



Effects of Video-based e-Learning on EFL Achievement: The Mediation Effect of Behavior Control Strategies

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The current study aimed to investigate whether video-based e-learning (i.e., the Educational Broadcasting Service (EBS)) influences the achievement of Korean high school students (years 2-3) in English as a foreign language (EFL) through the mediation of their use of behavior control strategies. The study used data from the 2010 and 2011 Korean Education Longitudinal Study of 2,309 students. Structural equation modeling was used to analyze whether the behavior control strategies mediated consistent use of EBS with high school students and whether video-based e-learning led to an increase or a decrease in the students' EFL achievement test scores. In general, consistent EBS use resulted in changes in the high school students' EFL achievement test results with the mediation of the behavior control strategies. However, a decrease model showed slightly better model-data fit than an increase model because in the decrease model the time management and resource use strategies had a significant negative relationship to decreases in the EFL test scores between year 2 and year 3. As a significant function of time management, EBS use seemed to work in preventing decreases in EFL achievement.

Keywords: e-learning, behavior control strategies, Educational Broadcasting Service, language development

Introduction

E-learning, in the form of the Educational Broadcasting Service (EBS), has been widely used in South Korea in the hope of reducing the costs of private education and social inequality (Kim & Kim, 2012, p. 11). However, education consumers are often concerned that students in an e-learning environment are likely to receive less guidance from teachers or parents than those in an off-line learning environment. Further, various multimedia effects that appear in the e-learning environment may distract students from consistently focusing on learning. Thus, students' self-control is a major determinant of successful e-learning, which requires them to possess self-regulated learning (SRL) skills, such as monitoring, managing, and motivating themselves, to engage in a private learning environment without teachers or peers (Zimmerman, 1990). As learners reach higher levels of knowledge acquisition, they must deeply engage with the learning content (Alexander, 1998), and deep engagement requires their consistent attention to learning. Teachers and peers generally should support long-term, persistent attention. Otherwise, students feel relatively distant from other members of their class, and both learners and teachers can miss direct communication, and they can experience difficulties with collaboration (Ozuorcun & Tabak, 2012). These experiences lead students to feel isolated and to be less engaged in the learning process (CCL, 2009). Therefore, such an environment strongly requires students' self-regulation ability. Evidence from the field suggests the importance of establishing self-regulatory learning

environments to replace teachers' and peers' management roles (Chae & Shin, 2015; Zhang, Zhou, Briggs, & Nunamaker, 2006).

Recently, scholars studying English as a foreign language (EFL) learning have emphasized SRL specifically in relation to online learning environments (Calabrese & Faiella, 2010). For example, students can be assisted to observe, interpret, and solve problems drawn from various on-line problem-based learning scenarios, such as WebQuests, in role-playing activities, with tutors assigned to small groups. In another example, students have used dictation-composition (dicto-comp)¹ with a TED talk to self-develop and correct their own English writing skills (Huh, 2015). Overall, the findings of previous studies on motivating learners have been positive because the learning conditions induce the learners to develop their own learning skills.

Previous studies have suggested that the core behaviors that construct self-regulation in an e-learning environment may mediate students' psychological environment and academic achievement (i.e., Bannert & Mengelkamp, 2013; Wang, Shannon, & Margaret, 2013). However, few studies have examined what kinds and degrees of language development are affected by self-regulation behaviors during the high school period in relation to students' entire lives. The current study aims to investigate the influence of SRL behavior strategies on the English-language development of Korean high school students (years 2 to 3) in an e-learning environment.

Literature Review

The Educational Broadcasting Service (EBS) has long been offered to the public in South Korea free of charge. However, little research has been conducted on the EBS's subject areas, including EFL. The current section provides an overview of the history of the EBS and literature relevant to the use of the EBS in the Korean EFL setting.

A Video-Based e-Learning System for Korean High School Students: EBS

The Korean Educational Development Institute (KEDI) launched EBS in 1978. The EBS e-learning service has been available to Korean students for the Korean Scholastic Ability Test (KSAT) preparation since its launch in 2004 (www.ebsi.co.kr), and most Korean students have begun to use it through a video-on-demand (VOD) service rather than via television broadcasts (Hwang, 2010). The participants in the current study (high school year 2 in 2010) had opportunities to watch EBSi (Educational Broadcasting Service through internet) English programs concerning English structure, comprehension, vocabulary, writing, and speaking to increase their GPA and word-memory skills and to prepare for the KSAT (Hwang, 2010). Most programs are provided to the e-learning VOD service through EBSi. Recently, a mobile application has also been provided. Figure 1 below shows example English class screens from the mobile application.

¹ An activity in which learners hear a text and work collaboratively to reproduce its content in their own words (Huh, 2015).

