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플립드 러닝에서 학습몰입과 학습지속의향에 영향을 미치는 온라인 사전학습 요인 연구: 기대일치모형을 기반으로*

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《 요 약 》

이 연구의 목적은 플립드 러닝 수업에 참여한 대학생을 대상으로 온라인 사전학습이 오프라인 교실학습에 미치는 영향에 대해 체계적으로 분석하는 것이다. 이를 위해 본 연구에서는 기대일치모형(Expectation Confirmation Model)을 적용하여 독립변수로 기대일치와 유용성, 매개변수로 학습몰입, 종속변수로 학습지속의향을 설정하여 기대일치, 유용성, 몰입 및 학습지속의향 간의 구조적 관계를 학습자 관점에서 탐색하였다. 연구대상은 서울시 소재 4년제 C 대학에서 개설한 플립드 러닝 수업 수강자를 대상으로 하였다. 온라인과 오프라인 방식을 활용하여 설문조사를 실시하였으며, 최종 292명의 수집된 데이터를 구조방정식 모델링 분석을 통해 검증한 결과는 다음과 같다. 첫째, 플립드 러닝에서 학습자의 사전학습에 대한 기대일치 정도는 각각 유용성과 학습몰입을 매개로 플립드 러닝의 학습지속의향에 유의미한 영향을 주었다. 둘째, 학습자가 인식한 유용성이 학습지속의향에 정적으로 영향을 미쳤다. 셋째, 학습몰입이 기대일치, 유용성과 학습지속의향 사이에서 간접매개하는 것으로 나타났다. 마지막으로 대학교육에서 플립드 러닝 수업의 교수설계와 실행 관련 시사점을 제시하였다.

주요어: 플립드 러닝, 기대일치모형, 기대일치, 유용성, 학습몰입, 학습지속의향

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Exploring Online Pre-class Learning Factors Influencing Learning the Engagement and Learning Persistence in Flipped Learning Through an Expectation-Confirmation Model*

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《 Abstract 》

The purpose of this study is to systematically analyze the effect of online pre-class learning on offline classroom learning in the context of university students who take flipped learning classes. To this purpose, the Expectation Confirmation Model was applied to explore the structural relationship between expectation confirmation, usefulness, engagement, and learning persistence from the learner's perspective. This was done by applying expectation confirmation and usefulness as independent variables, learning engagement as a mediating variable, and learning persistence as a dependent variable. The participants of this study were college students who took the flipped learning class offered at a large university located in Seoul. A survey was conducted using both online and offline methods. The data collected from the final 292 students was verified through structural equation modeling analysis, and the results are as follows: First, the degree of expectation confirmation for learners' pre-class learning in flipped learning had a significant effect on the learning persistence of flipped learning through usefulness and learning engagement. Second, the usefulness perceived by the learners had a positive effect on learning persistence. Third, learning engagement was found to indirectly mediate the relationship between expectation confirmation, usefulness, and learning persistence. Suggestions have been provided regarding instructional design and implementation for flipped learning in higher education.

Key words: flipped learning, expectation-confirmation model, confirmation of expectation, usefulness, learning engagement, learning persistence

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Ⅰ. Introduction

The development of various education technologies has promoted the use of media in the field of education and facilitated active discussions and studies regarding new learning methods and environments combined with such technologies (Chang & Tung, 2008; Lim et al., 2019). Emerging with the development of technology, flipped learning is known as an instructional strategy that uses a type of blended learning (Bergmann & Sams, 2012). It has been widely applied in higher education settings while also attracting attention as a new method of education for enhancing higher-order thinking skills in terms of combining technology and learner-centered methods (Aronson & Arfstrom, 2013). Studies on flipped learning reported that the instructional method has a positive effect on a learner's problem-solving ability, self-directed learning ability, learning motivation, and self-efficacy (Bishop & Verleger, 2013; Kim, Chun, & Choi, 2014; Kim, Kang, & Kang, 2017).

Flipped learning shifts the students' roles in the classroom learning from passive to active. Learners study online video lectures and reading materials provided by the instructors before class, and then interact with their peers more effectively by conducting problem solving, case studies, and discussions in classrooms (Bergmann & Sams, 2012; Enfield, 2013; Hong, 2016a). The characteristics of flipped learning have led to studies exploring instructional strategies for deploying such methods successfully (Bhang & Lee, 2014). Related previous studies indicate that the linkage between pre-class and in-class learning is important to enhance learners' engagement and participation in flipped classrooms (Cho & Lee, 2018; Han et al., 2015; Hong, 2016a; Kim & Song, 2017; Leem, 2016).

However, the difficulties learners have encountered with flipped learning have also been reported. It is reported that learners have difficulty of managing the time needed for online pre-class learning and there is a linkage between online pre-class learning and participation in classroom activities due to insufficient levels of learning (Chen et al., 2014; Hao, 2016; Kang, 2018; Kim, 2016). If this learning process is repeated, learners become neglectful of their participation in flipped learning due to the insufficient level of pre-class learning, resulting in a failure to achieve their expected learning outcomes

(Bishop & Verleger, 2013; Enfield, 2013; Hong, 2016a; Murphree, 2014; Oh, 2015).

