2018) reported that the LCC in HSs significantly influences the initial values and the rate of change of the school satisfaction trajectory. S. Park and An (2018) also found that the innovative school's LCC practices improved students' school life satisfaction and curriculum satisfaction.

Additionally, Y. Son (2016) investigated whether any difference occurs after conducting an LCEC for three weeks, finding that an LCEC had a significant positive effect on students' English interest, self-efficacy, and school satisfaction compared to lecture-type classes. Furthermore, the LCEC improved the degree of class understanding and participation and reduced the fear of challenging learning tasks.

Some studies adopted a partially comprehensive approach. C. Park and Kim (2017) found that the rate of change in Korean and mathematics academic achievement of innovative high school students was significantly higher than that of ordinary high school students, but there was no difference in the rate of change in subject interest. In their study, S. Park et al. (2019) reported that although there was no significant difference in the affective domain between school types, the gap in English and mathematics academic achievement between private and innovative high school students has narrowed. In addition, Shim (2018) revealed that school effectiveness in HSs was significantly improved in terms of academic achievement and school satisfaction.

According to S. H. Kim (2012), a Korean language grammar lesson based on LCC helps students experience a sense of achievement in task-solving activities, thus positively affecting their learning motivation and academic achievement. However, in her study, Cho (2014) reported that small group cooperative learning in a LCC did not significantly affect academic achievement but significantly affected interest and attitude toward mathematics, compared to students in conventional classes. In addition, J. Park's (2017) study on the effect of LCC activities using English literature indicated a significant increase in high-school students' interest but no achievement difference. Interestingly, S. Oh (2014) reported that LCEC positively affected students' achievement motivation, confidence, anxiety, and school satisfaction but negatively affected the subject's interest.

Taken together, previous studies reported that LCCs at HS positively impact students' cognitive development, achievement and self-efficacy, affective development, interest, attitude, and school satisfaction, behavioral development, class disengagement, comprehension, and participation. Namely, previous research findings suggest that an LCC is a major factor for students' well-rounded development at innovative middle schools. These results may imply the importance of LCC in English subject, especially about its instructional effectiveness. Therefore, this study analyzed the developmental trajectory of LCEC in HSs using various educational effectiveness variables. With a comprehensive approach, this study focused on cognitive, affective, and behavioral domains as outcome measures of instructional effectiveness in a single model.

## Research method

### Participants

This study used data from the first to third years of the Gyeonggi Education Panel Study (GEPS) administered by the Educational Research Institute. Data were collected annually in October. The middle school first-graders were sampled in 2012 and followed up until the third grade (2014). In this study, 938 students were sampled from 18 innovation schools (507 males (54%) and 431 females (46%)). In principle, innovative schools are designated through public selections for schools located in underprivileged regions, schools with a high ratio of students from low-income families, and small schools. Therefore, the students' SES and educational input levels are relatively low compared to those of normal schools. There were 936 students in the first year, 896 in the second year, and 867 in the third year, giving a total of 92.4% of the original sample who were maintained throughout the three years. Missing values are treated as MAR (missing at random) after inspection of the GEPS manual and descriptive statistics. To deal with violations of normality and missing data, full information maximum likelihood (FIML) estimation was employed.

### Variables and measures

#### *Indicator variables for the LCEC*

Table 1 shows indicator variables of the LCEC, which was operationally defined as a construct composed of four sub-domain indicators: question, discussion, self-directedness, and cooperation. If there were too many indicator variables in one latent variable, item parcels were applied to avoid the convergence problem in the high-order latent growth model (Matsunaga, 2008). All indicator items were divided into four sub-categories using the item parceling method. For each variable, 5-point Likert scales were used, from 1 = "strongly disagree" to 5 = "strongly agree."

Table 1. Indicator variables of LCEC

		Items	$\alpha$
Learning-centered English class	Question item parceling	1. Teacher and students ask questions and answer each other in class.	.848
		2. Teacher asks students questions to ensure they understand the lesson contents.	
		3. Teacher asks students to explain their answers.	
	Discussion item parceling	4. Teacher guides the students to bring their opinions together to make a conclusion on a given topic.	.818
		5. When a classmate expresses an opinion, the teacher encourages other students to argue based on reasonable grounds.	
	Self-directed item parceling	6. Teacher helps students find their own learning goals.	.804
		7. Teacher helps students to solve problems by themselves.	
		8. Students collect and investigate data to solve problems by themselves.	
	Cooperation item parceling	9. Students share their opinions on class contents.	.805
		10. Students form small groups to solve learning tasks together.	
		11. Each student shares their role to solve common tasks.	

