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A Model for Predicting Learning Flow and Achievement in Corporate e-Learning

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ABSTRACT

The primary objective of this study was to investigate the determinants of learning flow and achievement in corporate online training. Self-efficacy, intrinsic value, and test anxiety were selected as learners' motivational factors, while perceived usefulness and ease of use were also selected as learning environmental factors. Learning flow was considered as a mediator of predictors and achievement. Regarding methodological approach, structural equation modeling was employed in order to provide cause-and-effect inferences. The study participants were 248 learners who completed an e-learning courseware at a large Korean company and responded to online surveys. The findings suggested that self-efficacy, intrinsic value, and perceived usefulness and ease of use affected learning flow, while intrinsic value, test anxiety, and perceived usefulness and ease of use were significant predictors of achievement. The results revealed perceived usefulness and ease of use to be the most influential factor for both learning flow and achievement.

Keywords

Corporate e-learning, Self-efficacy, Intrinsic value, Technology acceptance, Learning flow

Introduction

E-learning has been around for more than a decade and has become widely regarded as a viable option for a variety of educational contexts. Especially, it forms the core of numerous business plans, as new technologies provide a new set of tools that can add value to traditional leaning modes, such as accessibility to content, efficient management of courseware and learners, and enhanced delivery channels (Wild, Griggs, & Downing, 2002). In addition to these positive benefits, economic savings have made e-learning a high priority for many corporations (Strother, 2002). Given that as much as 40% of money spent on in-person corporate learning is eaten up by travel cost (Zhang & Nunamaker, 2003), companies using online training can expect plenty of time and cost savings, compared with conventional face-to face training.

Despite the rapid growth of e-learning in the corporate training sector, this quantitative growth has not always guaranteed an equivalent improvement in the quality of learning. Especially, learners participating in online training in a corporate setting are likely to have their own job tasks to perform, which makes it difficult for them to concentrate on the learning itself. Hence, cognitive engagement of learners has drawn keen attention from researchers interested in the learners' experience during online learning as well as the learning outcome (Herrington, Oliver, & Reeves, 2003). More specifically, learning flow has been reported as a construct related to learners' engagement, predicting learning achievement. According to Csikszentmihalyi (1997), learning flow is characterized by complete absorption during learning. In other words, flow is the optimal experience as a mental state of extremely rewarding concentration that emerges in-between frustration and boredom. Flow becomes more important in the e-learning environment where there is no physical limitation in terms of time and space. When the learners do not experience flow, they may produce low engagement throughout learning, or even worse, fail to complete the e-learning (Skadberg & Kimmel, 2004). Considering that learning flow is a potential indicator of online learning achievement, more discussion on flow is necessary to expand our understanding of the phenomenon of corporate e-learning. The primary objective of this study is to investigate the determinants of learning flow and achievement in corporate online training.

Factors related to learning flow: Self-efficacy, intrinsic value, perceived usefulness and ease of use

Based on an extensive review of prior research, self-efficacy, intrinsic value, and perceived usefulness and ease of use of the e-learning program have been identified as critical variables predicting learning flow. Self-efficacy is a belief in one's capabilities to organize and execute the courses of action (Bandura, 1977). Since these beliefs are

determinants of how people think, behave, and feel, they play important roles during the course of learning. Zimmerman and Schunk (1989) described self-efficacy as an important factor that resides within the learner, mediates between cognition and affect, and affects academic performance. The relationship between self-efficacy and learning flow has been reported by previous studies. Meece, Blumenfeld and Hoyle (1988) examined the levels of self-efficacy of 275 fifth and sixth graders in a traditional classroom environment, and divided them into two groups of high and low self-efficacy. The former students showed higher outcome expectation, deeper engagement during learning for a longer period of time, and higher participation. In an online learning environment, Puzziferro (2008) investigated 815 undergraduate-level students' self-efficacy and self-regulated learning skills, and reported that self-efficacy was a significant predictor of learning flow and achievement as well.

Learners' intrinsic value has been identified as another important factor influencing learning flow. Intrinsic value is defined as the enjoyment one gains from doing the task (Wigfield & Cambria, 2010). Intrinsic value has been conceptualized in various ways (e.g., learning vs. performance goals, intrinsic vs. extrinsic orientation, task value, and intrinsic interest), but it essentially refers the reason for doing a task (Pintrich & DeGroot, 1990). When a learner is intrinsically motivated, (s)he is moved to act for the fun or challenge rather than for the external pressures or reward. That is, learners with intrinsic value pursue enjoyment of learning, understanding of new things, and therefore tend to regulate themselves in terms of cognition and behavior (Pintrich & DeGroot, 1990). Since learners in corporate context tend to enroll in e-learning programs on a needs-basis to improve their performance rather than because of external reward, intrinsic value is considered as a better predictor for the learning outcome (Ames & Archer, 1988). Therefore, intrinsic value was included as one of the factors in the present research model. In a previous study by Pintrich and DeGroot (1990), intrinsic value was highly correlated with the level of cognitive engagement of seventh graders in science and English classes. In addition, Wolters (2004), in a study conducted with 525 junior high school students, reported that students' mastery orientation, which means intrinsic value, was a significant predictor of cognitive engagement, when added in a model with other predictors such as prior standardized achievement, gender, performance-approach structure, performance-approach orientation, performance-avoidance orientation, and self-efficacy.