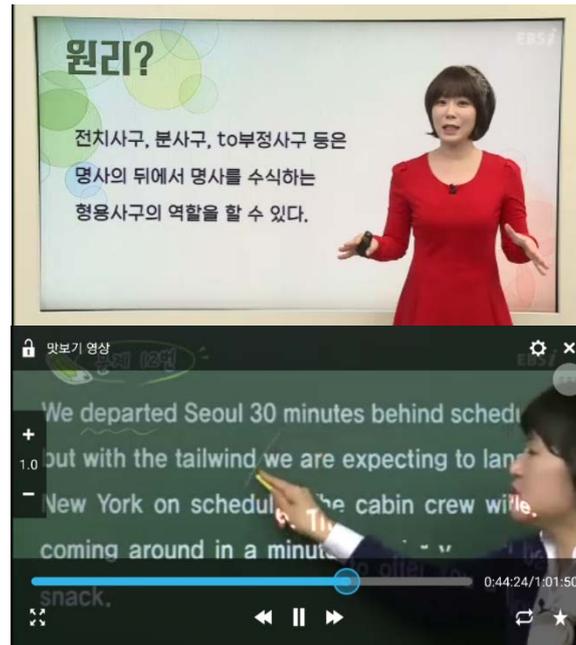


Figure 1. Screenshots of the English classes provided via the EBSi mobile application in 2016.

The EBS VOD programs are provided via a mobile app and the internet using a reference book that supplements the national standardized English textbooks. Students can pause and control the speed of the video. Students and the lecturer can exchange questions on a blackboard, and supplementary files can be downloaded from a space designated for each class. The VOD system traces a student's learning process, and unfinished lectures can automatically restart the next time the student logs in. The videos are mostly formatted as shown in Figure 1, but graphics and animation effects are sometimes used, depending on the learning content and materials. In Figure 1, the first picture is the general viewing screen, whereas the second picture displays the functions that become available when a user taps on the touchscreen.

The EBS was introduced in 1997 by the Ministry of Education and Human Resources Development (Ministry of EHRD) as part of a set of "comprehensive policies for normalization of public education and private education relief" (Baek, Kil, & Yoon, 2010, p. 229) and has been widely used for high school students' KSAT preparation. In so doing, the Korean government aimed to reduce educational gaps that were likely to increase in Korean society and to realize educational welfare (Lim & Jeoung, 2010). The so-called "EBS-linked KSAT in Korea" was launched in 2010, and the use of the EBS has constantly increased among high school students (Im & Kim, 2012). The EBS-linked KSAT in Korea occasioned a memorandum of understanding among the Ministry of EHRD, the EBS, and the Korea Education and Research Information Service (KERIS), which was contracted to introduce 70% of the KSAT content to the EBS program. Such changes in 2010 indeed led to the increased use of the EBSi by a factor of 1.6 times per year, indicating students' high reliance on EBS-based KSAT preparation (Jung, 2010).

The EBS has been widely used for a considerable time, but little relevant research has been conducted on the benefits of the use of EBS in an educational field. High school year 2 through year 3 is a period of particular concern, as those years occur in the transitional period of the EBS-linked KSAT. Therefore, studies conducted after 2010 warrant particular attention, although studies regarding the effects of the EBS-KSAT connection policy do not seem to converge (Choi & Kim, 2016). For instance, Yang, Lee, and Han (2006) and Chae, Lim, and Woo (2009) reported no statistically significant relation between the EBS and academic achievement. In contrast, Chae (2007) found that students who viewed the EBS-KSAT lectures achieved 3% to 4% higher scores than their counterparts. The data collected in Choi, Lim, and Lee's (2007) study from students in Daegu City showed higher achievement scores on math tests when the students consistently received EBS lectures than when they did not. The differences in the study results seem due in

part to methodological issues, such as whether a study analyzed simple correlations between the EBS and KSAT with a fixed data collection time (e.g., Yang, Lee, & Han, 2006), whether a study used a developmental approach to investigate changes over the high school period (Choi, Lim, & Lee, 2007), and what subjects were involved in the research. Thus, further studies seem necessary to supplement the existing research.

The developmental aspects of English academic achievement are known to differ from those of other subjects, such as mathematics and science. KEDI conducted a hierarchical linear modeling analysis of mathematics achievement among students from middle school year 1 through high school year 1 using the Korea Education Longitudinal Study (KELS) 2005 V, which showed that the entire variance is explained by both between-subject effects (the initial variance occupies 50% of the entire variance) and within-subject effects (the variance of change occupies 2.4% of the entire variance). In contrast, English lecture comprehension seemed to be due more to between-subject effects (the initial variance occupies 57% of the entire variance) than to within-subject effects (the variance of change occupies 2% of the entire variance). Further, the correlation between the initial score and the change rate was not significant in mathematical comprehension scores, while the initial comprehension score in English was negatively related to the changes in English scores. That is, changes in English comprehension were likely to decrease when the initial English comprehension score was high. English academic achievement shows large individual differences, but an initially high achievement score does not necessarily mean a higher growth rate over the course.