### Outcome variables

In Table 2, the outcome variables are as follows: class disengagement, English classroom-related variables, and students' school satisfaction, measured at the end of middle school.

Table 2. Description of outcome variables

Variables	Item description	$\alpha$	
Class disengagement	1. I make noise in class. 2. I sleep in class.	.640	
	Class comprehension	1 = 20% or less, 2 = 21-40%, 3 = 41-60%, 4 = 61-80%, 5 = 81% or more	-
	Class participation	1 = 0-10min, 2 = 11-20min, 3 = 21-30min, 4 = 31-40min, 5 = 41min more (with 1 class hour = 50 mins)	-
	Class attitude	1. I concentrate on the class. 2. I actively participate in class. 3. I must do my homework.	.901
English language related variables	Interest in subject	1. When I study, I read not only textbooks but also related reference books. 2. I can concentrate well when studying. 3. I want to study more to satisfy my curiosity. 4. I prefer to solve a question that is a bit more difficult than my current ability.	.890
	Self-efficacy	1. I'm certain I can understand the most difficult contents of the textbook. 2. I'm confident I can understand the most complex material presented by the teacher in class. 3. I'm confident I can do an excellent job on the assignments. 4. I believe I will receive an excellent grade in this class. 5. I'm certain I can master the skills being taught in this class.	.944
	Academic achievement	English academic achievement scores (standardized test scores)	-
Student satisfaction	1. The school is building up the students' learning abilities well. 2. The school is developing students' skills and aptitudes well. 3. The school is doing well in career counseling and guidance for student life. 4. The school is committed to students' safety. 5. The school offers a variety of creative after-school programs. 6. The school has a culture of respecting students' human rights.	.914	

First, 6-point Likert scales were used to measure the class disengagement variables, from 1 = "not at all" to 6 = "almost every day." Next, the variables related to the English classroom comprised: degree of class comprehension and participation, class attitude, subject interest, self-efficacy, and achievement in English. For each variable, 5-point Likert scales were used, from 1 = "do not agree at all" to 5 = "highly agree." To measure English class comprehension, a 5-point Likert scale was used from 1 = "20% or less" to 5 = "81% or more," while for the duration of participation, the scale ranged from 1 = "10 minutes or less" to 5

= “41 minutes or more” in a 50-minute class. English achievement consists of listening (10 items, 28 points) and reading (18 items, 72 points) sections, with a similar format to the Korean SAT English test, representing a scaled score. Except for class comprehension and participation, all outcome variables were treated as latent variables with multiple indicator items, and the internal consistency ( $\alpha$  coefficient) of each variable was checked, as shown in Table 2.

### Data analysis

In this study, the CFM was applied using *Mplus* 8.1 (Muthén & Muthén, 2019) to explore the trajectories of LCEC (see Appendix for model building). Figure 1 represents the research model. To estimate the model, the author first established measurement invariance for the factor loadings, mean parameters, and error variances of indicators in the LGCM across time points. Next, a second-order LGCM was estimated using latent factors of the identified LGCM as the measurement model.