While self-efficacy and intrinsic value are related to learner characteristics, usefulness and ease of use of the online learning programs are considered as important factors for learning. According to Davis (1989), as introduced as the part of the Technology Acceptance Model (TAM), perceived usefulness is defined as the degree to which a person believes that using a particular system will enhance his or her job performance. Perceived ease of use, on the other hand, refers to the degree to which a person believes that using a particular system will be free of effort. In an educational context, the particular system in Davis' definition is substituted for learning program. A body of literature related to perceived usefulness and ease of use reported that the learner's chance of experiencing flow during learning increases as the learners' perceived usefulness and ease of use increase. Chang and Wang (2009) conducted a study to understand users' communication behavior in Computer-Mediated Environments, employing the TAM. The result revealed that flow experience was affected by the perceived ease of use and the interactivity of online communication. Skaberg and Kimmel (2003) conducted a study applying the flow model to empirically evaluate visitors' experience while browsing a web site. As a result, perceived ease of use indirectly affected flow experience, mediated by the interactivity of the web site.

In sum, a review of the literature indicated that learners' self-efficacy, intrinsic value, and their perceived usefulness and ease of use may predict the experience of flow during online learning. Especially, self-efficacy and intrinsic value were suggested together as motivational components of learners' self-regulated learning by Pintrich and DeGroot (1990). In the present study, these two learner variables, along with two external variables, usefulness and ease of use of e-learning program, are formulated as the research hypothesis.

Factors related to achievement: Self-efficacy, intrinsic value, test anxiety, perceived usefulness and ease of use, and learning flow

Among the many variables related to achievement, the following are discussed as meaningful predictors in this study: self-efficacy, intrinsic value, test anxiety, perceived usefulness and ease of use, and learning flow. Self-efficacy has been consistently reported as an influential factor. Judge, Jackson, Shaw, Scott and Rich (2007) conducted a meta-analysis to estimate the contribution of self-efficacy to work-related performance. The results revealed that self-efficacy predicted performance in jobs or tasks of low complexity. Especially, self-efficacy had an

indirect effect on job performance, when mediated by individual personality. Martin (2009), in a large-scale, correlational study on secondary and undergraduate students' motivation in Australia, concluded that self-efficacy significantly correlated to learning achievement. Another study by Gore (2006) reported that undergraduate students' academic self-efficacy was a significant predictor of learning outcomes such as GPA and enrollment status. In a corporate online training context, Joo, Kim and Kim (2008) conducted a study identifying factors affecting learning achievement. After collecting survey data from 1,130 adult learners, they concluded that self-efficacy, along with self-regulated learning skills and task value, predicted achievement significantly.

Previous studies also showed that achievement tends to be predicted by intrinsic value. Since Bloom (1983) claimed that students learn better when they are internally motivated, the role of internal value and/or goal-orientation has been discussed in ample research. Pintrich and DeGroot (1990) conducted a correlational study examining relationships between motivational orientation, self-regulated learning, and classroom academic performance, and concluded that self-efficacy and intrinsic value were positively related to cognitive engagement and performance. More recently, Spinath, Spinath, Harlaar, and Plomin (2006) conducted a study with 1,678 nine-year-old UK elementary school children taking part in the Twins Early Development Study. They reported that students' intrinsic value contributes to the prediction of achievement in mathematics and English.

In addition to self-efficacy and intrinsic value, test anxiety is considered as another motivational factor influencing achievement (Pintrich & DeGroot, 1990). Test anxiety is likely to hinder concentration on performance, as it is defined as the experience of evaluating apprehension during the learning and exam process (Spielberger & Vagg, 1995). Mandler and Sarason (1952) examined the relationship between the level of text anxiety and science test scores of 186 middle school students, and reported that students with higher test anxiety scored lower than the students with lower test anxiety. For adult learners, Cassady and Johnson (2002) conducted a correlational study with 417 undergraduate students, and reported similar results with the level of test anxiety being negatively correlated with achievement scores. Although prior studies do exist in the traditional classroom environment, text anxiety in online learning has not been discussed sufficiently. Based on the framework suggested by Pintrich and DeGroot (1990), who incorporated test anxiety as one of the motivational factors along with self-efficacy and intrinsic value, this study employed test anxiety as a third predictor variable for achievement. Test anxiety is expected to explain students' affective or emotional reactions to the task, which would provide more comprehensive understanding of online learning. The framework of Pintrich and DeGroot (1990) has been recognized as a meaningful model predicting academic performance (Eccles & Wigfield, 2002).