Appropriate scaffolding has been known to be required in English learning, as it is particularly influenced by frequent exposure to a language-use environment (Gass, 2013). Therefore, technology-based learning methods have long been attempted in the field of language education. Such technology-based learning environments have been available to the public since the 1940s, when television appeared as a mass medium. Recently, the World Wide Web (Wang & Vasquez, 2012) and mobile technology (Godwin-Jones, 2011) have been widely used in education. Most research has suggested the effectiveness of language learning through video, and some studies have emphasized the short-term effects of learning based on video technology. The effectiveness of language learning using new media has attracted public attention, as English is a mandatory subject for many high-stakes assessments, such as college entrance examinations in various Asian countries, including Korea, Japan, and China. In sum, many researchers and educators perceive English education using video e-learning as a critical issue in achieving higher English scores in a short period with little expenditure.

Behavior Control Strategies and Academic Achievement in EFL

Behavior control strategies have been examined as a construct of SRL (Zimmerman, 1990). Such strategies seem to be more directly related to learning achievement than other components relevant to SRL (i.e., metacognition and motivation). Behavioral control strategies imply a tendency to make learning behaviors occur and to maintain them during a certain period (Credé & Phillips, 2011). The importance of using authentic behavioral tendencies to achieve success in work has been demonstrated in various studies (Duckworth & Kern, 2011; Kurzban, Duckworth, Kable, & Myers, 2013). However, successful cases of the use of behavior control strategies in video-centered e-learning and EFL learning environments are difficult to find.

Behavior control strategies seem to mediate relations between technology-embedded environments and academic achievement (i.e., Bannert & Mengelkamp, 2013; Wang, Shannon, & Margaret, 2013). For instance, Wang, Shannon, and Margaret (2013) documented previous studies that showed a positive relation between self-regulatory learning strategies and academic performance (Artino, 2009; Artino & McCoach, 2008; Paechter, Maier, & Macher, 2010; Puzziferro, 2008; Yukselturk & Bulut, 2007), and Yukselturk and Bulut (2009) confirmed that behavior control strategies are influenced by learners' personal characteristics and that these connections subsequently promote changes in the level of academic performance. Previous studies verified that prior online learning experience influences change over a period of years by mediating

behavior control strategies. The number of online courses previously taken directly influenced the effectiveness of learning strategies and affected the levels of motivation. However, these studies used primarily undergraduate and graduate students as participants. Other developmental periods critical to the development of behavior control strategies, such as the high school years, received little consideration in studies on the mediating effects of behavior control strategies on e-learning.

The mediating effect generally appears as students selectively absorb learning experiences (William & Burden, 2009, p. 40). Vygotsky and colleagues' concept of a mediating effect is related mainly to social interaction (Haas, 1996). However, the current study viewed behavior control strategies as a mediating variable through which selection and shaping occur as the EBS affects students' academic achievement. Self-control, a psychological construct similar to behavior control strategies, stands out in the second developmental stage after the student has passed through the first stage, according to Tharp and Gallimore's (1998) four-stage theory of transition from other to self-regulation (Stance & Kao, 2010). In the first stage, learners have little understanding of purposes or situations, but gradually become accustomed to understanding arrangements and relationships. In the second stage, learners begin to self-direct their own activities (Stance & Kao, 2010, p. 125). For instance, English learners tend to focus on acquiring simple conversational skills, questioning, feedback, and describing tasks in the initial stage, but they start to talk and direct themselves in the second stage. The current study highlighted the second stage, when behavior control strategies emerge in mediating roles during the course of EFL development.

In summary, the literature provides us with a considerable amount of information concerning the relation between EBS use and high school students' EFL achievement, but further investigation on the relation over *time* is needed. In addition, psychological agency in enhancing academic improvement should be further investigated. The current study aimed to explore the possible mediating effect of SRL for enhancing a positive relationship between EBS use and English achievement with Korean high school students.

Method

Research Questions

The current study investigated whether behavior control strategies influenced or changed Korean students' EFL performance scores between high school years 2 and 3 as the students took EBS e-learning programs. The research questions are as follows:

Does high school students' video-based e-learning use (EBS) predict an increase or a decrease in EFL achievement with the mediation of behavior control strategies? If so, what behavior control strategies increase high school students' EFL achievement and to what degree?

Research Design and Participants

This study used part of the Korean Educational Longitudinal Study KELS V (high school year 2, measured in 2010) and phase 6 (high school year 3, measured in 2011) to investigate how behavior control strategies mediate EBS use and academic achievement changes. KEDI (a national educational research institute in South Korea) conducts the KELS to monitor changes in Korean students' education and learning and levels of cognitive and noncognitive achievement. The KELS was the first nationally representative instrument to track data for Korean students' academic changes from middle school year 1 until they reach thirty years old. At the beginning of the data collection (middle school year 1), 6,908 students from 150 middle schools in South Korea responded to the survey regarding changes and growth in their educational, learning, and cognitive-noncognitive achievements in their family, school, and society. The current paper used data for the students' lives in high school years 2 (measured in 2010) and 3 (measured in 2011). All participants signed written consent forms prior to the study.