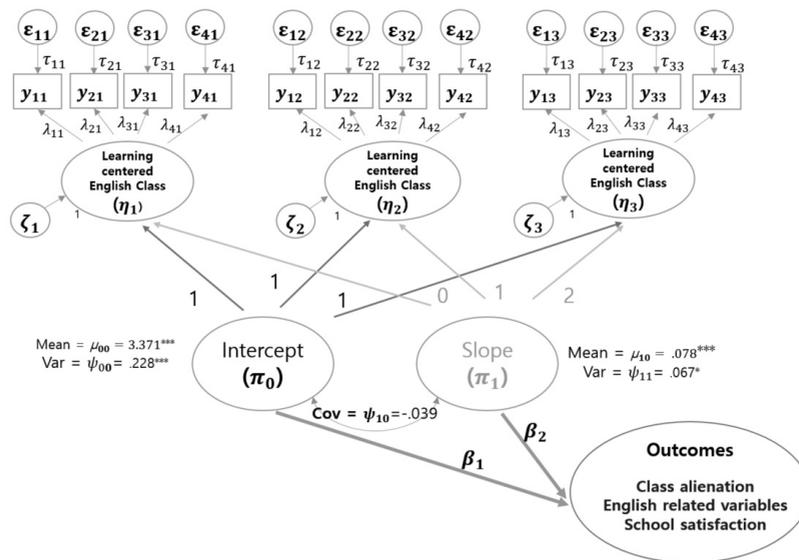


Figure 1. Schematic diagram of the research model

In Figure 1, ellipses denote latent variables, including the global domain (LCEC) and error terms ( $\eta$ ,  $\zeta$ , and  $\varepsilon$ ), squares denote observed indicators ( $y_1$ - $y_4$ ), and single-headed arrows refer to regression coefficient weights.

### Longitudinal measurement invariance (factorial invariance)

A CFM allows researchers to evaluate the quality of latent factors used to assess a global domain (i.e., LCEC) by estimating a CFA (confirmative factor analysis) before modeling individual latent factors as indicators of higher-order growth factors. When a measure has been shown to be consistent over multiple measurement points (or waves), it

is assumed that the measure has assessed the same construct, that is, a construct with the same meaning over time (Meredith & Horn, 2001). This consistency refers to measurement (or factor) invariance.

For longitudinal models, the measurement invariance can be tested by restricting parameters and comparing the fit indices of competing models (E. Kim & Willson, 2014). Typically, meeting the strong or partial strong invariance assumption is sufficient for the meaningful interpretation of model parameters (Thompson & Green, 2006). Under maximum likelihood with robust standard error estimation, measurement invariance is tested using a nested chi-square difference test ( $\Delta\chi^2$ ) between the unconstrained model and the model with equality constraints (Ferrer et al., 2008). However, the  $\chi^2$  statistic is highly sensitive to sample size; alternatively, Cheung and Rensvold (2002) suggested that the assumption of measurement invariance is tenable if the change in the CFI ( $\Delta\text{CFI}$ ) between the models is less than .01.

## Results

### Descriptive statistics

Table 3 presents the descriptive statistics of the LCEC over three measurement points. For the LCEC manifest indicator variables, every four sets of item parceling rose consistently from the first wave to the third wave.

Table 3. Descriptive statistics for the indicator variable

Variables		<i>N</i>	<i>M</i>	<i>SD</i>	Skewness	Kurtosis	
Learning-centered English class (LCEC)	Question item parceling	Wave 1	932	3.48	0.89	-0.305	0.196
		Wave 2	896	3.49	0.83	-0.129	0.252
		Wave 3	865	3.54	0.91	-0.222	0.427
	Discussion item parceling	Wave 1	932	3.26	0.92	-0.129	0.229
		Wave 2	896	3.31	0.92	-0.117	0.097
		Wave 3	865	3.43	0.92	-0.057	0.112
	Self-directed item parceling	Wave 1	936	3.34	0.84	0.000	0.147
		Wave 2	896	3.41	0.82	-0.042	0.186
		Wave 3	866	3.47	0.88	-0.294	0.135
	Cooperation item parceling	Wave 1	936	3.24	0.88	-0.180	0.162
		Wave 2	896	3.36	0.85	-0.155	0.190
		Wave 3	866	3.50	0.92	-0.297	0.137

Table 4 shows the descriptive statistics of outcome variables. All outcome variables are treated as latent constructs composed of multiple indicators. For class disengagement and school satisfaction, two and six items are used, indicating around 3 points. For English related variables, class comprehension and participation variable are a single item, but class attitude, subject interest, and self-efficacy are measured with three, four, five items, respectively, indicating a range from 2.98 to 3.57 points. The mean score of the standardized English achievement test is 53.69.