Perceived usefulness and ease of use of the online learning programs, as an external variable, is another influential factor for academic achievement. Johnson, Hornik and Salas (2008) conducted an empirical study to identify factors for successful e-learning in a university-level context. Based on the results of structural equation modeling, the study suggested that perceived usefulness was related to course performance and course satisfaction. Arbaugh and Duray (2002) also reported that perceived usefulness and perceived ease of use in web-based MBA programs were significant predictors of learning outcome as well as learners' satisfaction. These results are not surprising, and have been supported by many researchers (e.g., Liaw, 2008; Roca, Chiu & Martinez, 2006).

Lastly, learning flow has been related with academic achievement in prior research. From a theoretical standpoint, Kiili (2005) developed a participatory multimedia learning model which is rooted in multimedia learning principles and learning flow, and claimed that learning activities requiring less cognitive resources tend to enhance the experience of learning flow, which will eventually produce better academic performance. Several studies have also demonstrated a positive correlation between learners' engagement and achievement-related outcomes for elementary, middle, and high school students (Connell, Spencer, & Aber, 1994; Marks, 2000; Skinner, Wellborn, & Connell, 1990). Nystrand and Gamoran (1991) claimed that substantive engagement (similar to cognitive engagement) in the classroom was positively related to scores on an achievement test developed to measure students' in-depth understanding and synthesis. As such, previous studies have implied that the experience of learning flow would help student focus on learning and demonstrate better achievement, even if the difficulty level of the tasks is quite high.

To summarize, this literature review has suggested that self-efficacy, intrinsic value, test anxiety, perceived usefulness and ease of use, and learning flow might play substantial roles in relation to academic achievement. Hence, these variables were included in the research model, which was formulated as a research hypothesis.

Mediating effect of learning flow

As the research model is conceptualized based on the prior research, learning flow was set as a mediator variable to connect the predictors - self-efficacy, intrinsic value, and perceived usefulness and ease of use - and achievement. Although not many empirical studies examining the mediating effect of learning flow have been conducted, the present study propose that self-efficacy, intrinsic value, and perceived usefulness and ease of use will impact achievement, mediated by learning flow. Theoretically, Baron and Kenny (1986) stated that if A influences B, and B influences C, then there may exist a mediating effect of B between A and C. Therefore, a hypothesis regarding the mediating effect of learning flow has been incorporated into this study.

Purpose of the study and research model

After an extensive literature review, the present researchers found that previous studies investigated either learners' characteristics and motivation or learning environment issues, rather than incorporating these two into a comprehensive model. In addition, methodologically, correlational analysis and multiple regression analysis were most frequently adopted in the prior research (Harroff & Valentine, 2006; Morris, Wu, & Finnegan, 2005), which limits the interpretation of implications. This study intended to provide an integrated view in terms of research variables as well as methodological approach. Regarding research variables, self-efficacy, intrinsic value, and test anxiety were selected as learners' motivational factors, while perceived usefulness and ease of use were also selected as learning environmental factors. Learning flow was considered as a mediator of predictors and achievement. Regarding methodological approach, structural equation modeling was employed in order to provide cause-and-effect inferences.

The purpose of this study was to examine the structural relationships among self-efficacy, intrinsic value, test anxiety, perceived usefulness and ease of use of the e-learning courseware, learning flow and achievement. Representation of the hypothesized model tested in this study is shown in Figure 1.

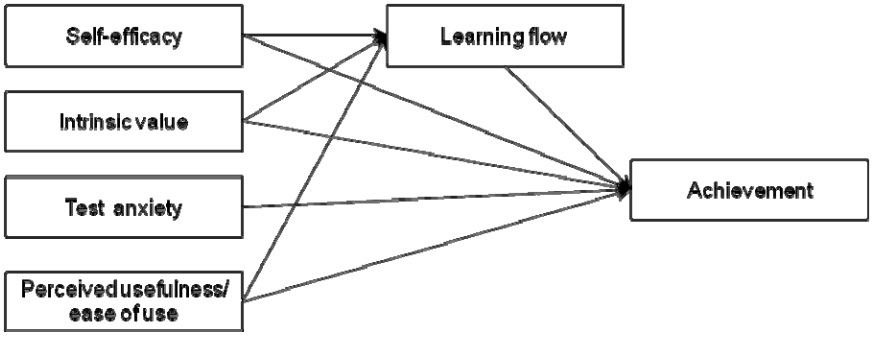

Figure 1. Hypothesized research model

This hypothetical model, derived from the literature review, was used to test the following hypotheses:

Hypothesis 1: Self-efficacy, intrinsic value, perceived usefulness and ease of use have positive effects on learning flow in the corporate e-learning environment.

Hypothesis 2: Self-efficacy, intrinsic value, test anxiety, perceived usefulness and ease of use, and learning flow have positive effects on achievement in the corporate e-learning environment.

