

## Structural Relationships among E-learners' Sense of Presence, Usage, Flow, Satisfaction, and Persistence

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### ABSTRACT

This study aimed to investigate the structural relationships among teaching presence, cognitive presence, usage, learning flow, satisfaction, and learning persistence in corporate e-learners. The research participants were 462 e-learners registered for cyber-lectures through an electronics company in South Korea. The extrinsic variables were sense of teaching presence, sense of cognitive presence, and usage. According to structural equation modeling, each of these variables and flow significantly affected satisfaction. Although sense of teaching presence and satisfaction significantly affected sense of cognitive presence, usage and flow did not significantly affect learning persistence. Accordingly, we established a corrected model after removing insignificant paths and investigated again. We confirmed that learning flow significantly intermediated among sense of teaching presence, sense of cognitive presence, and satisfaction but not between usage and satisfaction. In addition, satisfaction intermediated among sense of teaching presence, sense of cognitive presence, usage, flow, and learning persistence. These findings demonstrate the importance of sense of teaching presence, sense of cognitive presence, and usage for e-learners. We expect that the results will contribute to the formation and improvement of fundamental learning strategies for successful e-learning.

### Keywords

Sense of teaching presence, Sense of cognitive presence, Usage, Learning flow, Satisfaction

### Introduction

In an information society, where knowledge is a core resource, as the importance of human resource development increases, many enterprises emphasize employee education in order to improve their employees' capabilities. Moreover, as people acknowledge the benefits of e-learning—namely, that they can overcome time and space constraints through use of the Internet and other information and communication technologies—e-learning rapidly has become diffused and generalized. However, regardless of such quantitative growth, it can be difficult to actively engage online learners. Achieving flow in the e-learning process is challenging because e-learning differs from traditional education, which is conducted in e-learning. Thus, online learners may not be motivated to continue due to low learning satisfaction. As advocates have called for investigation of the e-learner's experience in the e-learning process to improve its quality, researchers have sought to understand the sense of presence and its role in e-learning.

Sense of presence is expressing not what exists in the physical environment but rather what one experiences and perceives (Witmer & Singer, 1998). When learners' sense of presence improves, they study content and situations meaningfully and experience flow in learning by actively participating in the learning process. This leads to positive learning outcomes (Garrison & Arbaugh, 2007; Wang & Kang, 2006). Given the importance of a sense of presence for e-learners and its connection to positive learning outcomes, researchers should investigate its role in e-learning environments, observe any causal relationship between flow and learning outcomes, and use the findings to create practical improvement strategies. Garrison, Anderson, and Archer (2001) proposed a community of inquiry model, in which learners develop individual intelligence through reflective thinking and critical discourse, based on social interactions with the instructor. They also emphasized the sense of presence that learners can perceive in their community of inquiry. Garrison and Arbaugh (2007) proposed the senses of teaching presence, cognitive presence, and social presence as indispensable factors for successful learning in the context of a community of inquiry.

Sense of teaching presence refers to a learner's perception regarding a general teaching phenomenon along with aspects of designing and systemizing instruction (Arnold & Ducate, 2006). Anderson, Rourke, Garrison, and Archer (2001) defined the sense of teaching presence as a learner's perception of their guide in cognitive and social processes, design, and facilitation aimed at helping them to realize individually meaningful and educationally

valuable results. The sense of teaching presence is distinct from the sense of *teacher* presence in that it focuses on instruction in e-learning environments. The sense of teaching presence can be divided into instructional design and organization, facilitation of discourse, and directed instruction within the community of inquiry (Garrison et al., 2001). Because the sense of teaching presence, which structuralizes learning content, encourages the learner's continual participation and facilitates discourse, it can lead learners to continue meaningful learning. This is particularly important in e-learning environments, where face-to-face interactions with an instructor are impractical. Sense of cognitive presence is defined as the degree of consistent and confirmed meaning in a learner's reflection and discourse (Garrison & Anderson, 2003). Kang, Park, and Shin (2007) elaborated the concept by defining it as the perception of a learner's ability to understand the learning topic through learning activity and to generate and confirm his or her own knowledge in the e-learning environment. The sense of cognitive presence extends a student's ability to restructure meaning gained through his or her communications and affects critical thinking involved in higher-order thinking and learning (Kanuka & Garrison, 2004). It is an essential component of higher-order exploratory, process-using critical thinking in e-learning, which is based on the learner's inner experience.

Flow is "the whole experience that people feel when they concentrate on some activities" and means the state in which one is fully concentrating on one's task or work and functioning optimally (Csikszentmihalyi, 1990). Csikszentmihalyi (1990) said that *flow* means a state where some behavior happens naturally, like flowing water, and one concentrates fully on one's work, losing one's sense of time, being unconscious of circumstances, and being fully obsessed with one's work. In a flow state, a person's level of concentration upon a project increases; the target of this concentration coalesces within a certain project; and the person's blocks thoughts, concerns, and worries unrelated to the project from consciousness. One feels a sense of control toward the project and feels the self to be in a flow state.

The current study did not adopt the notion of sense of social presence but did adopt senses of teaching presence and cognitive presence as effective variables for learning outcomes. We expected that a learner's learning flow, satisfaction, and learning persistence would not be affected by sense of social presence, as learners find it difficult to communicate with colleagues and creating social relationships in Korean corporate e-learning environments, where individualized learning prevails (Kim, 2009). We also established sense of presence as an effective variable for learning flow, considering that learning flow results from the sense of presence and is a factor in facilitating learning flow. In addition to exploring these initial hypotheses, we also explored the effects of sense of presence on learner satisfaction and persistence in e-learning.

### **Presence, flow, satisfaction, and persistence**

Sense of presence, along with flow, has been the subject of much attention in past studies. Riva (2006) defined it as a mental status in which one feels as though one is "there" when fully engaged in media use. Fountane (1992) explained sense of presence as a matter of focus with psychological interests. On the other hand, Barfield and his colleagues (1995) advocated considering flow as the result of a sense of presence. With regard to the relationship between sense of presence and learning flow, Wang and Kang (2006) introduced the senses of emotional presence, social presence, and cognitive presence as facilitating factors of engaging students in ideal learning through online pedagogy. They proposed an online pedagogy model as an instructional strategy and mentioned the importance of sense of presence for learning flow.