The KELS data originally included responses from students, teachers, and school administrators. Of these, only the student data were used in this study. The data collection method used stratified cluster random sampling, which divides the country into several strata based on regional sizes, selects cluster schools from each stratum, and lastly extracts sample students from the sampled schools. The sample included 150 of 29,259 schools nationwide, and 6,999 students enrolled in the 150 schools were selected from the entire population of 703,914 middle school students at that time in South Korea. The 6,908 students who agreed to have us use their data constituted the final sample group.

The KELS data were collected at multiple levels, including the student and school levels. The behavior control strategies used in this study represent a student-level process variable, and academic achievement is a student-level variable. To answer the research questions, behavior control strategies were viewed as determining academic achievement through the mediation of EBS use. The procedure with the variables on a time line is shown in Figure 2.

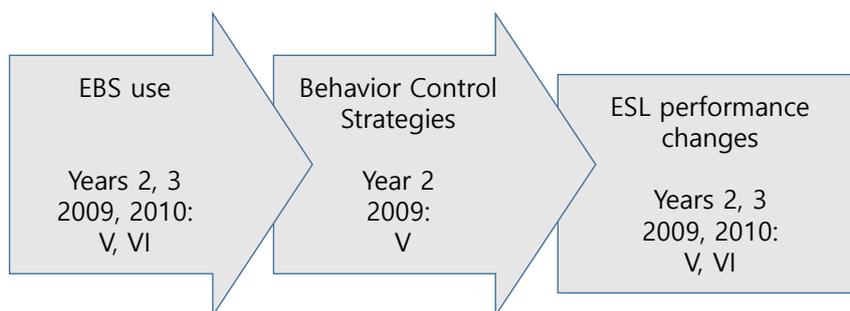


Figure 2. The variable selection on a time line using the Korea Education Longitudinal Study (KELS).

This study sample consisted of those who agreed to the use of the data without omission of the data on EBS use, behavior control strategies, and academic achievement in high school years 2 and 3 ($N = 2,309$).

Instruments

An EBS e-learning use survey was employed. Items about the helpfulness of the EBS e-learning English program were utilized to categorize the sample students as EBS users at a certain point during high school years 2 or 3, consistent users, and nonusers. The students were asked to respond to “Have you taken EBS internet/broadcasting this year (2009)?” on a six-item scale: “never helpful (1),” “not helpful (2),” “so-so (3),” “likely to help (4),” “very helpful (5),” and “do not use (6).” The current study examined whether the use of the EBS influenced a significant increase or decrease in EFL achievement. The responses indicating that use of EBS was drawn from the original data. Thus, those who answered “do not use” in both years 2 (2009) and 3 (2010) were categorized in the “EBS e-learning nonuser” group and served as the reference group. The remaining responses fell into “EBS e-learning user only in year 2,” “EBS e-learning user only in year 3,” and “EBS e-learning user in both years 2 and 3.” The three categories were formed as dummy variables for analysis and comparison with the reference group.

EFL academic achievement

The KELS includes several standardized test scores to track changes in Korean students’ academic achievement in the Korean language, English, mathematics, and social studies. Those tests include the mock KSAT, the Korean Assessment of National Academic Achievement (KANAA), and the National Coalition Assessment (NCA). The KELS used the mock KSAT for high school year 3 and the KANAA for high school year 2. The KANAA for year 3 was measured on a four-point Likert-type scale (1 = good, 4 = underachieving), and the KANAA for year 2 was measured on a continuous scale in which the

minimum score was 53 and the maximum score was 142. According to z-score analysis, the distribution of the score at year 2 was skewed considerably toward the positive side (0.444), and the kurtosis was negative (-0.178), indicating a fairly deviated distribution. In contrast, the skewness of the score at year 3 was close to zero (-0.071), and the kurtosis was -0.912, indicating a deviated but less skewed distribution. The current study aimed to explore variables that might influence the students' achievement changes between the two different time points. Due to the research goal and the deviated distribution, the students' percentile ranks for both years were computed to make the scores comparable between the years. The score for the 25th percentile was 3 points (basic) in high school year 2 and 76 points in year 3. The 75th percentile score in year 2 was 2 points (normal) and in year 3 was 115 points. Students who showed an increment from the 25th to the 75th percentile were categorized as "excessive increase," and those who showed a decrement from the 75th to the 25th percentile were categorized as "excessive decrease." For example, the increase model used students who scored below the 25th percentile (3 or 4, meaning basic or underachieving, respectively) in year 2 and scored higher than the 75th percentile (115 points) in year 3 as an increment indicator. Conversely, the decrease model used students who scored above the 75th percentile (1 or 2, meaning excellent or normal, respectively) in year 2 and below the 25th percentile (76 points) in year 3 as a decrement indicator.