Hypothesis 3: Learning flow has a mediating effect between predicting variables and achievement in the corporate e-learning environment.

Methodology

Participants

Participants in this study were the learners who were enrolled in e-learning programs in October 2009 at a large company in Korea. This company, running 30 sister-companies and 130 foreign branches, was selected because of its twelve-year history of implementing job-task-related e-learning courseware across the organization, which was expected to minimize the novelty effect of e-learning interventions to the learners. In addition, it was possible to examine the factors affecting the learning outcomes, since the learners shared an identical course registration system, learning management system, and evaluation criteria (Shea, Li, & Pickett, 2006). Two different surveys were administered for this study, with 326 and 271 learners responding to each. Of the 263 learners who responded to both surveys, 15 were eliminated due to incomplete responses. As a result, the study analysis was based on the remaining 248 usable responses. Demographically, there were more males than females (86.7% male, 13.3% female), and their age ranged from 23 to 58 (19.0% in their twenties, 52.8% in their thirties, 25.0% in their forties, and 3.2% in their fifties).

Measurement instruments

Several instruments, used or adapted from a variety of existing instruments, provided the study data. Table 1 presents the original sources, number of items implemented, and Cronbach's alpha calculated after modification to suit the research context.

Table 1. List of Measurement Instruments

Variables	Cronbach's alpha	# of items	Source
Self-efficacy	.90	9	Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich & DeGroot, 1990)
Intrinsic value	.89	9	
Test anxiety	.87	4	
Perceived usefulness and ease of use - Usefulness - ease of use	 .90 .81	 4 4	Technology Acceptance Model (TAM) (Davis, 1989)
Learning flow	.92	9	Flow State Scale (FSS) (Jackson & Marsh, 1996)

The instruments measuring self-efficacy, intrinsic value, and test anxiety were adopted from the Motivated Strategies for Learning Questionnaire (MSLQ) developed by Pintrich and DeGroot (1990). In order to assess *self-efficacy*, a 9-item, 5-point Likert scale was used, with 1 indicating 'strongly disagree' and 5 'strongly agree.' Sample items are 'I'm certain I can understand the ideas taught in this course' and 'Compared with others in this class, I think I'm a good student.' Cronbach's alpha from the present data was .90. Also, the construct reliability was .87, and the average variance extracted (AVE) was .92, demonstrating good convergent validity and discriminant validity. The instrument measuring *intrinsic value* consisted of 9 items using a 5-point Likert scale. Sample items are 'It is important for me to learn what is being taught in this class' and 'Even when I do poorly on a test I try to learn from my mistakes.' Cronbach's alpha from the present data was .89. The construct reliability and AVE were .97 and .94, respectively. *Test anxiety* was measured using a 4-item, 5-point Likert scale. A sample item is 'I am so nervous during a test that I cannot remember facts I have learned,' and the Cronbach's alpha from the present data was .87. The construct reliability and AVE were .89 and .80, respectively.

TAM suggested by Davis (1989) was employed to measure *perceived usefulness and ease of use* of the e-learning courseware. The instrument originally developed by Davis (1989) was translated into Korean by the present researchers and reviewed by two experts in educational technology field. There were 4 items for usefulness, and another 4 for ease of use. Sample items are 'This e-learning courseware improved my job performance' and 'Learning to use the e-learning courseware was easy for me'. Cronbach's alpha for perceived usefulness and perceived ease of use were .90 and .81, respectively. The construct reliability and AVE were .92 and .86, respectively, demonstrating good convergent validity and discriminant validity.

The instrument used to measure *learning flow* for this study was the Flow State Scale (FSS), which was originally developed by Jackson and Marsh (1996), and subsequently validated by Martin and Jackson (2008). Nine items on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree), were included in the instrument. A sample item is 'I am not concerned with what others think while I study.' Cronbach's alpha from the present data was .92. The construct reliability was .95, and the AVE was .91.

Achievement was measured by the scores from the final exam, consisting of 20 closed-ended items, which were randomly selected from the item pool. Learners were allowed to submit their answers only once. The possible achievement ranged from 0 to 60.

Data collection

Two online surveys were administered in order to analyze structural relationships among self-efficacy, intrinsic value, test anxiety, perceived usefulness and ease of use, learning flow, and achievement in corporate online learning. The first survey, collecting data related to self-efficacy, intrinsic value and test anxiety, was distributed during the first week of the program. The second survey, measuring perceived usefulness and ease of use, and learning flow, was delivered in the last week of the program. Achievement scores were collected from the database of the learning management system.