This suggests that learners' poor participation intention or lack of motivation for online pre-class learning can affect the whole course of flipped learning, leading to an inability to ensure continuous participation in class activities after online classes (Han et al., 2015; Hao, 2016; Kim, 2016). Therefore, it is necessary to identify the factors related to pre-class learning that influence learners' persistence in flipped learning from the learners' perspective (Kang, 2018). Considering that learners' willingness in learning to play important roles in completing learning, the expectation confirmation model (ECM) is expected to provide a useful framework for analyzing learners' activity patterns in flipped learning environments. The ECM proposed by Bhattacherjee (2001) is useful for exploring the relationships among variables that affect users' continuous use intention in a technology environment because it complements the limitations of the Technology Acceptance Model (TAM), which describes the relationship between users' use intention and actual use in a technology-based environment (Hwang, Chung, & Noh, 2016; Jeong, 2017; Lee, 2010). According the ECM, user's intention to continue IT usage is determined by the user' confirmation of expectations and their perceived usefulness of IT (Bhattacherjee, 2001). Therefore, ECM can be applied to examine learners' continued intentions in flipped learning. The level of confirmation and usefulness in online pre-class using technology affect the level of learning persistence in flipped learning.

In other words, the ECM may represent a useful framework for exploring the flipped learning process using online technology, as well as for analyzing related factors from the learner's perspective. However, even if the learner's expectations are satisfied in the online pre-class learning, it is difficult for all learners to experience a positive educational effect (Kim, 2016; Lee & Choi, 2019). Given that flipped learning requires self-directed learning ability, especially over the course of an entire lesson, it is necessary to check how active the learner is in the learning process (Hong, 2016b; Jung, 2017). In this regard, learning engagement has been recently emphasized as a factor that influences learning persistence in both online and o ffline learning (Jung & Lee, 2018; Kuh et al., 2008; Park & Yu, 2014). Learning engagement is defined as the quality of energy and effort, or the intensity of concentration, and interest, that learners put into the learning process to achieve the learning goals (Hu & Kuh, 2002). It has

been consistently reported as an important factor in predicting successful learning (Handelsman et al., 2005; Hu & Kuh, 2002). Learners who experience a high level of learning engagement in the learning process tend to be more engaged in learning and have a high level of motivation for continuous learning (Skinner, Wellborn, & Connell, 1990). In addition, learning engagement was also analyzed as a factor that has a significant impact on learning persistence in the online pre-class stage of flipped learning (Joo, Kim, & Kim, 2010; Jung & Lee, 2018; Kim, 2018; You, 2011).

Therefore, this study seeks to explore the structural relationships among affecting learning persistence in flipped learning by applying the ECM model. It is expected that learners' confirmation of expectations and usefulness in online pre-class learning, and learning engagement at all stages of flipped learning are important factors when predicting an individual's learning persistence. This study analyzes the degree to which learners' confirmation of expectations and usefulness in online pre-class learning predict learning persistence in flipped learning, while also examining learning engagement as a mediating variable. This study is expected to provide implications for designing instructional and learning strategies that can be used to facilitate learning engagement and persistence in flipped learning.

Ⅱ. Theoretical background

1. Pre-class learning in flipped learning

Flipped learning is a form of blended learning. It combines online and offline learning, and has recently attracted attention as an innovative educational method in the field of education. Flipped learning is an approach that flips the teaching and learning environment of traditional classroom instruction. The learner conducts online pre-class learning through videos or reading materials, which are uploaded by the instructor before classroom learning. Following this, group activities or discussions are conducted in the form of face-to-face learning in the classroom. In this process, the learner

absorbs knowledge in a self-directed manner and actively participates in the entire learning process (Bergmann & Sams, 2012; Bishop & Verleger, 2013; Gilboy, Heinerichs, & Pazzaglia, 2015; Hong, 2016a; Leem, 2016).

Flipped learning has been actively applied in higher education settings because it requires learners' self-directed ability (Kim et al., 2014; Leem, 2016; Oh, 2015). The learning structure and process of flipped learning can be divided into pre-class and in-class learning, although there are some differences among researchers. Pre-class learning consists of activities such as watching online video lectures, reading digital materials, homework, and quizzes. In-class learning, meanwhile, includes discussions, projects, problem solving, and exploration activities.

In online pre-class learning, learners receive basic information about the classroom learning contents, while it also acts as a clue for predicting the classroom learning contents. Pre-class learning components that enable learners to predict offline class contents from online pre-class learning include information such as the time and quality of pre-class learning, guidance regarding the next class, summaries of the learning contents, quizzes, and interactive activities. Learners can understand and predict the contents of the offline class through these cues provided in the online pre-class learning process, and can also use this process to form personal expectations for the offline class (Bhang & Lee, 2014; Han et al, 2015; Lee & Youn, 2017; Leem, 2016; Oh, 2015). This suggests that identifying learners' attitudes toward online pre-class learning and participation in the offline class is an important factor in continually encouraging learners to actively participate in the entire flipped learning course.