Behavior control strategies

To investigate the mediating effect of behavior control strategies in video-based e-learning users' EFL development, a modified version of the Motivated Strategies for Learning Questionnaire (MSQL) from the KELS was used. The behavior control strategies items were among those devised by Paul Pintrich and his colleagues to measure cognition, motivation, and learning strategies related to task performances (Pintrich, Smith, Garcia, & McKeachie, 1991). This scale, named "behavior control strategies measurement," was reconstructed from the MSQL to be applicable to Korean students, and the validity of the instrument was reviewed by the experts who participated in the KELS. It consists of 15 items and six underlying constructs. The six constructs are effort regulation (three items), time management (three items), space management (two items), teacher support (two items), peer support (three items), and resource use (two items). The participants were asked to mark their agreement with each of the 15 items on a four-point scale (1 = "disagree completely," 4 = "agree strongly"). An item related to effort regulation is "I do my best to learn what teachers teach." The participants selected one of four responses: "disagree (1)," "disagree somewhat (2)," "agree (3)," and "agree strongly (4)," with a higher score implying more frequent and greater use of the behavior control strategies. The omission of the midpoint of the scale was expected to increase the neighboring scale responses so that the participants' overall tendency could be more easily identified (Spagna, 1984). The behavior control strategy measure items are presented in the Appendix. The internal consistency of the 15-item scale was 0.83, indicating good reliability of the measurement.

Data Analysis

The structural equation modeling (SEM) technique was used to analyze the mediating effect and the relation among the variables, with students' EFL academic achievement in high school years 2 and 3 as the dependent variable and their EBS use as the independent variable. The behavior control strategies were included as a mediating factor between the dependent and independent variable. Basic information for the variables, such as the mean, standard deviation, and correlation, was computed using SPSS v.22 (IBM Corp., 2013). The SEM technique in AMOS 21.0 (Arbuckle, 2012) was also used to verify the "EBS-ESL increase model with behavior control strategies" (increase model) and the "EBS-ESL decrease model with behavior control strategies" (decrease model). The increase model assumed that EBS e-learning use would determine the likelihood of moving from the underachiever group (< 25th percentile) to the overachiever group (> 75th percentile) with the mediation of the behavior control strategies; in contrast, the decrease model assumed

that EBS e-learning use would predict a change from the overachiever group (> 75th percentile) to the underachiever group (< 25th percentile) with the mediation of the behavior control strategies. The models are shown in Figure 3.

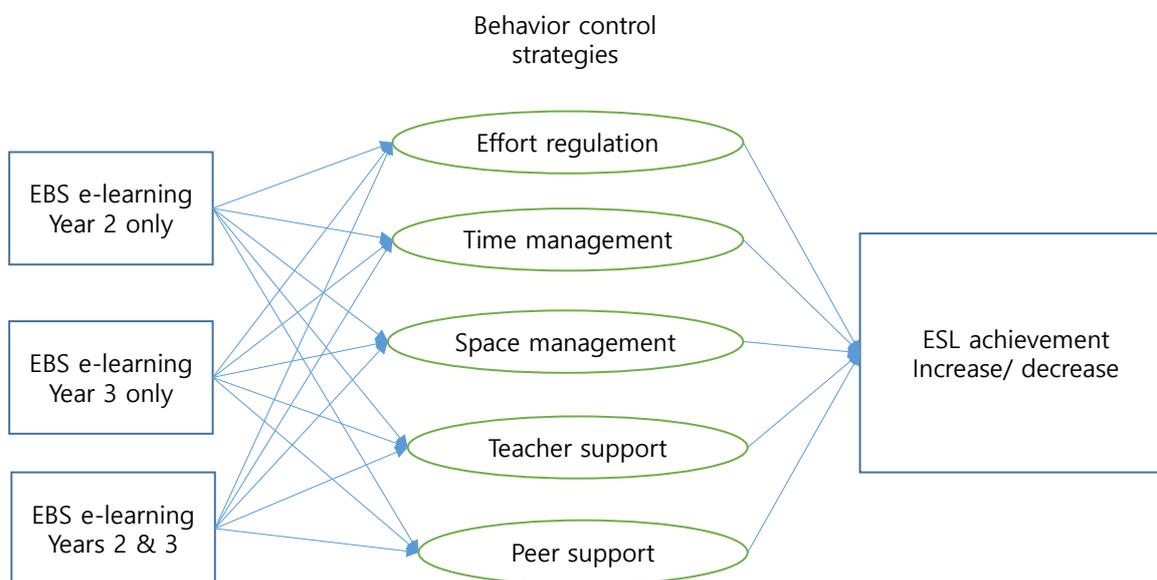


Figure 3. The mediating models of behavior control strategies for EFL achievement using EBS e-learning.

Various model-data fit indices were considered to judge how appropriate the model is for explaining the data. The RMR, RMSEA, and GFI were used to evaluate the overall data-model fit where the acceptance levels of RMR and RMSEA were known to be lower than 0.05 (Browne & Cudeck, 1993) and that of GFI was known to be greater than 0.90 (Tanaka & Huba, 1985). Similarly, the models seemed to fit the data in reference to the rule based on TLI and CFI ≥ 0.90 (Bentler & Bonett, 1980; Bentler, 1990). The data were also evaluated in terms of Hu and Bentler's (1999) rule, CFI > 0.95 and RMSEA < 0.06. Once the models agreed with the rules, they were compared using the Akaike information criterion (AIC) and the Bayesian information criterion (BIC). According to Merkle, You, and Preacher (2016), the AIC and BIC are the proper indices to judge the comparative priorities of the competing models (increase model vs. decrease model) regardless of the nestedness of the models, although the model with the smaller AIC or BIC may be preferred to the other.