In relation to sense of presence and learner satisfaction, Garrison and Cleveland-Innes (2005) wrote that interactions between instructors and learners more strongly affect learning achievement and learner satisfaction than do interactions between learners. Therefore, sense of teaching presence leads to effective learning, facilitated by direct engagement with an instructor and optimal guides. Wu and Hiltz (2004) also emphasized the importance of the instructor by showing significant correlations among learner cognition, learner motivation, pleasure, and satisfaction in a blended learning class. Cognitive presence is also an important factor that affects learning outcomes, such as satisfaction, achievement, and learning persistence. As cognitive presence increases, so do satisfaction and achievement (Kang, 2005).

In research on cognitive presence and learning persistence, Joo, Kim, and Park (2009) analyzed the relationships among cognitive sense of presence, satisfaction, and learning persistence using structural equation modeling (SEM). The participants were 375 employees of an electronics enterprise who had completed four weeks of a cyber-course. In their results, the cognitive sense of presence had significant effects both on satisfaction and on learning persistence. Similarly, Shin (2003) studied the relationships among teaching presence, satisfaction, learning achievement, and learning persistence

on 506 students registered for cyber-courses at K Cyber University and found that the sense of teaching presence had significant correlations with learning achievement and learning persistence.

### **Usage, satisfaction, and persistence**

This study established usefulness as an effective variable for learning flow, given that learning flow comes from the results of usefulness and is a factor facilitating learning flow. In addition, previous studies have reported the effects of usefulness on learner satisfaction and persistence in e-learning. Kim (2006) investigated the relationship among perceived usefulness, perceived ease of use, learner's attitudinal flow, and behavioral flow using SEM in an e-learning community. The participants were 62 undergraduate and graduate students registered for a cyber-course for pre-service teachers. The results showed that perceived usefulness and perceived ease of use affected attitudinal flow and that attitudinal flow affected behavioral flow. Kim and Oh (2005), in their research on corporate e-learning, also reported that usefulness directly affects ease of use and behavioral intention and that ease of use affects behavioral intention. Further, they confirmed that usage indirectly affects flow by intermediating behavioral intention.

Roca, Chiu, and Martinez (2006) reported that usage significantly affects satisfaction in their research on the effects of usage on satisfaction and learning persistence. In their study, 184 participants completed e-learning courses provided at the United Nations System Staff College and International Labor Organization. The results confirmed that usage indirectly affects learning persistence, as satisfaction intermediates them. In another study examining the relationships among usefulness, satisfaction, and learning persistence for 183 e-learners who had completed an asynchronous e-learning educational course at a university in Taiwan, usefulness had significant effects on satisfaction, and satisfaction had significant effects on learning persistence. In addition, the study proved the importance of usefulness in e-learning by empirically demonstrating the significant indirect effect of usefulness and the intermediation effect of satisfaction (Chiu, Hsu, Sun, Lin, & Sun, 2005). No, Lee, and Chung's (2008) study on the effects of perceived usefulness and perceived ease of use on persistent intention, using 203 e-learning users who had cyber-learning experience, showed usage had significant effects on persistent intention of use.

### **Flow, satisfaction, and persistence**

The current study established flow as an effective variable for learner satisfaction and persistence in e-learning. Kim (2005) examined the relationship between flow and satisfaction among 366 graduate students participating in cyber-courses. The research confirmed that flow significantly affects satisfaction. That is, learners themselves can affect their degree of satisfaction according to their perceived degree of flow in e-learning courses. According to Kang (2005), as cognitive presence increases, so do satisfaction and achievement. Flow is very important in education; once learners experience flow in the learning process, the learning process becomes pleasant. Accordingly, flow leads to active participation in learning and cooperative activities. It also gives the student a sense of satisfaction and achievement (Park & Kim, 2006). Shin (2006) conducted a study targeting 525 undergraduate students who had completed e-learning courses in order to examine the relationships among prerequisite variables and flow and the resultant variables of flow. The findings indicated that flow in e-learning is a significant variable affecting satisfaction in a study.

In the field of leisure and sport, Kim and Lee (2008) investigated the relationships among motivation, flow, and learning persistence for 199 aquatic sports participants. They reported that flow had a significant effect on persistent intention for participation. Cabrera, Nora, and Castaneda (1992) established a research model of learners' learning persistence based on previous literature reviews and analyzed their reliability using SEM. Their results show that flow in both learning objectives and educational organization had significant effects on the learning persistence of new university students.

### **Distinctive significance of the study**

First, this study attempted to clarify the cause-and-effect relationships among sense of teaching presence, sense of cognitive presence, flow, satisfaction, and persistence within an integrated view. Despite the importance of sense of teaching presence, sense of cognitive presence, and usefulness for e-learners, the research investigating their effects on learning

outcomes from an integrated view remains insufficient. Previous studies related to successful e-learning investigated simple correlation or effects between two variables rather than integrating the variables related to learning persistence. For example, studies have examined the relationship between teaching presence and satisfaction (Wu & Hiltz, 2004) as well as the effect of cognitive presence on satisfaction and presence (Kang, 2005), of teaching presence on persistence (Shin, 2003), of usage on satisfaction and persistence (Roca et al., 2006), of usage on persistence (No et al., 2008), of flow on satisfaction (Kim, 2005), of cognitive presence on satisfaction and achievement (Kang, 2005), and of flow on satisfaction and achievement (Park & Kim, 2006). Since learning outcomes in cyber-environments, such as satisfaction and learning persistence, are complex phenomena affected by assorted variables (Willging & Johnson, 2004), observers should consider the relevant variables' causal relationships with an integrative structural view.