2. Flipped learning and the expectation confirmation model

The ECM was proposed by Bhattacherjee (2001), based on Oliver's (1977) Expectation-Confirmation Theory. As a model developed to predict the intention of using a new technology based on perceived usefulness, confirmation of expectation, and satisfaction, this model is useful for structurally exploring the relationships among variables that affect continuance intention. The ECM posits that an individual's intention to continue IT usage is dependent on three variables: the extent of the user's

confirmation of expectations, perceived usefulness, and the user's level of satisfaction with the IT (Lee, 2010). The ECM explains the continuance intention of technology, focusing on the relationship between usefulness and satisfaction caused by the degree of agreement between the user's beliefs before using the technology and the subjective judgments made after the actual use (Jeong, 2014). Analyzing users' post-adoption factors seamlessly, especially in an online environment, the ECM analyzes users' intentions in various technology-based environment contexts (Hwang et al., 2016; Jeong, 2017; Min, 2017; Seo, Lee, & Chung, 2013; Suh, 2011).

Considering that flipped learning is a process of online pre-class learning using technology and offline in-class learning, the ECM can explain the factors that influence the learner's continuous participation in flipped learning. By applying the expectation confirmation variables of the ECM to flipped learning, it can be assumed that the learners form personal expectations through the online pre-class learning process and then form the follow-up perception of the flipped class using the online media, based on the application of the knowledge previously learned in the offline in-class learning. This affects learning persistence via the variables mediating them. According to Min's (2017) study, which applied the ECM to learners using digital textbooks, the expectation confirmation variables had a significant effect on both usefulness and satisfaction, while usefulness and satisfaction had a significant influence on learning persistence. As a variable that influences the learning persistence of flipped learning, usefulness can be regarded as the personal perception of whether the use of online media in pre-class learning was effective when learners achieved their learning goals. Therefore, it can be predicted that if learners perceive what they have learned in the online pre-class learning as useful in the later offline class, the sustainability of flipped learning increases (Bhattacherjee, 2001; Cha & Park, 2017; Davis, 1989; Joo, Yu, & Lim, 2016; Min, 2017).

Satisfaction among ECM variables is the learner's subjective response to the learning experience (Joo, Kim, & Park, 2009), and is also defined as an immediate attitude regarding whether learning experiences meet learners' expectations (Elliott & Healy, 2001). In flipped learning classes that require the learner's active attitude, there are personal and environmental characteristics that influence the learners' satisfaction, and the need to identify and analyze these factors was raised (Hong, 2016b; Kim et al., 2014; Kim & Lee, 2015). In the study of modifying and applying the ECM to the MOOC environment, it was mentioned that the satisfaction level had no direct effect on continuous use intention, while also being less influential as a mediating variable than other variables (Jeong, 2017). Continuance use intention, the outcome variable of the ECM, means that the user intends to use the technology continuously, which is known to predict the actual use (Bhattacherjee, 2001). In this study, the terms of the variables into the learning persistence of flipped learning were modified in consideration of the field and the subjects of research.

3. Flipped learning and learning persistence

According to previous studies that have analyzed the learning effects of flipped learning in a university context, learners experience a meaningful learning process, such as improved problem-solving skills, deep learning, immediate feedback, continuous interaction, and positive emotions (Kim, Kang, & Kang, 2017). Flipped learning learners have also shown improved levels of self-regulation, self-directed learning ability, preference for higher task difficulty, learning engagement, learning motivation, satisfaction, and academic achievement (Enfield, 2013; Hong, 2016b; Joo et al., 2010; Jung, 2017; Kim et al., 2014; Kim, Roh, & Yu, 2015; Lee & Jung, 2018). However, these findings have also reported that learners' willingness to practice fell in statistically significant categories (Jung, 2017), or that there was no significant effect on improving motivation to learn (Hong, 2016b).

One reason for this phenomenon is the difficulty of the online pre-class learning that students experience as the first step in the flipped learning process. In flipped learning, online pre-class learning consists of a one-sided transfer of knowledge and information, or requires less attention and poses a lesser challenge for learners, causing them to learn actively (Kerres & Witt, 2003; Leem, 2016). According to a study that presented the experiences of learners who participated in the flipped learning class, the learners were dissatisfied with the video lectures provided for the online pre-class learning, and could not concentrate on the videos while pretending to listen to them, feeling that their self-learning was insufficient. They also mentioned that it was difficult to know what

the key contents or information to be addressed in the offline class were (Kim, 2016; Leem, 2016; Oh, 2015).

As can be seen from previous studies, one of the best features of flipped learning classes, and a key factor in instructional design and implementation, is that online pre-class learning and offline in-class learning do not exist independent of each other (Bhang & Lee, 2014; Kim, 2016). In flipped learning, both the online pre-class learning and offline in-class learning can be more meaningful when the two stages are organically related. This allows us to predict the extent to which learners' online pre-class learning will affect the learning continuity of the entire flipped learning process. In cases where learners do not perform well in the online pre-class learning, the offline in-class learning will be affected, which may in turn affect the learning continuity of the entire flipped learning process. Mentioning the reasons related to online pre-class learning as problems related to learners' continuous participation in flipped learning, Hong (2016a) has pointed out that the link between the learning contents presented in the pre-class learning and the classroom activities should be considered first for successful flipped learning lessons. In this regard, this study aims to examine the link between online pre-class learning and offline in-class learning from the learner's perspective, as well as to analyze the factors that influence learning persistence.