Results and Discussion

Descriptive Statistics

"EBS e-learning users only in year 2" numbered 396 (9.14%), "EBS e-learning users only in year 3" numbered 1074 (24.80%), and "EBS e-learning users in both years 2 and 3" numbered 532 (12.28%). The remaining 2,329 (53.78%) participants never used EBS e-learning in either year 2 or year 3. Overall, more students were served only in year 3 or in both years than only in year 2 (the year the EBS-linked KSAT was launched).

Of the six underlying constructs of behavior control strategies, peer support was most frequently used ($M = 3.06$; $SD = 0.51$), followed by space management ($M = 2.86$; $SD = 0.56$) and effort regulation ($M = 2.80$; $SD = 0.53$). Students used the time management strategy the least ($M = 2.32$; $SD = 0.57$).

TABLE 1.
Descriptive Statistics of the Variables

<i>Variable</i>	<i>Mean / N</i>	<i>SD / %</i>
EBS e-learning use		
Year 2 only	396	9.14%
Year 3 only	1074	24.80%
Years 2 & 3	532	12.28%
No use in either year 2 or 3	2329	53.78%
Behavior control strategies		
Effort regulation	2.80	0.53
Time management	2.32	0.57
Space management	2.86	0.56
Teacher support	2.44	0.63
Peer support	3.06	0.51
Resource use	2.50	.58
EFL achievement		
Increase (25 th p → 75 th p)	653	26.3%
Decrease (75 th p → 25 th p)	365	15.0%
Raw score (year 3)	2.08	0.80
Raw score (year 2)	98.92	19.28

Note: *p* means percentile.

The number of excessively increasing students who fell into the 25th percentile in year 2 and the 75th percentile in year 3 was 653 (26.3%), which was greater than the number of excessively decreasing students who moved from the 75th percentile in year 2 to the 25th percentile in year 3 (365, 12%).

Model Selection

Various model-data fit indices suggested that the decrease model fits the KELS data better than the increase model. Table 2 displays the absolute fit indices of RMR, RMSEA, and GFI, and the increment fit indices of TLI and CFI. All the indices satisfied the rules suggested by the SEM researchers, as discussed in the method section. Selection preferences between the two competing models were further examined using the AIC and BIC, and the decrease model seemed to fit the given data better than the increase model. The AIC for the decrease model (M2) was 733.498, which was smaller than that for the increase model (739.131). Likewise, the BIC for the decrease model (734.826) was smaller, indicating a closer fit, than that for the increase model (740.459), as shown in Table 2.

TABLE 2.
Model-data Fit Indices for the “EBS-EFL Increase Model with Behavior Control Strategies” and the “EBS-EFL Decrease Model with Behavior Control Strategies”

	AIC	BIC	RMR	RMSEA	GFI	TLI	CFI
Increase model	739.131	740.459	.014	.042	.974	.938	.959
Decrease model (selected)	733.498	734.826	.014	.042	.974	.939	.959

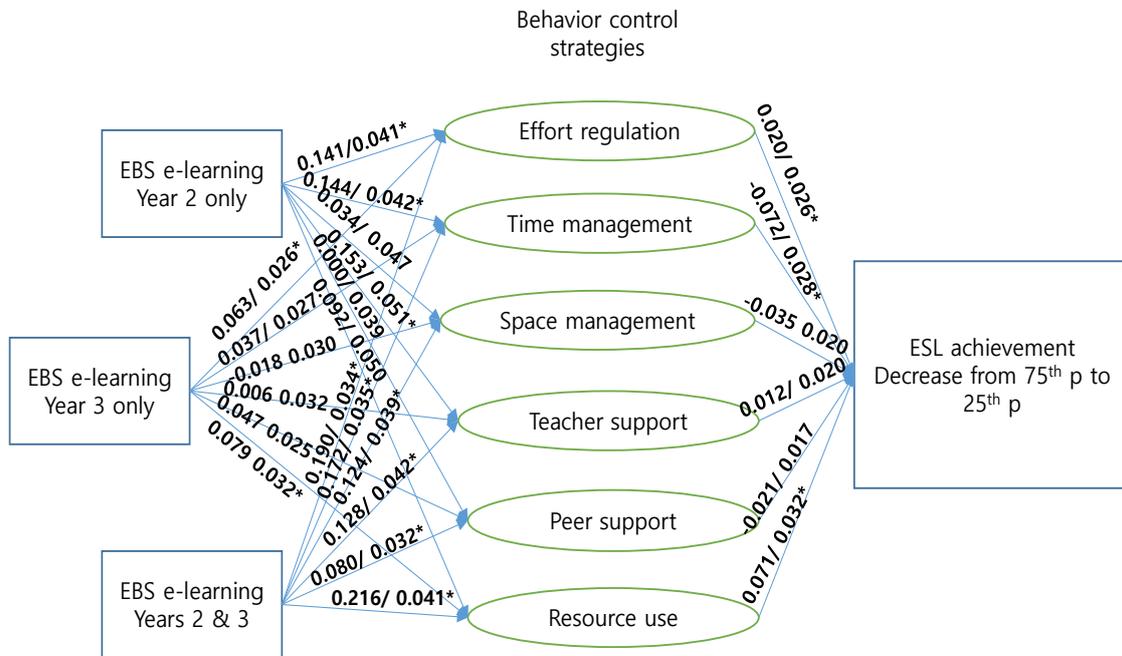
Note: Increase model means “EBS-EFL increase model with behavior control strategies” and Decrease model means “EBS-EFL decrease model with behavior control strategies”