Second, previous studies on the relationships among flow, satisfaction, and persistence using SEM have not addressed important variables in predicting successful e-learning. Joo et al. (2009) did not include the sense of teaching presence in e-learning but did suggest the necessity of investigating it. Kim (2006) investigated the relationships among usefulness, ease of use, and behavioral and attitudinal flow but did not include the outcome variables of flow. Chiu et al. (2005) investigated the relationships among usefulness, satisfaction, and persistence with the intermediation effect of satisfaction but did not include the teaching and cognitive sense of presence prior to looking at usefulness and outcome variables. Moreover, the results of previous studies are somewhat contradictory. Thomas's (2000) investigation of the effects of students' social networks on learning persistence in a university setting found that the relationships among social networks, scholastic integration, social integration, grades, flow in objectives, flow in educational organization, and learning persistence were not significant.

### Research purpose and hypotheses

The purpose of this study is to explain the relationships among the sense of teaching presence, usage, and learning outcomes, which facilitate learner flow in corporate e-learning, by integrating all the variables in a single structural model. Based on a review of the previous literature, we established research hypotheses and hypothetical research models of corporate e-learning. These are shown in Figure 1.

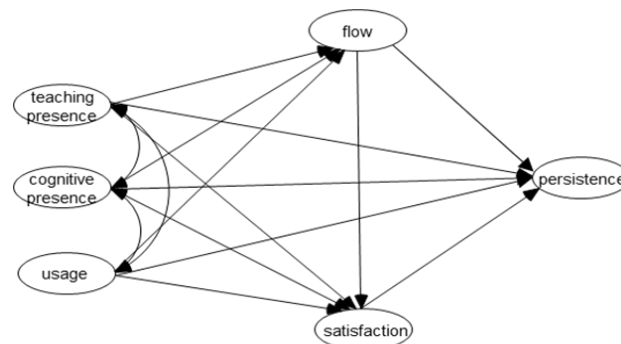


Figure 1. Hypothetical research model of corporate e-learning

First, the sense of teaching presence, sense of cognitive presence, and usage affect flow. Second, the sense of teaching presence, sense of cognitive presence, usage, and flow affect satisfaction. Third, the sense of teaching presence, sense of cognitive presence, usage, flow, and satisfaction affect learning persistence. Fourth, learning flow intermediates the sense of teaching presence, sense of cognitive presence, usage, and satisfaction. Fifth, satisfaction intermediates the sense of teaching presence, cognitive presence, usage, flow, and persistence.

## Method

### Research participants

This study investigated the structural relationships among sense of presence, ease of use, learning flow, satisfaction, and learning persistence for e-learners at Enterprise A. Enterprise A was selected for its use of the same registration

and management systems, learning service, and evaluation and grade generation systems for all its sub-branches. It is engaged in electronics, chemistry, and communication services and owns 30 sub-companies, 130 corporations, 70 branches, 40 factories, and 70 research institutes. Enterprise A first created five courses in 1998 and has since systematically offered job-related educational course to its employees, including “Business Skills-Up,” “Business Creativity,” and “Project Master.” We chose to investigate a single enterprise for the consistency of its registration system and learning management system. Because the course was established to meet Korea’s employee insurance refund policy, enacted in 2009, most students have completed it in order to meet the policy standard. We issued a survey to 462 participants to measure sense of teaching presence, cognitive presence, usage, learning flow, satisfaction, and learning persistence. There were 375 male participants (81.2%) and 87 female participants (18.8%). The participants’ ages ranged from 24 to 54. Their job statuses were as follows: 29.5% staff, 21.4% deputy section chiefs; 17.3% section chiefs, 15.1% deputy department heads, 7.4% department heads, and 9.2% other.

### **Measurement instrument**

To measure the sense of presence, we used the validated instrument designed specifically for measuring sense of presence by Garrison, Cleveland-Innes, and Fung (2004) and extracted only the sense of teaching presence and sense of cognitive presence. This instrument derives from the community of inquiry model by Garrison, Anderson, and Archer (2001). The sense of teaching presence is measured by 13 items (e.g., “I am satisfied with interactions with the professor, such as questions, answers, etc.”). The sense of cognitive presence is measured by eight items (e.g., “I understood the subjects and problems given during class”). For both variables, the inter-item consistency had a Cronbach’s  $\alpha$  of .94. We removed the second item in one instance of duplicated items (“I am well adapted to the online environment” and “I am well adapted to my learning environment”) out of the 13 items measuring sense of teaching presence. Thus, the final measurement used 12 items for sense of teaching presence and 8 for sense of cognitive presence. The construct reliability of sense of teaching presence (the reliability of the dormant variable) was .99, and the average extracted variance was .99. The construct reliability for sense of cognitive presence (the reliability of the dormant variable) was .95, and the average extracted variance was .91. Thus, we confirmed the instrument’s convergent and discriminant validity.

We measured usage by extracting items from Davis’s (1989) Technology Acceptance Model instrument. Usage consisted of usefulness and ease of use. Usefulness (e.g., “I think that it is useful to study the current course”) and ease of use (e.g., “It is possible to study the current course without serious effort”) each had four items. Inter-item consistency had a Cronbach’s  $\alpha$  of .87 for usefulness and .86 for ease of use. The construct reliabilities of usefulness and ease of use were both .99, and the average extracted variance was .97. Thus, we confirmed that the instrument had convergent and discriminant validity.

We used nine items from the Flow State Scale instrument validated by Martin and Jackson (2008) to measure learning flow (e.g., “I feel that I am able to control my environment when I study”). The inter-item consistency for learning flow items had a Cronbach’s  $\alpha$  of .83 for participants in high school gym class and .84 for those in high school music class. The construct reliability was .99, and the average extracted variance was .99. Thus, we confirmed that the instrument had convergent and discriminant validity.

We defined satisfaction as the degree to which learners felt satisfied with their e-learning experience. To measure this variable, we revised Shin’s (2003) measurement instrument for corporate settings. The instrument consists of eight items (e.g., “It was a valuable experience to study the current course”) rated on a 5-point Likert scale. The inter-item consistency had a Cronbach’s  $\alpha$  of .96, the construct reliability in the current study was .99, and the average extracted variance was .99. Thus, we confirmed the instrument’s convergent and discriminant validity.