Table 4. Descriptive statistics for the outcome variable

Variables		<i>N</i>	<i>M</i>	<i>SD</i>	
Class disengagement	Item 1	868	4.41	1.57	
	Item 2	869	3.66	1.76	
Class comprehension		869	3.40	1.43	
Class participation		868	3.36	1.26	
Class attitude	Item 1	870	3.57	1.12	
	Item 2	869	3.48	1.10	
	Item 3	868	3.54	1.19	
English-related variables	Interest in subject	Item 1	865	3.02	1.18
		Item 2	865	3.20	1.09
		Item 3	866	2.98	1.15
		Item 4	865	2.98	1.18
Self-efficacy		Item 1	866	3.26	1.12
		Item 2	865	3.18	1.13
		Item 3	866	3.44	1.12
		Item 4	865	3.16	1.14
		Item 5	866	3.27	1.09
Standardized achievement score		872	53.69	23.21	
School satisfaction		Item 1	868	3.33	0.89
		Item 2	868	3.37	0.92
		Item 3	869	3.52	0.93
		Item 4	866	3.59	0.86
		Item 5	867	3.42	0.96
		Item 6	867	3.52	0.90

### Longitudinal measurement invariance and growth pattern

A sequence of increasingly constrained longitudinal measurement models was specified to test the measurement invariance of second-order growth factors. To test these sequences of constraints, first, the least restrictive models (configural invariance) were tested, and then factor loadings and intercepts were fixed equal in a stepwise manner. Longitudinal measurement invariance is the degree to which the measurement model of a latent variable is the same over time in the analysis. Table 5 lists the sequence and specific sets of constraints tested to assess the measurement invariance of the second-order factor models. According to the  $\Delta$ CFI, which is lower than .01 and overall adequate model fit, the longitudinal invariance assumption was met, that is strong invariance (equal intercepts) assumption.

### Nested model comparison for measurement invariance

The results of the nested model comparisons for measurement invariance are shown in Table 5. First, the assumption of weak invariance by comparing M3 with M2 was tested. According to Cheung and Rensvold's guideline (2002), the result indicated that the

constraints incorporated in M3 do not significantly reduce the model fit compared to M2 (the configural model) ( $\Delta\text{CFI} = .002$ ). Thus, the assumption of weak invariance is satisfied. Moreover, in comparing M3 (the weak invariance model) to M4 (the strong invariance model), which adds constraints to make the manifest variable means equal across time, the constraints incorporated in M4 also do not significantly reduce the model fit ( $\Delta\text{CFI} = .008$ ).

Table 5. Fit indices for invariance tests

	$\chi^2(df)$	MC	$\Delta\chi^2(\Delta df)$	CFI	TLI	$\Delta\text{CFI}$
Configural invariance (M2)	190.754(41)			0.982		
Weak invariance (M3)	214.956(47)	$p = 0.00048$	24.202(6)	0.980	0.972	0.002
Strong invariance (M4)	285.998(55)	$p = 0$	71.042(8)	0.972	0.967	0.008

Note: MC = Model comparison. All models included autocorrelated errors.

To determine the best model for the developmental course of LCEC, models comparison was conducted between a no-growth model (null model) where no slope component was assumed for LCEC and a linear growth model (linear model). Table 6 shows that the linear growth model provided a better fit to the data for LCEC,  $\chi^2(df = 50, N = 938) = 190.436$ ,  $p = .000$ ; CFI = .974, TLI = .965, RSMEA = .055, SRMR = .035.

Table 6. Fit Indices of the measurement model

	$\chi^2$	$df$	CFI	TLI	RMSEA	SRMR
Null Model	228.482*	53	0.967	0.959	0.059	0.063
Linear Model	190.436*	50	0.974	0.965	0.055	0.035

Note: CFI = comparative fit index; TLI = Tucker and Lewis index; RMSEA = root mean squared error of approximation; SRMR = standardized root mean square residual.