4. Mediating role of learning engagement

Learning engagement, a variable that confirms the degree of active participation of learners in the learning process, has recently attracted attention regarding achievement in higher education. Many scholars have attempted to define engagement. According to Schaufeli and colleagues (2002), engagement is defined as the level of learners' participation in activities in continuing to conduct various activities. Hu and Kuh (2002), meanwhile, have defined it as the quality of mental energy and effort that learners put in achieving their goals. Learning engagement is a psychological process in which learners continuously interact with the learning processes and activities surrounding them to achieve their learning goals beyond simply attending classroom lessons. It also represents a state in which the learner actively participates and pays attention to the

learning activities (Coates, 2005; Handelsman et al., 2005). In other words, learning engagement is a process of interacting with the surrounding environment to achieve the learner's goal. It can be also described as the degree of aggressive and active participation in the learning process.

Learning engagement consists of three sub-factors: cognitive, emotional, and behavioral engagement (Handelsman et al., 2005; Kahn, 1990). Cognitive engagement describes the development of strategies by which learners use cognitive control to achieve their learning goals, meaning an effort is made to plan or control their own learning processes. Emotional engagement refers to the affective state of a learner regarding the contents of the learning, such as their effort or willingness to continue pursuing learning when they lose enthusiasm, interest, or experience boredom. Behavioral engagement describes behavioral efforts that learners show in the learning process to achieve learning, such as school attendance, task performance, raising hands to ask questions in class, or participating in discussions. It is easier to observe than cognitive engagement or emotional engagement (Linnenbrink & Pintrich, 2003). Therefore, in flipped learning environments, which require the learner to actively participate as a subject of learning, the learning engagement variable is suitable as an index for measuring the learner's attitude in various ways.

In previous studies on learning engagement, it has both indirectly explained learners' motivations and is referred to as a variable that represents multidimensional factors combined with learners' motivation, interest, and efforts (Skinner & Belmont, 1993; Yoo & Kang, 2011). In supportive studies, Kim, Jee, and Lee (2011) analyzed university students' satisfaction with their majors, reporting that psychological satisfaction did not directly affect the learner's behavioral intention, engagement had a direct effect on behavioral intention, and psychological satisfaction had a significant effect on behavioral intention. These results support the idea that learning engagement is more significant in explaining learning persistence than satisfaction, which is an affective variable. Furthermore, Oliver (1980), a leading proponent of the underlying theory of the ECM, argued that satisfaction is both an emotional variable and an influence on temporary experiences, while satisfaction can also be included in the emotional category, which is a sub-factor of engagement (Christenson, Reschly, & Wylie, 2012). In a flipped learning

environment, therefore, it can be assumed that learning engagement can both mediate learner factors and directly predict learning persistence.

In the studies conducted by selecting learning engagement as a mediating variable, Kim and colleagues (2015) proved that learning engagement acts as a mediating factor in terms of both learner characteristics and learning persistence in the e-learning environment. Jung and Lee (2018), meanwhile, explored the relationship between learning engagement and learning persistence in the MOOC environment, proving that learning engagement directly affects learning persistence and mediates learner factors. It does this by verifying that learning engagement not only directly influences learning persistence, but also because it mediates between academic self-efficacy, teaching presence, and perceived usefulness.

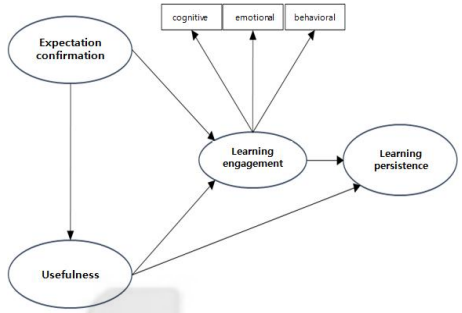
In this study, given that flipped learning has been conducted in a technology-based learning environment as in previous studies, learning engagement was selected as a mediating variable to identify the degree of learner participation in the learning environment, rather than considering the satisfaction variable of the ECM. The expectation confirmation was considered to be the degree of expectation for the offline in-class learning after the learner's technology acceptance (online pre-class learning), while usefulness was defined as the degree of personal perception regarding whether the use of online media has been effective in helping learners achieve their learning goals. It can be assumed that these variables will influence whether the learner will continue to use the technology (learning persistence) through learning engagement experienced in the flipped learning process.

Ⅲ. Methodology

1. Research model and hypotheses

To analyze variables that influence learning persistence in flipped learning, the purpose of this study is to analyze whether prior variables significantly influence

learning persistence through learning engagement based on the ECM. To this aim, a research model was therefore established, as shown in [Figure 1].