This study derived an instrument to measure learning persistence, including the perceived importance of completing the course, ability to overcome hindrance factors for learning persistence, and motivation to take the e-learning course, by revising Shin’s (2003) measurement instrument. We used six items (e.g., “I will successfully complete the course regardless of my difficulty with the current lecture”). Their inter-item consistency had a Cronbach’s  $\alpha$  of .83. After we examined content reliability, we removed two items (“I am not likely to continue studying at KNOU” and “I would like to quit my studies”) that were not appropriate for a corporate e-learning environment. Thus, the final instrument measuring learning persistence consisted of four items. The construct reliability in the current study

was .97, and the average extracted variance was .99. Thus, we confirmed the instrument's convergent and discriminant validity.

### Research procedure

To investigate the structural causal relationships among sense of teaching presence, sense of cognitive presence, usage, learning flow, satisfaction, and learning persistence, we conducted an online survey for e-learners enrolled in courses at Enterprise A. We administered the survey the week prior to the e-learners completing the four-week course.

The main instructional methods were lectures given by the instructor delivered by video. Students were able to engage in individualized learning at any time. There were no online projects or discussions. Students were allowed to ask any questions through e-mail or online discussion boards. The e-learning platform was the LMS system developed based on SCORM 2.0 by the enterprise itself. The main contents of lectures were accessible in PowerPoint slides. Students were able to download the instructional materials at any time.

The course required three hours a week for four weeks. Each week's instructional materials were delivered separately. Evaluation consisted of multiple-choice tests that the students took online. The main topic of the course was job-related training. There was one instructor, whose primary role was to deliver video lectures, and one assistant instructor, who managed student requests.

### Data analysis

To investigate the causal relationship between sense of teaching presence and sense of cognitive presence in corporate e-learning, we established the hypothetical research model shown in Figure 1 (see Section 1.5) and the statistical model in Figure 2. As seen in the statistical model, we established each dormant mathematical variable using index variables from the research model.

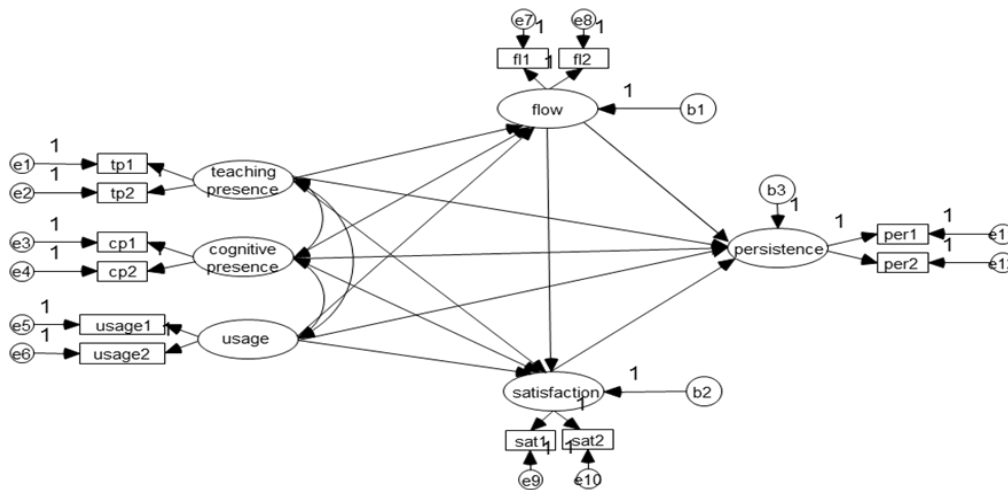


Figure 2. Statistical model of corporate e-learning

In establishing the model, we used an item parcel method to avoid overweighting on the measurement model since there are single-factor measurement variables in exploratory factor analysis results among sense of teaching presence, sense of cognitive presence, usage, learning flow, satisfaction, and learning persistence. Item parceling is using a total or average by randomly binding the first-level variable, which measures the same causal factors (Kishton & Widamn, 1994). By using the item parcel method, we can reduce the number of index variables that measure each dormant variable and ultimately reduce the prediction error. Furthermore, this method allows us to confirm the

multivariate normal distribution assumption better than individual item analyses would (Bandalos, 2002; Sass & Smith, 2006).

To determine the prediction method for the statistical model, we examined multivariate normal distributions of eight variables of the SEM using AMOS 6.0. As a result, we were able to satisfy the conditions of skewnesses and kurtoses for single variables. We predicted the model fitness and parameters using a Maximum Likelihood Estimation (MLE) procedure, given that the multivariate normal distribution assumption was satisfied. We evaluated the model fitness through CMIN, TLI, CFI, and RMSEA. We also examined statistical significance among variables with a confidence level of .05.

## Results

### Descriptive statistics and correlation analysis

In SEM, if each measurement variable is not normally distributed, the assumptions of the multivariate normal distribution cannot be satisfied. As a result, the model will give distorted values, and the researcher will be unable to achieve an exact statistical investigation. Therefore, to confirm the goodness of fit for the multivariate normal distribution of the collected data, we examined means, standard deviations, skewnesses, and kurtoses.

The variable means ranged from 3.55 to 4.22, standard deviations from .66 to .73, skewnesses from .12 to .67, and kurtoses from .10 to .30. This satisfied the basic assumptions of SEM, as the skewnesses of the measurement variables were less than 3, and their kurtoses were less than 10 (Kline, 2005). Therefore, the variables satisfied the basic assumptions of a multivariate normal distribution for SEM examination. The results of analysis of the correlations among the cyber-learners' sense of teaching presence, sense of cognitive presence, usage, learning flow, satisfaction, and learning persistence showed that all variables were significant. Table 1 displays the specific means, standard deviations, and correlation of each variable.