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

As shown in Table 7, significant variance of both intercept ( $\sigma^2 = 0.228$ ,  $SE = 0.037$ ,  $p < .001$ ) and slope ( $\sigma^2 = 0.067$ ,  $SE = 0.021$ ,  $p < .01$ ) indicated significant individual differences of initial levels and growth rate in LCEC. Intercept mean ( $M = 3.371$ ,  $SD = 0.032$ ,  $p < .001$ ) and slope mean ( $M = 0.078$ ,  $SD = 0.016$ ,  $p < .001$ ) for LCEC were significantly different from zero and positive, indicating that students perceived LCEC implementation to increase over time. That is, students' perceived LCEC scores averaged 3.371 at Grade 7 and then increased steadily to an average of .078 from Grades 7 through 9. Furthermore, although statistically nonsignificant, the intercept and slope factors for LCEC were negatively correlated ( $r = -.039$ , ns), implying that students who reported high initial levels of LCEC implementation tended to indicate a more rapid decrease (lower rate of change) in LCEC implementation across three-time points, compared with students who reported lower initial levels.

Table 7. Unconditional linear model estimates of LCEC

	Mean		Variance		Covariance
	Intercept	Slope	Intercept	Slope	
LCEC	3.371***	0.078***	0.228***	0.067**	-0.039

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

### Outcome variables of LCEC growth factors

The regression coefficients in Table 8 are interpreted as follows: the statistically significant intercept value, -1.507, indicates the change in class disengagement for each one-unit increase in the second-order initial level of LCEC growth factor. This means that individuals reporting higher initial levels of LCEC generally showed lower class disengagement than individuals who perceived lower initial LCEC engagement levels.

Likewise, regarding the degree of English class comprehension, participation, attitude, and English achievement, only the intercept of the LCEC growth factor shows positive effects. These results can be interpreted as follows: as the initial level of LCEC increases one unit, the degree of English class comprehension (4.14), participation (4.478), English class attitude (3.652), and English achievement (45.681) also increase. Notably, the more LCEC was established in the first year of middle school, the higher the class participation. In contrast, although not statistically significant, the growth rate of LCEC shows a negative effect on class participation, implying that LCEC's positive effect on class participation might disappear or reverse over time.

On the other hand, both LCEC growth factors showed a statistically significant positive effect on English subject interest and self-efficacy. The intercept values of 2.2 and 2.517, respectively, indicate a change in English subject interest and self-efficacy for each one-unit increase in the second-order initial level of LCEC growth factor. Slope values of 3.261 and 4.089 denote the change in English subject interest and self-efficacy for each one-unit increase in the second-order slope factor. This means that as the initial value of LCEC is high, that is LCEC is well implemented in the first year of secondary English classroom, students' English subject interest and self-efficacy increase. Furthermore, as the growth rate of LCEC is steeper, that is well carried out during HS middle school years, English subject interest and self-efficacy also increase. In other words, individuals with a more rapid rate of change in LCEC experienced greater English subject interest and self-efficacy than individuals with a slow or average rate of change in LCEC.

Next, an intercept value of 0.854 means that individuals reporting higher initial levels of LCEC generally showed greater school satisfaction than individuals with lower initial LCEC levels. Furthermore, the slope estimate value, 1.221, refers to the change in school satisfaction for each one-unit increase in the second-order slope factor. In other words, individuals with a more rapid rate of change in LCEC experienced more school satisfaction than individuals with a slow or average rate of change in LCEC.

Interestingly, considering the positive effect of both initial level and change rate of LCEC on English subject interest, English self-efficacy, and school satisfaction, it can be inferred that LCEC's initial positive effect on English subject interest, self-efficacy, and

school satisfaction did not disappear but accelerated in a positive direction over the years.

Additionally, according to the comparison of standardized regression coefficients, the effect of the initial value of LCEC on class comprehension (.727), class participation (.886), and class attitude (.872) was relatively high. On the other hand, interest in English subject (.636) and English self-efficacy (.624) show a moderate effect. Lastly, English achievement (.492) and school satisfaction (.285) reveal a relatively weak effect size.