Data analysis

The hypothesized research model illustrated in Figure 1 was specified as the statistical model using latent variables (see Figure 2). Item parcels were used to minimize any possible overweight on a particular variable in the model, given that self-efficacy, intrinsic value, test anxiety, and learning flow are unidimensional factors. A parcel can be defined as an aggregate-level indicator comprised of the sum or average of two or more items (Kishton & Widamn, 1994), which is likely to reduce measurement error by using fewer observed variables and to ensure the assumption of multivariate normality (Bandalos, 2002; Sass & Smith, 2006). Multivariate normality was checked using AMOS 6.0 by observing the skewness and degree of kurtosis for all the measured variables together. Since each variable was normally distributed, maximum likelihood estimation was selected as an appropriate statistical estimation method. The goodness of fit indices used for this study were the minimum sample discrepancy (CMIN), Tucker-Lewis index (TLI), comparative fit index (CFI), and root-mean-square error of approximation (RMSEA), and the direct effects among the variables were tested at the significance level of .05.

Results

Descriptive statistics and correlations among the variables

The means, standard deviations, skewness and kurtosis for all the measured variables were analyzed together to check the normality assumption. The ranges of these statistics were 2.56 to 33.75, .50 to .10.15, .03 to .71 (absolute values), and .01 to 3.34, respectively (See Table 2). According to Kline (2005), absolute skewness values less than 3 and absolute kurtosis values less than 10 meet the assumption of the multivariate normal distribution of the data for structural equation modeling. Correlations were also examined to check the strength of the relationships among the variables of interest, and the results revealed significant correlations among all of the variables at the alpha level of .05 (see Table 2).

Table 2. Means, standard deviations and correlation coefficients

Variables	1	2	3	4	5	6	7	8	9	10	11
1. Self-efficacy 1	1										
2. Self-efficacy 2	.78*	1									
3. Intrinsic value 1	.63*	.61*	1								
4. Intrinsic value 2	.60*	.56*	.78*	1							
5. Test anxiety 1	-.30*	-.30*	-.29*	-.26*	1						
6. Test anxiety 2	-.35*	-.29*	-.33*	-.33*	.75*	1					

7. Perceived usefulness	.46*	.47*	.50*	.43*	-.20*	-.22*	1				
8. Perceived ease of use	.40*	.43*	.42*	.40*	-.15*	-.20*	.79*	1			
9. Learning flow 1	.31*	.32*	.37*	.28*	-.16*	-.18*	.58*	.48*	1		
10. Learning flow 2	.30*	.32*	.31*	.22*	-.17*	-.16*	.47*	.36*	.73*	1	
11. Achievement	.21*	.18*	.28*	.29*	-.18*	-.24*	.28*	.20*	.28*	.25*	1
M	4.02	3.75	4.10	4.10	2.56	2.64	3.87	3.81	3.88	3.80	33.75
SD	.56	.54	.51	.50	.88	.88	.62	.65	.69	.71	10.15
Skewness	.03	.28	-.17	.08	.04	.03	-.13	.11	-.34	-.49	-.71
Kurtosis	-.34	.30	.18	-.05	-.26	-.25	.01	-.51	.38	.25	3.34
n	248	248	248	248	248	248	248	248	248	248	248

*p<.05

Assessment of measurement model

Based on the result of maximum likelihood estimation, Table 3 shows the goodness of fit indices for the *a priori* measurement model, indicating that the measurement model exhibited a good fit with the data collected (e.g., RMSEA=.000).

Table 3. Fit statistics for the measurement model

	CMIN (χ^2)	p	df	TLI	CFI	RMSEA (90% confidence interval)
Measurement model	22.19	.625	25	1.003	1.000	.000 (.000～.044)

Note a: n=248

Note b: df = degree of freedom; TLI = Tucker-Lewis index; CFI = comparative fit index; RMSEA = root-mean-square error of approximation.

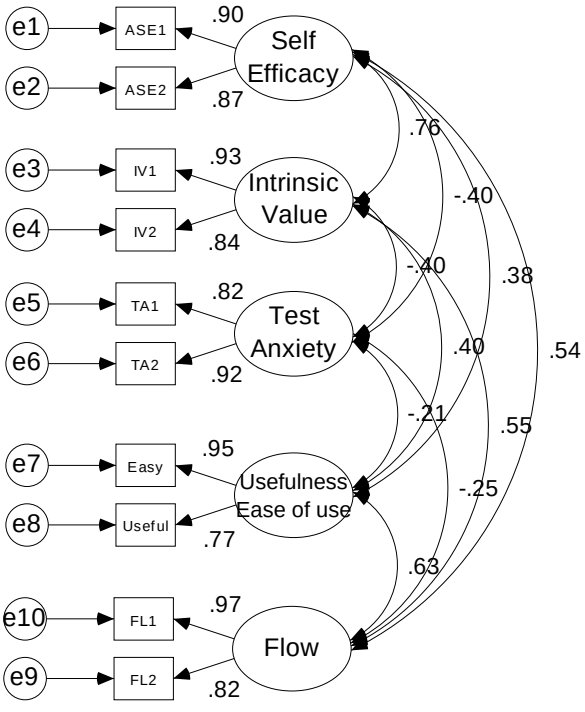

Figure 2. Result of confirmatory factor analysis

According to Figure 2, the factor loadings ranged from .77 to .97, indicating the adequate validity of all the factors in the measurement model since all the loadings were greater than .50 (Hair, Anderson, Tatham, & Black, 1992). In

addition, the cross-loadings of the variables ranged from -.21 to .76, confirming that all constructs in the estimated model fulfilled the condition of convergent, as well as discriminant, validity. Therefore, the measurement model appeared to fit the data well and did not need to be changed.