The interpretations for each path in the model were based on the decrease model, as it provided better model-data fit (smaller AIC and BIC values).

Path Analysis of the Decrease Model

As seen in the competing model selection procedure, the students' use of EBS e-learning seemed to determine the likelihood of high achievers becoming underachieving students with the mediation of behavior control strategies (Figure 4).

In general, EBS e-learning in both years 2 and 3 seemed to affect each of the behavior control strategies, whereas EBS e-learning in only year 2 or 3 was likely to influence some of the behavior control strategies in comparison to the reference group (EBS e-learning in neither year 2 nor 3). Notably, EBS e-learning was highly and significantly related to effort regulation in either year 2 or year 3 or in both years in reference to the reference group. This finding indicates that EBS e-learners in any year are likely to show behaviors of making their best efforts and being eager to study. The consistent EBS e-learners (in both years 2 and 3) were likely to report that they tended to use resources such as books and the internet, whereas such resource-use behaviors were not as strongly related to EBS e-learning in either year 2 or year 3 alone. Interestingly, those who used EBS e-learning only in year 2 were frequent users of teacher support ($b = 0.153$; S.E. = 0.051, $p < 0.05$), which was not apparent in those who used EBS e-learning only in year 3 ($b = 0.006$; S.E. = 0.032; $p = 0.863$). This finding seems understandable because EBS e-learning in younger students might be motivated by teachers, which might be related to their tendency to require teacher support.



Note: p means percentile

Figure 4. Unstandardized and standardized regression weights for the decrease model.

Regarding the relation between the use of behavior control strategies and EFL achievement, effort regulation, time management, and resource use were significantly related to a dramatic decrease in EFL achievement. However, it should be noted that the directions of the relations vary. For instance, students who frequently used effort regulation and various resources were, unexpectedly, more likely to move from the 75th to the 25th percentile than other groups (effort regulation $b = 0.020$; S.E. = 0.026; $p < 0.05$; resource use $b = 0.071$; S.E. = 0.032; $p < 0.05$), indicating a decrement of their achievement rankings. However, good time managers tended not to move from the high-achiever group to the low-achiever group ($b = -0.072$; S.E. = 0.028; $p < 0.05$). In other words, only the time management strategies resulted in significant positive outcomes in the EFL students' achievement over the period of one year. The time management strategy appeared most considerable in consistent e-learning users. Thus, it might be expected that students with

better time management skills are more likely to use e-learning, which subsequently decreases their likelihood of moving from the high-achiever to the low-achiever group (see Figure 4).

Discussion and Conclusion

The current study highlighted in what way and to what extent behavior control strategies stand out as a mediator of EBS learning and EFL achievement in high school students. This investigation was based on general SRL literature, such as Yukselturk and Bulut (2007) and Paechter, Maier, and Macher (2010). The behavior control strategies seemed particularly noticeable in this developmental stage (late high school years), which Tharp and Gallimore (1998) argue is a period of transition from other to self-regulation. The major findings of the current study supported the existing research that suggests a mediation effect of behavior control strategies and was consistent with Tharp and Gallimore's (1998) four-stage theory.

Regarding our research questions, the mediating effect of the behavior control strategies can be assumed to fall between the technology-embedded environment (represented by EBS use) and EFL achievement. The results showed the appropriateness of both the increase model, represented by the group with a change from the 25th to the 75th percentile, and the decrease model, represented by the group with a change from the 75th to the 25th percentile. However, the greater model-data fit was found in the decrease model, where the change from overachiever (25th percentile) to underachiever (75th percentile) was included as an outcome. Both the models included behavior control strategies as mediators.