[Figure 1] Research model

In this model, no path has been established regarding the effect of the expectation confirmation variable on learning persistence (Bhattacherjee, 2001). Min's (2017) study has also reported that expectation confirmation did not have a significant effect on learning persistence. The model reflects the following three research hypotheses:

H1. Learners' confirmation of expectations of online pre-class learning have effects on learning persistence through each variable of usefulness and learning engagement in flipped learning.

H2. Learners' perceived usefulness of online pre-class learning have effects on learning persistence in flipped learning.

H3. Learning engagement has a mediating effect on the relationships between preceding variables and learning persistence in flipped learning.

2. Participants and procedures

This study was conducted on 4-year college students who participated in flipped learning classes at a large private university in Seoul in the first semester of 2019. A

total of 292 responses were used for the final data analysis from online and offline surveys. Demographically, 132 male students (45.2%) and 160 female students (54.8%) participated in the survey. In the distribution of the years of the respondents, the third-year students (juniors) accounted for the highest proportion, 129 students (44.2%), followed by 86 first-years (freshmen) (29.4%), 49 in their fourth/final year (seniors) (16.8%) and 28 second-years (sophomores) (9.6%). Among the respondents, management and economics constituted most of the students' majors (70 respondents, 24%), followed by nursing (68, 23.3%) and education (67, 22.9%).

3. Instruments

In this study, a questionnaire was used to measure the expectation confirmation and usefulness as antecedent variables, while learning engagement was established as a mediating variable, and learning persistence as a dependent variable. The measurement tool for each variable was used by modifying the items used in the previous studies. The revised questions were reviewed by three experts in educational technology.

The questionnaire for expectation confirmation, usefulness, and learning persistence was reconstructed according to the context of this study, based on the measurement items developed by Bhattacheriee (2001) and the measurement tools adapted by Min (2017). In particular, we defined each of the variables of the ECM and constructed the items of the measurement tools based on previous studies (Bhattacheriee, 2001; Bhattacherjee & Premkumar, 2004; Davis, 1989; Venkatesh & Davis, 1996). We also modified the learning engagement measurement tool adapted and used by Yoo (2011), which was developed by Handelsman and colleagues (2005), according to the flipped learning context. This measurement instrument was verified in a study by He (2009), and was then used by Park and Song (2018) to measure learning engagement for high school students. The examples of survey items are listed in <Table 2>.

<Table 1> Measurement instruments

Variables		No. of items	Sources
expectation confirmation		3	Bhattacheriee (2001) Min (2017)
usefulness		4	
learning persistence		3	
learning engagement	behavioral engagement	6	Handelsman et al. (2005)
	emotional engagement	5	He (2009)
	cognitive engagement	9	Yoo (2011)

<Table 2> Questionnaire items used in this study

Constructs		examples of items
expectation confirmation		My experience with participating in online pre-class of flipped learning was better than I had expected.
usefulness		I find the online pre-class learning stage of flipped learning to be useful to me.
learning persistence		I will continue to participate in flipped learning as regularly as I do now in other classes.
learning engagement	behavioral engagement	I participate actively in questions & answers, and presentation activities during flipped learning classes.
	emotional engagement	I find ways to make flipped learning interesting to me.
	cognitive engagement	I summarize the learning contents well in the flipped learning process.

Flipped learning related variables, such as expectation confirmation, usefulness, learning engagement, and learning persistence, were measured on the Likert 5-point scale, while the Cronbach α was calculated to verify the reliability of the measurement tool. The Cronbach α value of each variable was found to be .931 of expectation confirmation, .888 of usefulness, .933 of learning engagement, and .901 of learning persistence, satisfying the general internal consistency reliability criterion (.7 or higher). The validity of the measurement tool was determined through convergent validity and discriminant validity. First, convergent validity was found to be .963 of expectation confirmation, .884 of usefulness, .892 of learning engagement, and .783 of learning persistence. This was found to be appropriate by showing a value of 0.6 or higher, which is a standard of judgment (Gefen, 2003). Discriminant validity is calculated by comparing the average variance extraction (AVE) of the latent variable with the square of the correlation coefficient. If the AVE value of the latent variable is greater than the

square of the correlation coefficient ($\varnothing^2$) between the latent variables, it is assumed that there is discriminant validity (Yu, 2012). In this study, the correlation coefficient square of the latent variables is .501 - 635 and AVE value is .703 - .896. Thus, the average variance extraction (AVE) value was found to be higher than the value of the discriminant correlation coefficient square, confirming the validity of the measurement tool.

4. Data analysis

First, frequency analysis was performed to classify the demographic characteristics of the survey respondents. Second, descriptive statistical analysis was conducted to identify the response distribution and level of the research variables. Third, confirmatory factor analysis and a reliability analysis of the research variables were carried out to verify the reliability and validity of the measurement tool of expectation confirmation, usefulness, learning engagement, and learning persistence. Fourth, path analysis between the latent variables was conducted to identify the relationship between the research model variables. Fifth, to verify the statistical significance of the research model, the Bootstrapping technique was used to verify the statistical significance on the direct, indirect, and total effects of the research variables of expectation confirmation, usefulness, learning engagement, and learning persistence. Bootstrapping was conducted a total of 5,000 times, and the 95% confidence interval was set to verify the statistical significance of the estimated values.