Structural model and hypothesis testing

The proposed relationships were analyzed, as shown in Table 4, and the initial structural model provided a good fit to the data (e.g., TLI= 1.005; CFI= 1.000; RMSEA= .000(.000～.038)).

Table 4. Fit statistics for the structural model

	CMIN (χ^2)	p	df	TLI	CFI	RMSEA (90% confidence interval)
Structural model	26.51	.696	31	1.005	1.000	.000 (.000~.038)

Note: n=248

In order to test the hypothesis, direct effects among self-efficacy, intrinsic value, test anxiety, perceived usefulness and ease of use, learning flow, and achievement were examined at the alpha level of .05, by reviewing the β weights. First, the effects of self-efficacy, intrinsic value, and perceived usefulness and ease of use on learning flow were investigated. The effect of self-efficacy on learning flow was β=.205 (t= 2.203, p<.05), and the effect of intrinsic value on learning flow was β =.204 (t= 2.174, p<.05). The effect of perceived usefulness and ease of use on learning flow was examined as β =.466 (t= 7.565, p<.05). Second, the effects of self-efficacy, intrinsic value, test anxiety, perceived usefulness and ease of use, and learning flow on the achievement were investigated. The effect of self-efficacy on achievement was β =-.122 (t= -1.038, p>.05), while the effect of intrinsic value on achievement was β =.232 (t= 1.983, p<.05), the effect of test anxiety was β =-.152 (t= -2.122, p<.05), and the effect of perceived usefulness and ease of use was β =.171(t= 2.036, p<.05). Lastly, the effect of learning flow on achievement was β =.078(t= .842, p>.05). To summarize, all of the direct effects were statistically significant other than the effects of self-efficacy and learning flow on achievement. Hence, the two insignificant path coefficients, "self-efficacy→achievement" and "learning flow→achievement", were removed from the structural model to keep the model concise, as shown in Figure 3.

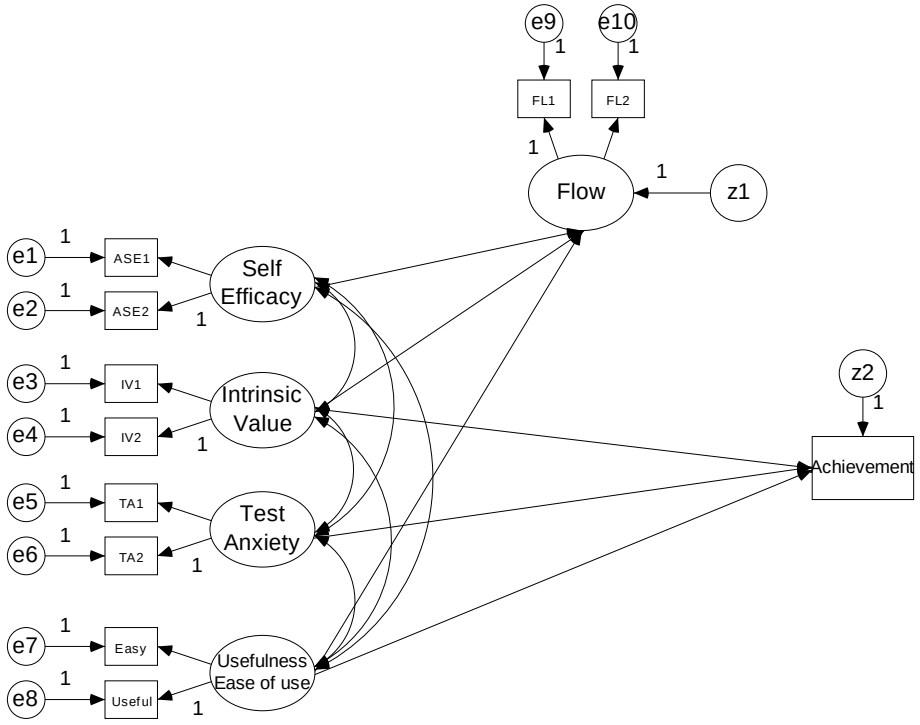

Figure 3. Modified structural model

As the original and modified models were in a hierarchical relationship, chi-square statistic was used to examine the statistical difference between the two models. The absence of any significant difference between the two models in terms of the goodness of fit (χ^2_D=5.06, p=.08) confirmed the modified structural model as the final research model. Table 5 presents the goodness of fit indices for the modified model, indicating that the model exhibited a good fit (TLI=1.006; CFI=1.000; RMSEA=.000). Although the CMIN value of the modified structural model was 1.52 larger than that of the initially hypothesized model, the difference was not significant as mentioned above. The standardized path coefficients of the modified model are shown in Figure 4.