Table 8. Effects of growth factors of LCEC on outcome variables

	Growth factors	<i>b</i>	<i>SE</i>	$\beta$	Outcomes
LCEC	Intercept	-1.507***	0.369	-0.467***	Class disengagement
	Slope	0.211	0.483	0.045	
	Intercept	4.140***	0.572	0.727***	English class comprehension
	Slope	1.941	1.018	0.234	
	Intercept	4.478***	0.833	0.886***	English class participation
	Slope	-0.246	1.360	-0.033	
	Intercept	3.652***	0.572	0.872***	English class attitude
	Slope	0.837	0.917	0.138	
	Intercept	2.200***	0.247	0.636***	Interest in English subject
	Slope	3.261***	0.434	0.648***	
	Intercept	2.517***	0.302	0.624***	English self-efficacy
	Slope	4.089***	0.673	0.698***	
	Intercept	45.681***	7.864	0.492***	English academic achievement
	Slope	12.958	13.705	0.096	
	Intercept	0.854***	0.117	0.285***	School satisfaction
	Slope	1.221***	0.191	0.280***	

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

## Discussion and conclusion

This study investigated the developmental trajectories of the LCEC, in which teachers provide students with various opportunities to engage in English learning through open-ended questions, interactive discussions, self-directed learning, and collaborative group work. The objective of the LCEC is to grow a well-rounded person by building students' intellectual, emotional, and behavioral growth. The author employed higher-order latent growth curve analyses for the trajectory of LCEC and regressed associations between the growth factors of LCEC and its teaching effectiveness covariates. The analyses yielded two key findings: (a) validation of longitudinal establishment of LCEC practices at secondary HSs over time, and (b) comprehensive associations, varying in effects, between the growth factors of LCEC and instructional effectiveness.

More specifically, LCEC increased slightly over three years at the secondary HS, supporting Sato's (2011) learning community theory and researchers of CLI (B. Chung & Hwang, 2011; S. Kim, 2009; J. Lee & Lee, 2015). Namely, EFL learners' perceptions of LCEC implementation inclined slightly during innovative middle school. In particular, both the initial value and change rate of the LCEC practice were positive and statistically significant, indicating that the LCEC has already been established in the first year of innovative middle school. Its growth rate may accelerate in a positive direction during the three years of innovative middle school.

From a wide array of school effectiveness perspectives, this study includes multiple outcome variables to assess the instructional effectiveness of LCEC as a classroom innovation policy. In doing so, this study focused on cognitive, affective, and behavioral domains of teaching effectiveness as outcome variables in a single model.

Despite a relatively low SES regarding cognitive instructional effectiveness, LCEC showed a positive effect on students' English self-efficacy and achievement in the first year of innovation middle school. This result supports many previous studies that support the positive effect on English self-efficacy (H. J. Lee et al., 2013; Y. Son, 2016) and English achievement (An & Park, 2019; Bae & Kim, 2016; Baek & Park, 2015; M. Kim & Park, 2019; S. H. Kim, 2012; H. Oh, 2016; C. Park & Kim, 2017; Seo & Chon, 2018; Shim, 2018). That is, the students in 7th grade who perceived that the LCEC was well-established reported feeling more confident about their English self-efficacy and scored higher on English achievement tests. Moreover, the growth rate of LCEC showed a positive effect on English self-efficacy, suggesting that students who experience a steeper increase in LCEC practices over three years are more self-efficacious in English learning.

When it comes to affective instructional effectiveness, LCECs showed positive effects on English class interest and school satisfaction. Both LCEC growth factors showed positive effects, indicating that the better the LCEC is implemented, the higher the interest in English learning, and the higher the satisfaction with school life, not only in the first year but throughout middle school. In other words, the initial level and growth rate of LCECs positively predicted students' interest in English and general school satisfaction, suggesting that the more learners perceived LCEC to be well-established in the first year and over time, the more likely they were to feel interested in English learning and satisfied with school systems such as curriculum and climate. These results echo the existing findings that LCCs contribute to students' satisfaction (Jeong et al., 2018; S. Oh, 2014; S. Park & An, 2018; S. Oh, 2014; C. Park & Kim, 2017; Shim, 2018; Y. Son, 2016) and interest in English (Cho, 2014; J. Park, 2017; Ro, 2015; Y. Son, 2016). However, this evidence differs from previous research findings (S. Oh, 2014) that showed a decline in interest in English. Given the small sample size and descriptive nature of the previous study, a follow-up study is necessary to investigate how LCEC influences students' interest in English and other subjects.