Table 1. Means, standard deviations, and correlation matrix

Measurement variable	Correlations of measurement variable												
	1	2	3	4	5	6	7	8	9	10	11	12	
1. teaching presence1	1												
2. teaching presence2	.85*	1											
3. cognitive presence1	.67*	.68*	1										
4. cognitive presence2	.65*	.68*	.85*	1									
7. usefulness	.57*	.60*	.68*	.68*	1								
8. ease of use	.52*	.53*	.56*	.56*	.66*	1							
9. flow1	.70*	.75*	.73*	.74*	.65*	.55*	1						
10. flow2	.69*	.72*	.71*	.73*	.62*	.53*	.89*	1					
11. satisfaction1	.65*	.72*	.69*	.76*	.69*	.49*	.79*	.76*	1				
12. satisfaction2	.67*	.72*	.71*	.78*	.68*	.48*	.79*	.76*	.93*	1			
13. persistence1	.57*	.65*	.62*	.66*	.64*	.43*	.70*	.64*	.82*	.81*	1		
14. persistence2	.66*	.67*	.61*	.63*	.59*	.45*	.72*	.69*	.76*	.76*	.73*	1	
Mean	3.55	3.69	3.81	3.90	3.93	3.73	3.86	3.81	4.11	4.06	4.22	3.98	
Standard Deviations	.70	.70	.68	.67	.72	.73	.66	.67	.66	.68	.68	.72	
Skewness	.20	-.13	-.20	-.40	-.30	-.32	-.15	-.12	-.54	-.57	-.67	-.42	
Kurtosis	-.29	.13	.19	.30	-.13	.10	-.27	-.25	.28	.34	.27	-.25	
N	462	462	462	462	462	462	462	462	462	462	462	462	

Note. \*  $p < .05$ .

### Measurement model investigation

Before examining the structural regression model's possibilities for model prediction and goodness of fit, we predicted the measurement model's fitness by the MLE method based on the second step of possibility confirming model prediction process (Kline, 2005). The prediction results of goodness of fit are displayed in Table 2. As seen in Table 2, all goodness of fit indices for the measurement model, including RMSEA (.054-.082), show the measurement model has goodness of fit.

Table 2. Overall model fit indices for measurement model

	CMIN	df	TLI	CFI	RMSEA (90% Confidence Interval)
Measurement Model	121.426	39	.977	.986	.068 (.054-.082)

Note.  $n = 462$ .

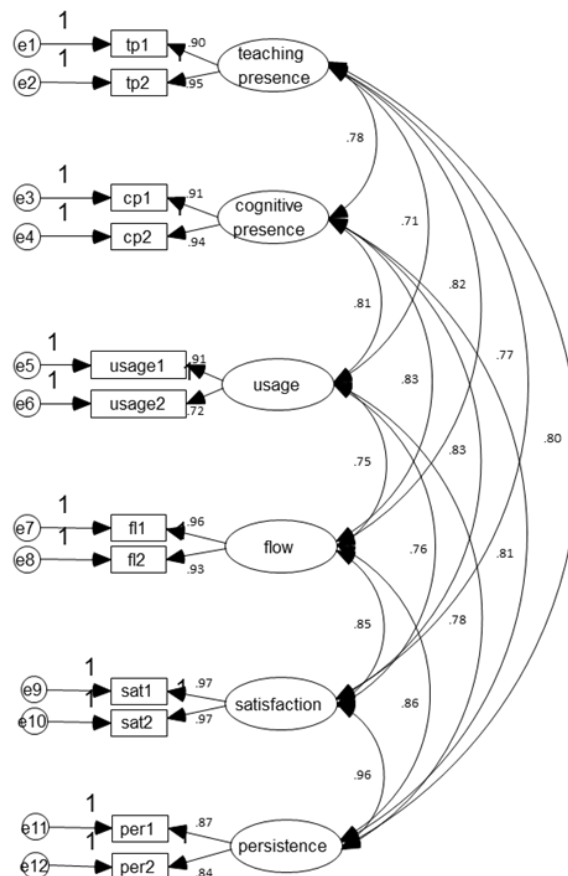


Figure 3. Measurement model parameter estimation result

Figure 3 shows that an examination of the relationships among the latent and index variables revealed the average factor load value for each path of the measurement variables ranged from .726 to .968, which was significant at an alpha level of .05. Considering the factor load value must be more than .30 (Hair, Anderson, Tatham, & Black, 1992), the measurement variables appeared to properly measure the corresponding latent variables. That is, the established measurement variables measured each latent variable under each research model with enough convergent accountability and apparently discriminated enough among the latent variables, with no corrections necessary regarding the measurement model. Since the measurement model appeared to statistically measure all latent variables of the research model accurately and with accountability, the causal relationships among measured latent variables predicted the established fitness and parameters of the structural regression model.



### Structural model examination

Table 3 shows the specific results examining the fitness of the initial structural model to the collected data. Since the initial fitness of the structural model was TLI = .977, CFI = .986, and RMSEA = .068 (.054-.082), we confirmed that the fitness index of the initial structural model indicated it was a good model.

Table 3. Initial structural model fitness examination result

	CMIN	df	TLI	CFI	RMSEA (90% Confidence Interval)
Initial Structural Model	121.426	39	.977	.986	.068 (.054-.082)

Note.  $n = 462$ .

Accordingly, we examined the direct effects among sense of teaching presence, sense of cognitive presence, usage, satisfaction, and learning persistence. The results were as follows. First, examination of the effects of sense of teaching presence, sense of cognitive presence, and usage on learning flow showed the following: sense of teaching presence,  $\beta = .413$  ( $t = 8.200, p < .05$ ); sense of cognitive presence,  $\beta = .411$  ( $t = 6.174, p < .05$ ); and usage,  $\beta = .122$  ( $t = 2.027, p < .05$ ).