Table 5. Fit statistics for the structural model (modified)

	CMIN (χ^2)	p	df	TLI	CFI	RMSEA (90% confidence interval)
Structural model (modified)	28.03	.713	33	1.006	1.000	.000 (.000~.036)
Hypothesized model	26.51	.696	31	1.005	1.000	.000 (.000~.038)

Note: n=248

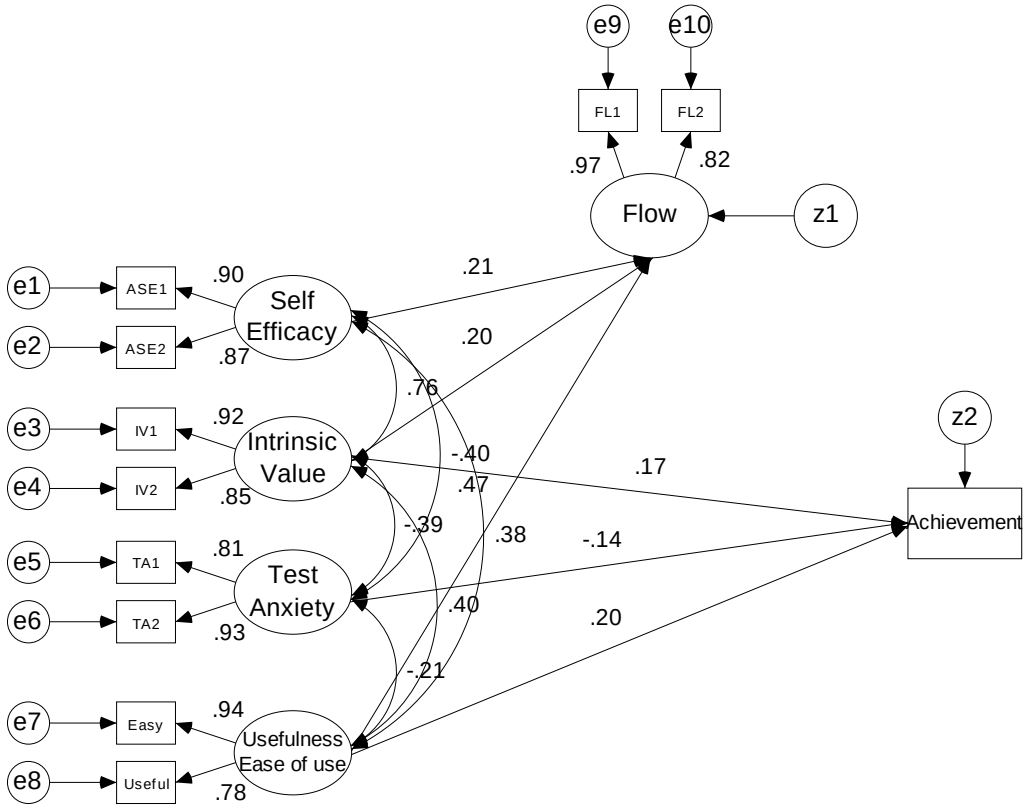

Figure 4. Modified model with standardized path coefficients

The direct effects among the variables included in the modified model were tested (See Table 6). First, the effects of self-efficacy, intrinsic value, and perceived usefulness and ease of use on learning flow were investigated respectively. The effect of self-efficacy on learning flow was β =.205(t= 2.216, p<.05), and the effect of intrinsic value on learning flow was β =.204(t= 2.191, p<.05). The effect of perceived usefulness and ease of use on learning flow was examined as β =.468(t= 7.581, p<.05). Second, the effects of intrinsic value, test anxiety, and perceived usefulness and ease of use on the achievement were investigated. The effect of intrinsic value on achievement was β =.168(t= 2.237, p<.05), the effect of test anxiety was β =-.140(t= -1.980, p<.05), and the effect of perceived usefulness and ease of use was β =.204(t= 2.918, p<.05). The results indicated that self-efficacy, intrinsic value, and perceived usefulness and ease of use had significant effects on learning flow, thereby supporting the first hypothesis. The second hypothesis was partly supported by the result, since intrinsic value, test anxiety, and perceived usefulness

and ease of use had significant effects on achievement. Among these, perceived usefulness and ease of use had a relatively larger effect on learning flow and achievement as well. The third hypothesis was rejected, as the effect of learning flow on achievement was not statistically significant.