Ⅳ. Results

1. Descriptive statistics

First, to verify the normal distribution of the collected data, we checked the mean, standard deviation, skewness, and kurtosis of expectation confirmation, as well as usefulness, learning engagement, and learning persistence. As shown in <Table 3>, the

mean of the variables ranges from 3.15 to 3.80, while the standard deviation ranges from .696 to 1.220. The absolute value of the skewness ranges from .118 to .832, while that of the kurtosis ranges from .056 to .671. If the absolute value of the skewness is less than 2, while that of the kurtosis is less than 7, it can be seen that the normal distribution assumptions of the data are met (Curran, West, & Finch, 1996), and all of these data can be said to have secured multivariate normality.

In order to confirm the significance of the influencing relationship between the variables of the research model, the correlation between the measurement variables was examined. The correlations between the variables ranged from .453 to .839, which all of which were found to be statistically significant.

<Table 3> Descriptive statistics and correlations for variables

Measurement Variable		1	2	3	4	5	6	7	8	9	10	11	12	13
1.	EC1	1												
2.	EC2	.839	1											
3.	EC3	.806	.810	1										
4.	US1	.669	.680	.664	1									
5.	US2	.575	.619	.556	.705	1								
6.	US3	.595	.600	.575	.723	.646	1							
7.	US4	.449	.467	.487	.643	.584	.691	1						
8.	LP1	.671	.646	.647	.613	.557	.609	.505	1					
9.	LP2	.572	.546	.529	.575	.484	.607	.568	.806	1				
10.	LP3	.495	.516	.515	.618	.481	.628	.628	.663	.792	1			
11.	LE1	.568	.543	.559	.568	.446	.504	.397	.534	.527	.486	1		
12	LE2	.597	.564	.614	.630	.469	.591	.482	.605	.600	.566	.694	1	
13.	LE3	.459	.453	.494	.579	.468	.495	.513	.419	.428	.459	.667	.569	1
Mean		3.38	3.43	3.37	3.65	3.8	3.72	3.68	3.42	3.29	3.45	3.68	3.15	3.22
S.D		1.05	1.015	1.061	1.059	0.965	1.021	1.044	1.22	1.19	1.122	0.696	0.949	0.820
Skewness		-.361	-.488	-.306	-.638	-.832	-.655	-.572	-.474	-.310	-.460	-.155	-.118	-.202
Kurtosis		-.299	-.214	-.375	-.180	.532	.056	-.25	-.657	-.671	-.392	.229	-.384	-.178

Note. n= 292, All values were significant at $^{**}p$< .01 / EC= Expectation confirmation; US= Usefulness; LP= Learning persistence; LE1= Behavioral learning engagement,; LE2= Emotional learning engagement; LE3= Cognitive learning engagement

2. Measurement model

In order to evaluate the research model using the structural equation, we first reviewed the model fit index of the measurement model. In the criteria for goodness-of-fit evaluation, more than 0.90 of TLI and CFI, and less than 0.05 of SRMR, indicates a good fit, while less than 0.10 of RMSEA is evaluated to represent a moderate level of fit (Browne & Cudeck, 1993; Kline, 2011). The results of the verification showed CFI .949, TLI .933, SRMR .044, and RMSEA .097, and these derived values meet the conditions of the model. Therefore, the measurement model of this study was judged to be suitable.

The path analysis of the latent variables was conducted to identify the influencing relationship between the variables set in this study, and the results are shown in <Table 4>. First, expectation confirmation was found to have a positive effect on usefulness (β= .81, p< .001). When learners who have experienced online pre-class learning have a high level of expectation confirmation, they recognize that pre-learning conducted using online media is useful. Second, usefulness was also found to have a positively significant effect on learning engagement (β= .52, p< .001). This suggests that learners who perceived the use of online media in pre-class learning process as being useful for learning could engage in learning with greater ease. Third, learning engagement had a positive effect on learning persistence (β= .31, p< .001). Fourth, it was found that expectation confirmation had a positive effect on learning engagement (β= .34, p< .001). This shows that learners can be engaged in learning from the point when the expectation is confirmed in the learners' online pre-class learning. Finally, usefulness was a factor that had a significant effect on learning persistence (β= 55, p< .001).

<Table 4> Path coefficients of the measurement model

Path	Estimates (B)	Standardized Estimates (β)	S.E.	C.R.	p-value
expectation confirmation → usefulness	.66	.80	.051	12.877	.000
usefulness → learning engagement	.45	.52	.082	5.49	.000
learning engagement → learning persistence	.48	.31	.133	3.582	.000
expectation confirmation → learning engagement	.24	.34	.063	3.798	.000
usefulness → learning persistence	.73	.55	.120	6.087	.000

3. Structural model

As the goodness-of-fit index of the measurement model meets all the reference values, the model fit index was reviewed, as shown in <Table 5>, to analyze the goodness-of-fit of the structural model (see <Table 5>). The results of goodness-of-fit analysis of the structural model showed that the CFI, TLI, SRMR, and RMSEA were .948, .933, .047, and .096, respectively. These values meet the conditions of the model, meaning that the structural model of this study was judged to be suitable.