Second, examination of the effects of sense of teaching presence, sense of cognitive presence, usage, and learning flow on satisfaction revealed the following: sense of teaching presence,  $\beta = .109$  ( $t = 2.091, p < .05$ ); cognitive presence,  $\beta = .272$  ( $t = 4.054, p < .05$ ); and usage,  $\beta = .144$  ( $t = 2.550, p < .05$ ). Third, examination of the effects of sense of teaching presence, sense of cognitive presence, usage, learning flow, and satisfaction on learning persistence showed the following: sense of teaching presence,  $\beta = .136$  ( $t = 12.687, p < .05$ ) and cognitive presence,  $\beta = .797$  ( $t = 12.687, p < .05$ ). The effect of usage was not statistically significant.

The initial structural model of this study reveals the significant fact that removing the paths between sense of cognitive presence and learning persistence, between usage and learning persistence, and between learning flow and learning persistence did not affect the model fitness. Accordingly, we established a simplified model, as seen in Figure 4, in which we removed the paths mentioned.

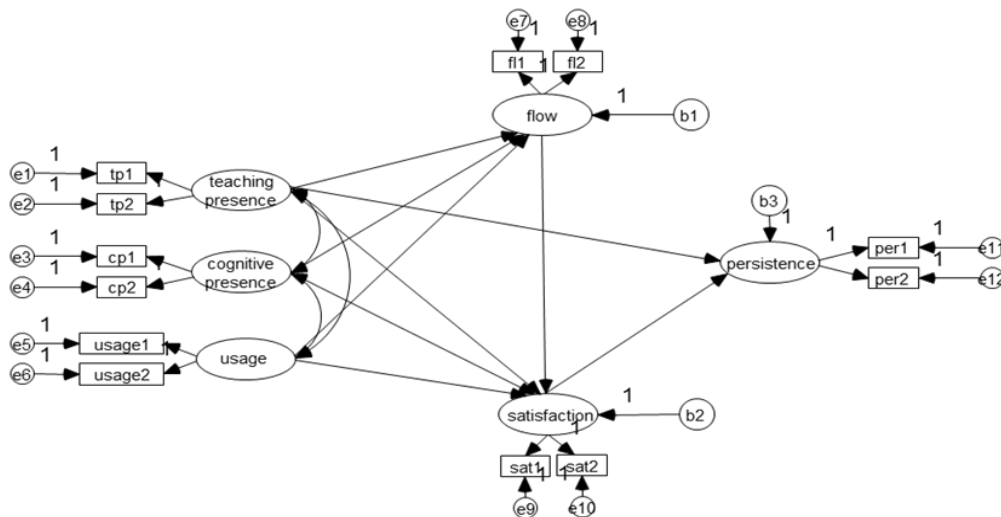


Figure 4. Revised research model of corporate e-learning

Because the initial structural model and revised model have hierarchical relationships, we conducted a chi-square test to determine whether there was a statistically significant difference between the two. The result showed no difference between the models in their goodness of fit ( $CMIN_D = 5.389, p = .145$ ). Accordingly, although there was no difference in goodness of fit between the models, we selected the revised model and estimated the goodness of fit and parameters because the revised model was simpler. Table 4 shows the results of the revised structural model's

goodness of fit. By confirming the goodness of fit index, we confirmed that the model fitness was good ( $CMIN_D = 5.389, p = .145$ ).

Table 4. Examination results of fitness of corrected model

	CMIN	df	TLI	CFI	RMSEA (90% Confidence Interval)
Corrected Structural Model	126.815	42	.978	.986	.066 (.053~.080)
Initial Structural Model	121.426	39	.977	.986	.068 (.054~.082)

Note.  $n = 462$ .

As seen in Table 4, the model's overall fitness index appeared similar to the initial structural model, but the absolute fitness index value  $\chi^2$  was 5.389 higher. The fitness indices were statistically significant; all the fitness indices of the revised structural model satisfied the fitness criteria. Figure 5 displays the structural estimation parameters of the revised model.

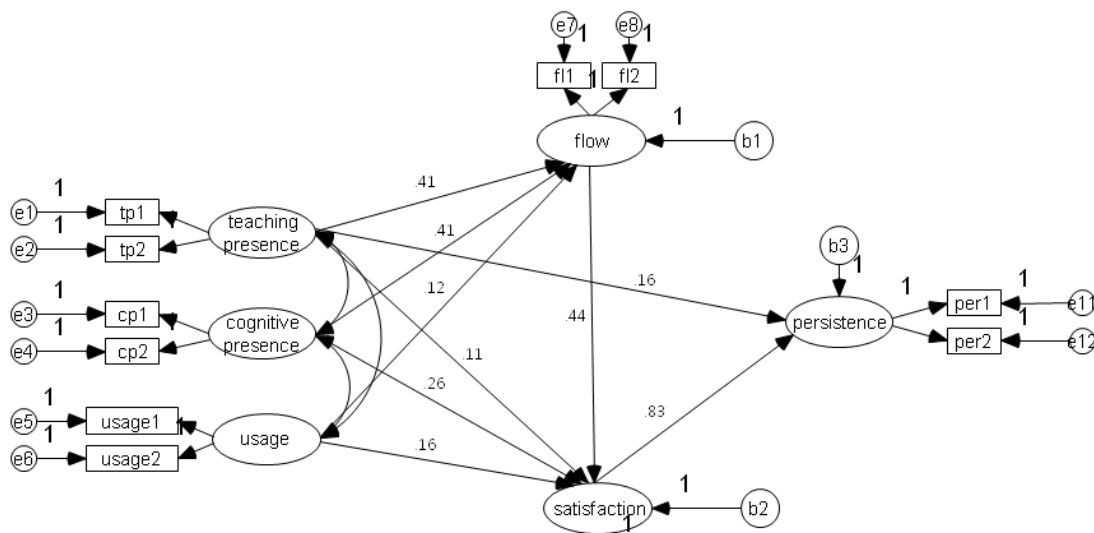


Figure 5. Standard path coefficient of revised model

The results of the parameters regarding the revised model path coefficients are as follows. First, the effect of sense of teaching presence on learning persistence was  $\beta = .413$  ( $t = 8.220, p < .05$ ). The effects of sense of cognitive presence and usage on learning flow were  $\beta = .414$  ( $t = 6.178, p < .05$ ) and  $\beta = .119$  ( $t = 1.968, p < .05$ ), respectively. Second, investigation of the effects of sense of teaching presence, sense of cognitive presence, usage, and learning flow on satisfaction revealed the following: sense of teaching presence,  $\beta = .105$  ( $t = 2.011, p < .05$ ); sense of cognitive presence,  $\beta = .257$  ( $t = 3.011, p < .05$ ); usage,  $\beta = .155$  ( $t = 2.727, p < .05$ ); and learning flow,  $\beta = .437$  ( $t = 7.143, p < .05$ ).