The major conclusion of the current study is an important addition to the previous SRL literature (e.g., Artino, 2009; Artino & McCoach, 2008). We specified two behavior control strategies, the effort regulation strategy and the time management strategy, that stand out in high school students' EFL achievement. In particular, the effort regulation strategy was found to have a close relationship with the use of e-learning in both years 2 and 3. This finding is to be expected, as consistent e-learners should readily show a greater tendency to overcome their difficulties and make better efforts than their counterparts. However, effort regulation did not seem to lead to significant EFL improvement, but the time management strategy proved to positively influence EFL academic achievement in Korean high school students. More effective academic achievement within this short period during students' high school years seemed to be achieved through time management, for example, by following plans and paying attention to the use of time. Such a time management strategy eventually contributed to preventing a decrement in the EFL academic ranks over the course of the EBS e-learning program. Time management skills might function positively, particularly among Korean students preparing for high-stakes exams who are often stressed by managing many subjects at the same time.

The current study has implications both for educational policy in South Korea and for more general educational situations. The nationwide encouragement of the use of the video-based EBS in South Korea has contributed to increasing the number of EBS users. Our data indicated that more students used the EBS in year 3, when the "EBS-linked KSAT in Korea" policy began, than in year 2. However, the sudden policy change did not appear to produce significant changes in student EFL achievement: the students who used the EBS only in year 3 had no significant strong relation with behavior control strategies; therefore, we thought it best to include EFL achievement in the models. However, students who used the EBS in both years 2 and 3 were likely to show a greater use of behavior control strategies, which ultimately seemed to lead to a lower likelihood of dropping from the high EFL achievement group to the low achievement group. In other words, students' consistent involvement with EBS learning seemed to result in preventing their underachievement in EFL. It is not clear whether the positive relation between consistent e-learning engagement and the low levels of underachievement are due to the policy change between year 2 (2010) and year 3 (2011).

In conclusion, we found that the consistency of e-learning use in EFL learning may be related to greater use of behavior control strategies and subsequently to the prevention of underachievement regardless of the policy change. The data collection occurred only in the South Korean educational system. However, the core message of the current study is deemed to have implications for other nations. The use of technology,

especially internet video broadcasting for education, is a worldwide phenomenon. For example, there were more than 58 million users of massive open online courses (MOOCs) in 2016 (Marsh, 2017). Policy makers and education providers seek approaches that are particularly influential in improving educational outcomes. We found that consistently encouraging the use of e-learning was likely to improve EFL achievement. Greater inclusion of and links to EBS programs in high-stakes tests seems to function positively, at least in the current research situation.

Several limitations remain. First, the study sample was limited to South Korea. Thus, samples from more general and international situations would be desirable to confirm our conclusions. Second, the study used percentile scores, a modified version of the EFL raw scores used to compare changes between years due to a change in the test forms between the two end points, which might have resulted in an unintended distortion of the data due to simple rank ordering. For instance, 75th percentile in a 4-point scale does not necessarily mean 75th percentile in a continuous scale. In this study, the 25th and 75th percentiles would not be as clear-cut as those for year 3. A future study is required that uses identical test forms to capture changes from one year to the next and to ensure more valid and reliable comparisons across years. Third, the data collection may be somewhat old to apply to the current educational situation. Consideration of the data from 2010 and 2011 was still important because of the launch of the “EBS-linked KSAT in Korea” policy in 2010. Nationally representative data targeted to a specific research purpose is not an easy task. Thus, we decided to use the ready-to-use data for the current study. In addition, different domains within the EFL subject area must be further specified. The current study attempted to identify the mediating effects of SRL in general EFL achievement. It was not possible in this study to indicate what specific aspects of EFL were improved using the ready-made data of external researchers. For instance, did listening skills, reading skills, or both improve throughout the e-learning courses with the mediation of SRL? Is writing skill improvement influenced more by SRL than by other skills? What particular SRL strategies were more or less related to improvements in EFL speaking skills? These questions should be answered using more elaborate research designs and targeted data collection.

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Appendix

Behavior Control Strategies Measure Used in the Korean Educational Longitudinal Study (KELS) V (measured in 2010 for high school year 2)

Direction: The following questions regard students' attitudes in general learning situations. Please mark \surd in the blank as you agree.

	Disagree completely	Disagree	Agree	Agree strongly
1) I work hard to do well in learning.	1	2	3	4
2) I keep studying contents while they are too difficult to learn.	1	2	3	4
3) I do my best to learn what teachers teach.	1	2	3	4
4) I make good use of my study time (except schooling times) for school curriculum.	1	2	3	4
5) I find it hard to stick to a study schedule.	1	2	3	4
6) I fully use my time for studying.	1	2	3	4
7) I usually study in a place where I can concentrate on my coursework.	1	2	3	4
8) I have a regular place set aside for studying.	1	2	3	4
9) I ask teachers to clarify concepts I don't understand well.	1	2	3	4
10) If I have trouble learning material in a class, I try to obtain help from teachers.	1	2	3	4
11) If I have trouble learning material in a class, I try to obtain help from friends.	1	2	3	4
12) I try to identify students in this class whom I can ask for help if necessary.	1	2	3	4
13) If I have trouble learning material in a class, I ask someone who may know it.	1	2	3	4
14) If I have trouble learning material in a class, I try to find references from books in the library.	1	2	3	4
15) If I have trouble finding answers in learning or doing homework, I use the internet or SNS.	1	2	3	4