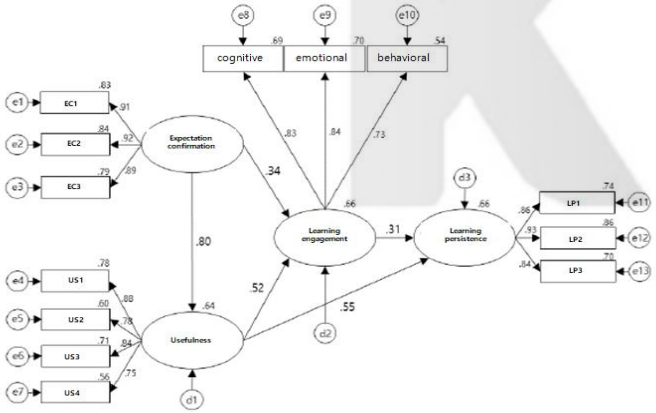
<Table 5> Fit statistics for the structural model

	χ^2	CFI	TLI	SRMR	RMSEA
Structural model	221.827	.948	.933	.046	.096
Criteria	-	> .90	> .90	< .05	< .1

Next, the results of analyzing the factor and path coefficients of the structural model are shown in [Figure 2]. First, expectation confirmation had a significantly direct effect on learning engagement (β= .34, p< .001), while learning engagement also had a statistically significant direct effect on the quantity of learning persistence (β= .31, p< .001). The usefulness also had a statistically significant effect on expectation confirmation (β=.80, p<.001), while there was also a statistically significant direct effect

from usefulness on learning engagement (β= .52, p<.001). Learning persistence also had a significantly direct effect on usefulness (β= .55, p<.001).

<Table 6> shows the results regarding the direct, indirect, and mediating effects on the paths between the variables of the structural model. The indirect effect of expectation confirmation on learning persistence through the mediation of learning engagement was statistically significant (β= .10, p< .001.), proving that learning engagement is partially mediated in the influencing relationship between expectation confirmation and learning persistence. The effect of expectation confirmation on learning persistence through usefulness and learning engagement was also found to have an indirect mediating effect (β= .13, p< .01.). Usefulness also has an indirect effect on learning persistence through the mediation of learning engagement (β= .71, p< .01.), indicating that learning engagement has mediated both usefulness and learning persistence.



[Figure 2] Structural Model with standardized path coefficients

<Table 6> Analysis of the direct, indirect, and total effects among variables

Variables	Direct Effect	Indirect Effect	Total Effect
usefulness → learning engagement → learning persistence	.55***	.16**	.71***
expectation confirmation → usefulness → learning engagement	.34***	.42***	.75**
expectation confirmation → learning engagement → learning persistence	-	.10**	.10**
expectation confirmation → usefulness learning engagement → learning persistence	-	.13**	.13**
expectation confirmation → learning persistence	-	.76**	.76**

**p< .01, ***p< .001

Based on the above results, the verification results for the research hypotheses can be summarized as follows: First, the degree of learners' expectation confirmation for online pre-class learning in flipped learning has a positive effect on learning persistence through both usefulness and the learning engagement variables. Second, the usefulness of learners' online pre-classes learning in flipped learning has a positive effect on learning persistence. Third, learning engagement in flipped learning has a mediating effect on the relationship between preceding variables (expectation confirmation and usefulness) and learning persistence.

V. Discussions

This study attempted to analyze the relationship among such factors as expectations confirmation and usefulness for online pre-class learning, learning engagement, and learning persistence in flipped learning environments, based on surveys conducted on college students in Seoul. The results showed that the degree of learners' expectation confirmation for online pre-class learning in flipped learning classes had a positive effect on learning persistence through the usefulness and learning engagement variables. In addition, the usefulness of learners' online pre-class learning in flipped learning was

found to have a positive effect on the consequent learning persistence. Finally, learning engagement in flipped learning had an indirect effect in the relationship between the degree of expectation confirmation and learning persistence while having an indirect effect in the relationship between the usefulness and learning persistence.

First, in flipped learning, the degree of learners' expectation confirmation for pre-class learning had a significant effect on learning persistence through each path of usefulness and learning engagement. This suggests that expectation confirmation, which occurred at the individual level through the online pre-class learning stage of the flipped learning process, affects the perception of the usefulness of online media use, and a high level of usefulness eventually leads to continuous learning. By applying online learning experiences to offline classroom environments, it is believed that learners' expectations are confirmed and the level of expectation confirmation affects learning engagement, which, in turn, affects learning continuity.

These results suggest that the instructors' preparation for online learning contents should be sufficient to improve the learners' learning persistence in flipped learning. Thus, when designing flipped learning, the instructor should use the learning time, content summary, quiz, and lesson plan, which constitute the learning components of the online pre-class learning, to clarify the parts applied to the contents of the main offline class. In addition, the instructors should also reduce the confusion of the learners by clearly establishing the difficulty level of both online and offline classes as well as by allowing students to apply learning experiences from the online learning into learning activities in the classroom learning sphere (Lee & Choi, 2019; Song et al., 2019). This can promote the learners' intention to persist in learning by helping them to predict the application point of the learning contents.