Third, investigation of the effects of sense of teaching presence and satisfaction on learning persistence revealed the effect of sense of teaching presence on learning persistence was  $\beta = .161$  ( $t = 3.648, p < .05$ ) and that of satisfaction was  $\beta = .833$  ( $t = 17.917, p < .05$ ). These results showed the significant effects of sense of teaching presence, sense of cognitive presence, and usage on satisfaction. In addition, the sense of teaching presence and satisfaction had significant effects on learning persistence. Among the variables affecting learning flow, sense of teaching presence, sense of cognitive presence, and usage had relatively stronger effects than the others had. Table 5 summarizes the direct model effects.

Table 5. Direct model effects

Direct		Non-standardization	Error of	C.R.	<i>p</i>	Standardization
Flow	← Teaching presence	.40	.05	8.22	*	.41
	← Cognitive presence	.42	.07	6.18	*	.41
	← Usage	.14	.07	1.97	*	.12
Satisfaction	← Teaching presence	.11	.05	2.01	*	.11
	← Cognitive presence	.27	.07	3.84	*	.26
	← Usage	.19	.07	2.73	*	.16
	← Flow	.46	.06	7.14	*	.44
Persistence	← Teaching presence	.14	.04	3.65	*	.16
	← Satisfaction	.75	.04	17.92	*	.83

Note. \* *p* < .05.

These results of this study show sense of teaching presence, sense of cognitive presence, and usage had significant effects on learning flow. In addition, sense of teaching presence, sense of cognitive presence, and usage had significant effects on satisfaction. Satisfaction also had significant effects on learning persistence. Moreover, learning flow had significant effects on satisfaction, and satisfaction had significant effects on learning persistence. Therefore, we found that sense of teaching presence, sense of cognitive presence, and usage had significant effects on satisfaction by intermediating learning flow. Further, sense of teaching presence, sense of cognitive presence, and usage were found to have significant effects on learning persistence by intermediating satisfaction. This shows the possibility that learning flow has significant effects on learning persistence by intermediating satisfaction. Accordingly, the Sobel test was applied to examine the significance of the indirect effects.

The indirect effect of sense of teaching presence on satisfaction by intermediating learning flow was  $Z = 5.41$  ( $p < .001$ ), and that of sense of cognitive presence on satisfaction by intermediating learning flow was  $Z = 4.69$  ( $p < .001$ ). On the other hand, the indirect effect of usage on satisfaction by intermediating learning flow was  $Z = 1.90$  ( $p = .057$ ), which was not statistically significant. At the same time, the indirect effect of sense of teaching presence on learning persistence by intermediating satisfaction was  $Z = 2.01$  ( $p = .04$ ). This number was  $Z = 3.73$  ( $p < .001$ ) for sense of cognitive presence and  $Z = 2.65$  ( $p < .001$ ) for usage. The indirect effect of learning flow on learning persistence by intermediating satisfaction was statistically significant,  $Z = 6.65$  ( $p < .001$ ). That is, learning flow is able to intermediate between sense of teaching presence and satisfaction, between sense of cognitive presence and learning persistence, and between sense of cognitive presence and satisfaction. In addition, we found that in corporate e-learning environments, satisfaction intermediates between the following pairs of variables: sense of teaching presence and learning persistence, sense of cognitive presence and learning persistence, usage and learning persistence, and learning flow and learning persistence. Table 6 displays the indirect effect analysis of the variables affecting learning outcomes.

Table 6. Direct and indirect effects of the modified model

Relevant variables		Total effect	Direct effect	Indirect effect
Flow	← Teaching presence	.40	.40*	-
	← Cognitive presence	.42	.42*	-
	← Usage	.14	.14*	-
Satisfaction	← Teaching presence	.30	.11*	.18*
	← Cognitive presence	.46	.27*	.19*
	← Usage	.25	.19*	.06
	← Flow	.46	.46*	-
Persistence	← Teaching presence	.22	.14*	.08*
	← Cognitive presence	.20	-	.20*
	← Usage	.14	-	.14*

Flow	.35	-	.35*
Satisfaction	.75	.75*	-

Note. \*  $p < .05$ .  $n = 462$ .

## Discussion and conclusion

This study analyzed the structural causal relationships among learners' sense of teaching presence, sense of cognitive presence, usage, learning flow, and learning outcomes (satisfaction and learning persistence) using SEM. It explained the learning process connections to learning outcomes by using an integrative view to investigate how learners experience the learning process in e-learning environments. Based on the research results, we find the following.

First, we confirmed that sense of teaching presence, sense of cognitive presence, and usage have significant effects on learning flow in corporate e-learning. The significant effects between teaching and cognitive presence on learning flow are consistent with previous research findings (Barfield, Zeltzer, Sheridan, & Slater, 1995; Wang & Kang, 2006). The significant effect of usage on learning flow is also consistent with previous research results (Kim, 2006; Kim & Oh, 2005).

Second, we confirmed that sense of teaching presence, sense of cognitive presence, usage, and learning flow have a significant effect on satisfaction in corporate e-learning. The significant effects of teaching presence (Garrison & Cleveland-Innes, 2005; Shin, 2003; Wu & Hiltz, 2004), cognitive presence (Joo et al., 2009; Kim, 2008; King, 2005), usage (Chiu et al., 2005; Roca et al., 2006), and flow on satisfaction (Shin, 2006; Kim, 2005) are consistent with previous research results.