Table 6. Effect decomposition for the modified model

Direct effects			Unstandardized Coefficient (B)	Standardized Coefficient(β)	Estimation error	t	p
Learning flow	←	self-efficacy	.265	.205	.119	2.216	.027*
	←	intrinsic value	.292	.204	.133	2.191	.028*
	←	perceived usefulness and ease of use	.512	.468	.068	7.581	.001*
Achievement	←	intrinsic value	4.037	.168	1.805	2.237	.025*
	←	test anxiety	-1.733	-.140	.875	-1.980	.048*
	←	perceived usefulness and ease of use	3.750	.204	1.285	2.918	.004*

*p<.05

Discussion

The structural relationships among self-efficacy, intrinsic value, test anxiety, perceived usefulness and ease of use, learning flow and achievement were analyzed in this study. First, self-efficacy, intrinsic value, and perceived usefulness and ease of use had statistically significant direct effects on learning flow. This indicates that learners are likely to experience flow during learning when they have higher self-efficacy and intrinsic value, and when they perceive the e-learning courseware to be useful and easy to use. Regarding the effect of self-efficacy on learning flow, the result supports the previous study by Puzziferro (2008) who claimed that self-efficacy predicted learning flow and performance. In terms of the effect of intrinsic value on learning flow, the result is consistent with the claim made by Pintrich and DeGroot (1990) and by Miltiadou and Savenye (2003) that learners' intrinsic value is one of the powerful predictors of learning. Also, the positive effect of perceived usefulness and ease of use on learning flow echoes the suggestions made by Johnson and colleagues (2008) for creating successful online learning environment, and by Harroff and Valentine (2006), who indicated that the message design of online learning contents influences the learners' learning flow.

Second, intrinsic value, test anxiety, and perceived usefulness and ease of use had statistically significant direct effects on achievement. This result is consistent with that reported in a previous study by Miltiadou and Savenye (2003). Also, test anxiety appeared to have a negative relationship with achievement, as reported by Cassady and Johnson (2002), and Kleijn et al. (1994). The result related to perceived usefulness and ease of use supports the claim made by Shin (2006) who demonstrated that both of perceived usefulness and perceived ease of use influence learners' achievement. Johnson and colleagues (2008) also suggested that perceived usefulness is a significant predictor of learners' satisfaction and achievement.

However, contrary to the previous studies, self-efficacy and learning flow failed to predict achievement. For example, Puzziferro (2008) reported that self-efficacy was a significant predictor of achievement for freshmen in online university, and Pajares (1996) also claimed that self-efficacy, as much as individual learning capability, was a critical factor for learning. The present researchers noticed that the previous studies only examined motivational factors, and excluded external factors such as usefulness and ease of use of the learning program. In other words, although self-efficacy was a significant predictor in a model without external variables, the result may differ when factors other than learner characteristics are added to the model.

Third, the result indicated that learning flow was not a meaningful predictor of achievement, which is not consistent with the results from the prior research that reported learning flow as an influential factor for learning outcome (Kim, 2005; Nystrand & Gamoran, 1991; Seok, 2008). This finding may be partially attributed to the study context. For example, Seok (2008) recruited elementary school students, while Kim (2005) worked with undergraduate and graduate-level students. Given that the present study was conducted in a corporate setting where the learners had to

continue performing their own job-tasks and could not focus exclusively on the learning itself, the analysis of learning flow may need to follow a different approach in this context.

Conclusion

The purpose of this study was to investigate the direct effects of self-efficacy, intrinsic value, test anxiety, and perceived usefulness and ease of use on learning flow and achievement in corporate e-learning. In addition, the indirect effects of self-efficacy, intrinsic value, test anxiety, and perceived usefulness and ease of use on achievement, as mediated by learning flow, were also examined. The findings suggested that self-efficacy, intrinsic value, and perceived usefulness and ease of use affected learning flow, while intrinsic value, test anxiety, and perceived usefulness and ease of use were significant predictors of achievement. The results revealed perceived usefulness and ease of use to be the most influential factor for both learning flow and achievement. This suggests that instructors and instructional designers need to employ strategies that increase learners' self-efficacy and intrinsic motivation in order to facilitate learning flow. To improve academic achievement by providing internal motivation to the learners, learning tasks should be designed so that they are relevant and valuable to learners. Most of all, the design of the learning environment should be centered around learners so that every feature and function of the online system is useful and easy to use.

Finally, four implications for further research to broaden the understanding and address the study limitations are presented. First, the role of self-efficacy in a comprehensive model incorporating both learner characteristics and external factors should be re-examined to confirm the present study results. Second, learning flow in a variety of research contexts should be investigated. As reported in this study, learning flow in a corporate setting may have a different function compared to that in an academic setting. Third, the measurement of learning flow needs to be elaborated in further research. Since the self-reporting instrument used in this study may not reflect the actual level of immersive learning experience, observation or interview should be performed to increase the robustness of the methodology. Lastly, the present study results can only be applied to the Korean corporate e-learning setting. In order to generalize the model, future study should included samples selected from other countries or various learning contexts.

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