Last, for behavioral instructional effectiveness in the English classroom, LCEC in the first year only showed positive effects on class disengagement, English class attitude, class comprehension, and participation. The effect sizes of behavioral variables were relatively large compared to other cognitive and affective variables. Namely, 7th-graders who perceived a higher level of implementation of LCEC reported being likely to engage in the general class as well as English class, including better class-taking attitude, a higher degree of content understanding, and more active participation.

However, as the grade increased, the effect of the LCEC growth rate disappeared. As expected in previous studies, LCECs alleviated classroom disengagement in the first year of HS, but as the school years progressed, the effectiveness of LCEC faded out. This result partly corroborates a review of the positive effectiveness of LCEC on class disengagement (Ryu & Kim, 2014), English class attitude (Cho, 2014), English class comprehension (Y. Son, 2016), and participation (H. J. Lee et al., 2013; Y. Son, 2016). To sustain students' classroom engagement, more in-depth research and intervention policies are needed.

According to the previous findings of multilevel SEM, English self-efficacy, interest, and teachers' interactional teaching style showed indirect positive effects on English achievement via students' English class attitude, comprehension, and participation (Y. Oh & Cha, 2017). Similarly, it can be posited that LCECs improve students' English self-efficacy and interest in English as well as overall classroom disengagement, class attitude, comprehension, and class participation, resulting in enhanced English achievement and school satisfaction. All these outcomes lead to the conclusion that LCECs are an important predictor of students' cognitive, affective, and behavioral development in secondary school life. The findings support the school innovation project through CLI that encourages students' genuine learning and growth.

Some limitations of this study are to be mentioned. The current data are mainly based on large-scale self-reported survey data. Although secondary panel data allow researchers to reach large longitudinal samples of subjects, there is a lack of necessary variables for research aims, such as students' prior proficiency, learning history, including after school learning or private tutoring, family background. To perform a follow-up study, a qualitative approach is needed. While the data used in this study are relatively out of date, this initial period of HS policy is quite crucial for building a stepping stone to the LCEC movement from theoretical and practical perspectives. Basically, this research is analyzed based on the student level variables in the HS, but their interpretation is treated as both student and school level data at the same time.

The findings have some implications regarding the impact that LCEC has on students' cognitive, affective, and behavioral development in school life. This study can be grounds for the researcher to do follow-up research about classroom innovation in other subjects at HS. This study can also provide evidence for educators to implement LCEC practices in English classrooms to facilitate students' active learning. In CLI, teachers should first engage students in classroom activities. The major role of teachers in LCECs is to design the learning content and materials that encourage students to ask questions, express their ideas, and be active in learning through various opportunities. During LCEC, teachers interact with students, asking them to link their prior experiences to their new learning in the classroom. Thus, LCECs may help individuals to manage their daily school lives and educational development during secondary school.

Through LCEC courses, teachers should go beyond supporting students and pursue their career development, forming a professional learning community for better teaching practices. Hence, pedagogical interventions geared toward enhancing teachers' professional development are necessary for school reform policy. In sum, this study has highlighted the teaching effectiveness of LCECs, in which teachers' critical role is emphasized more than ever. In light of these findings, further attention should be paid to language teachers' facilitative role in LCC in the EFL classroom.

As a policy measure to activate LCEC courses at secondary school, in-service teacher training, and the prevention of teachers' burnout syndrome is necessary through professional learning community activities. The classroom teaching situation is challenging, so teachers should acquire practical knowledge through collective intelligence experiences to lead LCC (So & Kim, 2010). Thus, teachers' practical knowledge and collegiality within the professional learning community are necessary to establish LCECs in secondary schools.

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## Appendix. CFM Model Building

The CFM statistical technique was employed using *Mplus* 8.1 (Muthén, 2019). Longitudinal confirmatory factor analysis is carried out to build the base measurement model. Then, secondary latent growth factors using the primary measurement model are incorporated into a higher-order latent growth curve model, the CFM. LCEC comprises four indicator variables ( $y_1$ - $y_4$ ).