Third, we confirmed the significant effects of sense of teaching presence and satisfaction on learning persistence in corporate e-learning. The significant effect of teaching presence on learning persistence is consistent with previous research findings (Shin, 2003). The significant effect of satisfaction on learning persistence is consistent with previous studies that reported if learners are satisfied with overall aspects, such as the instructor, teaching method, process, and learning environments, they are likely to continue their learning after completing the course (Levy, 2005; Müller, 2008). On the other hand, in this study, sense of cognitive presence, flow, and usage did not directly affect persistence. This finding is not consistent with previous studies, which reported opposite results (Joo et al., 2009; Kim, 2008). This suggests the possibility that the sense of cognitive presence does not directly affect learning persistence. Further, findings on the effect of usage on persistence are not consistent with previous studies (Noh et al., 2008). Although previous studies (Chiu et al., 2005; Roca et al., 2006) did not observe direct effects of usage on learning persistence, they reported that usage significantly affects learning persistence by intermediating satisfaction. Then, the findings regarding the effect of learning flow on learning persistence are also not consistent with previous studies, which reported opposite results, namely, that flow does affect persistence in sports environments (Kim & Lee, 2005; Kim & Lee, 2008). These results likely differ due to the environmental distinction: Flow in a sports environment means that participants are deeply engaged in attitudes or behavioral aspects of the sport rather than in cognitive processes.

Fourth, satisfaction intermediated among sense of teaching presence, sense of cognitive presence, usage, learning flow, and learning persistence. These results mean that when learners' perceived sense of teaching and cognitive presence improve, they can experience flow. Accordingly, learners' overall satisfaction improves, and learning persistence in taking relevant courses increases even after the students complete the current course. This finding is consistent with the results of Chiu et al. (2005).

The suggestions and contributions from the current research results are as follows: First, the results of this study confirmed the significant effect of a sense of teaching presence on flow, satisfaction, and learning persistence. E-learning designers, therefore, should increase learners' sense of teaching presence by providing them with opportunities to ask questions about class content as part of the learning process in order to confirm what the learners know and to correct any misunderstandings. Educators should also encourage each learner's consistent participation by managing his or her learning process through e-mail, short message services, or a webpage.

Second, the results of this study confirmed the significant effect of a sense of cognitive presence on flow and satisfaction and the indirect effect on persistence. To increase the sense of cognitive presence, e-learning designers should structure learning content appropriately, allow learners themselves to generate new knowledge, and develop systems to help learners manage their learning resources and time.

Third, the research results confirmed the significant effect of usage on flow and satisfaction and the indirect effect on persistence. E-learning designers, therefore, must improve usage by providing practical cases closely related to the students' work so learners can feel that the system is very useful and easy for them to use.

Fourth, the current research results confirmed the significant intermediation effects of flow between teaching presence and satisfaction and between cognitive presence and satisfaction. Accordingly, it is expected to devise strategies to increase flow in the e-learning process for learning outcome achievement. Since usage is also an effective variable on flow, it is important to construct the environment for flow by increasing learning usage in the learning environment. In order to increase usage, therefore, e-learning designers should devise strategies to raise flow in the learning process, improve learning outcomes, avoid distractions for learners, and consider the learners' convenience so that they are not hindered in their studies.

Fifth, the current research results investigated the significant intermediation effects of satisfaction between teaching presence and learning persistence, between cognitive presence and learning persistence, and between flow and learning persistence. This means that regardless of cognitive presence and flow, learners' learning persistence cannot be guaranteed without satisfaction. Accordingly, strategies to increase learners' satisfaction are necessary in the e-learning design and management aspects. It is reported that a learner's satisfaction can be divided into both internal satisfaction caused by intellectual curiosity and self-achievement and external satisfaction caused by rewards and incentives achieved by time and efforts that one invested (Keller & Suzuki, 1988). Thus, it is necessary in curriculum management for learners to gain satisfaction in the learning process where learners flow by achieving intellectual curiosity; to feel external satisfaction through external compensation by grade, reward, or external incentives; and to reflect consistent learning outcomes with invested time and effort.

Sixth, if we practically apply the current research results for the corporate learning environment, we can assume that successful e-learning would be guaranteed by the e-learner's sense of cognitive and teaching presence because the sense of cognitive and teaching presence will increase the learner's flow, satisfaction, and learning persistence, as the current study concluded. We can also expect an increase in return on investment (ROI) due to the employees' performance improvement in their knowledge, skills, and attitude improvement by the successful e-learning. At the same time, we can consider the cost effectiveness of corporate learning by extending e-learning programs rather than off-line training programs.

The limitations of the study and our suggestions for further research studies are as follows. First, the results of this study have limited generalizability: We used 462 participants, all employees of Enterprise A in South Korea, who received an employment insurance refund of the course cost. Future studies should investigate whether different e-learning settings or cyber-universities produce the same results. Second, since we expect that the perceived degree of a sense of cognitive presence differs for individual learners. Further research is needed to investigate various motivational variables rather than simply reflect learner characteristics. Third, we administered the study to reflect corporate e-learning characteristics after removing sense of social presence and focusing on sense of teaching presence and sense of cognitive presence. However, future studies should consider the sense of social presence that learners experience in e-learning environments because successful learning occurs through the integration of the senses of teaching presence, cognitive presence, and social presence. Fourth, the current research examined satisfaction and learning persistence as a learning outcome variable. The current research removed learning achievement from the learning outcome variable. It was hard to decide that learning achievement explains learning outcomes because learners receive the employment insurance refund from Enterprise A only if they give out more than 70% correct answers. However, since achievement is an important variable for measuring learning outcomes, further studies should include achievement as a learning outcome variable. The ultimate purpose of corporate educational training is not a better grade but to improve employees' performance through their application of the knowledge and skills obtained in e-learning. We suggest future research include studies on learning transfer or return on investment.

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