Learners' expectation confirmation in flipped learning is also a personal motivational factor. Therefore, instructors can reinforce the learners' intrinsic motivation by providing continuous feedback through the offline class in order to continue learners' online learning (Bhang & Lee, 2014; Bishop & Verleger, 2013; Cho & Lee; 2018; Enfield, 2013; Leem, 2016). According to Joo, Ham, and Jung (2014), who studied learners' intentions to continue their mobile learning in an online environment, effort expectancy and performance expectancy affected the continuous intention of mobile learning. It was found that their results are similar to those produced by this study in that the learners' intrinsic motivational variables on the use of technology are factors that influence learning persistence.

Second, the usefulness perceived by the learner was found to have an effect on learning persistence. In flipped learning, usefulness does not just mean that the use of the media has been useful; it also includes whether the online media used was useful as a tool for delivering learning content (Min, 2017). Therefore, the results of this study suggest that if the learner recognizes that the contents of online pre-class learning delivered through technology are useful for application in the offline classes, the willingness to continue learning can be increased even in the offline classes. In addition, according to the degree to which the learner recognizes that the online media may be used as a tool of learning in the online pre-class learning process of flipped learning was a useful delivery media for the learner, they also become positive about the use of media in the next flipped learning classes. This, in turn, may lead to a virtuous cycle that has a positive impact on the learner's participation in the offline classes. According to the ECM, it is important to identify the intention to reuse after using the technology (Bhattacherjee, 2001), which was also found in the results of this study.

Therefore, for successful pre-class learning, instructors should first consider online media that can effectively deliver the contents of learning. According to previous studies (Bhang & Lee, 2014; Lee & Youn, 2017; Oh, 2015; Oh, 2017), learners in flipped learning do not simply expect the use of the latest technology in online pre-class learning, and nor do they require high-quality learning videos or materials. Learners have more positive perceptions of the media used in online pre-class learning when they recognize that the contents of the pre-class learning are related to the activities of the offline classes, as well as that the delivery method is also efficient.

Third, learning engagement in this study has had an indirect effect by acting as a mediating variable in the relationships among variables. Specifically, learning engagement in flipped learning played a mediating role in the relationship between expectation confirmation and usefulness, which are preceding variables, and learning persistence, which is a dependent variable. This is consistent with the results of previous studies suggesting that learning engagement plays an important role in the

process of enhancing learning persistence in the online and offline learning environments, such as flipped learning (Joo et al., 2010; Jung & Lee, 2018; Kim, 2018; Kim et al., 2015; Kim & Park, 2012). Kwon and Chung (2018) found that the level of pre-class learning engagement affected the amount of classroom engagement. In this study, it was reaffirmed that learning engagement plays an important role in the process of enhancing learning persistence in flipped learning, combined with on/offline learning. It suggests that flipped learning can represent continuous learning if learners take ownership in the learning process and focus or immerse themselves in the learning activities offered in both online pre-class learning and offline in-class learning.

Therefore, when learners are engaged in flipped learning, they are actively learning, meaning that the learning outcome is both positive and affects learning persistence. In flipped learning, therefore, learners need to check their own learning contents after the online learning stage (Lee, Kim, & Kim, 2014). As a way of increasing learners' engagement in the offline classes, teachers need to develop instructional strategies for encouraging learners to actively participate in group activities, as well as considering how to provide a space of communication for online learning (Han et al, 2015; Hong, 2016a; Leem, 2016). In addition, this study took a different approach to existing studies that have either analyzed the before-and-after results of flipped learning (Cheong & Kwak, 2017; Hong, 2016b; Kim et al., 2017; Lee & Jung, 2018; Lee et al., 2014) or have analyzed online and offline learning separately (Kim, Yu, & Kim, 2019). It is expected that the findings may be used to design a connection plan between online and offline classes in flipped learning, as learner factors affecting learning engagement and learning persistence were analyzed by linking online pre-class learning and offline pre-class learning in the overall flipped learning process.

Finally, this study attempts to develop a new theory through the ECM model, and then applying it into the context of learners' continuance intention in flipped learning Hence, the proposed model makes an important contribution to the emerging literature on the behaviors of learners, learners' traits, and learners' participation in flipped learning environments using technology.

Despi te the findings, this study also has several limitations. The suggestions for further research, based on the results of this study, are as follows: Flipped learning is a

technology-based education, and previous studies mention that the learning effect was insufficient because learners were not familiar with flipped classes that use media. It can be expected that the level of expectation confirmation and usefulness for the media will differ according to the degree of learners' flipped learning experience. After finding out that the course of flipped learning consisted of online pre-class learning and offline in-class learning via e-mail with the instructors before the survey, the survey was conducted after 10 weeks of semester had been completed. However, the number of flipped learning classes varies from three to nine, depending on the lesson plan and learning progress, which may limit the flipped learning experience of the learners who participated in the survey. Since the number of flipped learning classes may cause a difference in the degree of familiarity with the student's learning, it is necessary to control the number of flipped learning classes or to conduct a study that uses a set number of flipped learning classes.

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