Figure 1 illustrates the CFM diagram for tracing LCEC growth trajectories over time. The first-order growth factor model (measurement model) at each time point  $t$  is defined by measurement intercept values ( $\tau_{jt}$ ) for each indicator ( $y_{jit}$ ), factor loadings ( $\lambda_{jt}$ ), a latent factor variable ( $\eta_{it}$ ), and a residual for each indicator variable ( $\varepsilon_{jit}$ ), where the subscript  $i$  denotes individual participants and the subscript  $j$  refers to each indicator variable. Thus, the regression equation of  $y_j$  for individual  $i$  ( $= 1, 2, 3, \dots n$ ) at each measurement time point  $t$  ( $= 0, 1, 2, \dots n$ ) is written as follows:

$$y_{jit} = \tau_{jt} + \lambda_{jt} \times \eta_{it} + \varepsilon_{jit}, \quad \varepsilon_{jit} \sim \text{NID}(0, \sigma_{jt}^2) \quad (1.1)$$

The three repeated measures of LCEC coalesce into an aggregate intercept ( $\pi_0$ ) and an aggregate slope ( $\pi_1$ ). These aggregated latent variables ( $\eta_{it}$ ) are specified as the second-order factors of the CFM.

$$\eta_{it} = \pi_{0i} + \lambda_t \times \pi_{1i} + \zeta_{it}, \quad (1.2)$$

$$\pi_{0i} = \mu_{00} + \zeta_{0i}, \quad \zeta_{0i} \sim \text{NID}(0, \Psi_{00}) \quad (1.3)$$

$$\pi_{1i} = \mu_{10} + \zeta_{1i}, \quad \zeta_{1i} \sim \text{NID}(0, \Psi_{11}) \quad (1.4)$$

$$\Psi = \begin{bmatrix} \Psi_{00} \\ \Psi_{10} \ \Psi_{11} \end{bmatrix} \quad (1.5)$$

The second-order intercepts and slopes in this CFM have a mean ( $\mu$ ) (the intercept  $\mu_{00}$  and the slope  $\mu_{10}$ ) and residuals ( $\zeta$ s), and the residuals with a mean of zero and a variance-covariance structure ( $\Psi$ ). This second-order growth curve model includes growth factors, including the intercept (initial level) of LCEC and its slope (rate of change), which captures the change in a global domain over time. That is, the higher-order growth factors (i.e., the intercept and slope of LCEC) have a mean (the average trend) and variance (the amount of inter-individual variation around the mean). This model

without any covariates refers to an unconditional; additionally, when the covariates are incorporated in the model as predictors or outcomes, it is labeled a conditional model.

This method is a confirmatory factor analysis (CFA) because it first specifies global factors and then analyzes their growth curve. The outcome variable (D) can be predicted using growth parameters ( $\pi_0$  and  $\pi_1$ ) as well as primary, time-specific, latent variables ( $\eta_{1-3}$ ). This equation is expressed as:

$$y_{ji} = \tau_j + \lambda_j \times D_i + \varepsilon_{ji}, \quad \varepsilon_{ji} \sim \text{NID}(0, \sigma_j^2) \quad (1.6)$$

Where the subscript  $j$  refers to specific indicator variable  $j$ , and the subscript  $i$  (= 1, 2, 3, ... n) denotes individual  $i$ . D is a latent factor with a variance  $\psi_1$ , and  $\varepsilon$  is the residual for  $y$ .  $\varepsilon$  is normally and independently distributed (NID) with a mean of zero and a variance of  $\sigma^2$ . The CFM with the latent variable outcome D is expressed as follows:

$$D_i = \mu_D + \beta_1 \pi_{0i} + \beta_2 \pi_{1i} + \beta_3 \eta_{it} + \zeta_{1i}, \quad \zeta_{1i} \sim \text{NID}(0, \psi_1) \quad (1.7)$$

$\beta_1$  and  $\beta_2$  are regression coefficients that link growth parameters ( $\pi_{0i}$  and  $\pi_{1i}$ , respectively) to the distal latent outcome (D).  $\beta_3$  is the regression coefficient connecting the time-specific primary latent parameter ( $\eta_{it}$ ) to the distal latent outcome variable D. The  $\beta$  coefficients can be interpreted as unique effects after controlling for the effects of the other covariates in the model. The CFM model illustrated in Figure 1 represents the following research inquiries: (a) the initial level and growth rate of LCEC, and (b) the instructional effectiveness of these growth factors of LCEC.