The effects of computer self-efficacy, self-regulated learning strategy, and LMS quality on e-learner's satisfaction[†]

(이러닝 학습자 만족에 영향을 미치는 컴퓨터 자기 효능감, 자기 조절 효능감 및 LMS 품질)

이종기[*]

(Jong Ki Lee)

요 약 Sloan 컨소시엄 2004에 의하면 원격교육이 고등 교육 분야에서 빠르게 성장하는 분야이다. 본 연구는 정보시스템 성공모델에 기초하여, 학습관리시스템에 대한 만족과 함께 이러닝 학습자 특성과 관련된 요인을 중심한 연구로서, 이러닝 학습자의 자기조절 학습 전략과 학습자의 컴퓨터 자기 효능감에 초점을 맞춘 연구이다. 학습자의 학습관리시스템 만족과 관련한 요인은 시스템 품질, 학습 컨텐츠 품질, 학습자와 교수자간의 서비스 품질로 구성하였다. 실증분석의 결과 이러닝의 학습관리시스템 만족과 관련하여 인지된 유용성, 인지된 사용용이성 및 서비스품질이 주요 요인으로 나타났고, 학습자 스스로의 자기조절학습 전략과 컴퓨터 자기 효능감 역시 이러닝 만족에 영향을 미치는 중요 요인임을 증명되었다.

핵심주제어 : 이러닝, 학습관리시스템, 자기조절학습전략, 컴퓨터 자기효능감. 이러닝 사용자 만족

Abstract According to the 2004 Sloan Consortium Report, distance education is the fastest growing sector of higher education. This study suggests a research model, based on an e-Learning success model, the relationship of the e-learner's self-regulated learning strategy, computer self-efficacy, and system quality perception of the e-Learning environment. As a result, perceived usefulness, perceived ease of use, and service quality effect on e-lerner's satisfaction. In addition to, self-regulated learning strategy based on computer self-efficacy is also important variable regarding e-learner's satisfaction.

Key Words : e-Learning, LMS, self-regulated learning strategy, computer self-efficacy

1. Introduction

The Sloan Consortium Online Learning Survey Report [27] showed that online learning is at historically high levels and has not reached a plateau in its growth annual rate of approximately 20%. The report also revealed that a majority of institutions of higher education say online learning is just as good as traditional classroom instruction, and it is believed that online learning will experience the same relative improvements as compared to face-to-face instruction over the next three

years.

The tendency of educational engineering in introducing theoretical variables explaining e-Learning effectiveness has been insufficient, except for a few information systems [i.e., 23; 17].

Moreover, this approach of putting together information systems and educational engineering is rarely observed.

This research investigates the theoretical background of pedagogical e-Learning. It closely examines the relationship between information systems success models and e-Learning, and it suggests and verifies new research models that assess or evaluate e-Learning effectiveness based on models of educational engineering variables and information systems, which will be verified theoretically or empirically.

2. Theoretical background

2.1 Computer self-efficacy and self-regulated learning strategy

Computer self-efficacy means one's perception of their computer skills about computer use [8]. Also, it is defined as self assessment regarding one's computer skills [29].

Computer self-efficacy is related more to computer management ability for a particular task than to partial computer skills in information technology [8]. For example, it is likely that the use of spreadsheet to data analysis, means that one can use e-Learning systems for educational purposes [19]. In addition, Thatcher & Pamela [28] reported that personal innovativeness in IT will be positively related to computer self-efficacy.

A learner's independent assessment of self-regulated learning ability is called self-regulatory efficacy [SRE; 6]. According to

the cognitive psychology theory, SRE is the efficacy of well performed, self-regulatory mechanisms such as self-observation, self-judgment, self-response [4].

Confidence promotes learning performance by promoting individual goals in traditional education psychology [5]. Self-directed learning [SDL] is a very important concept for web-based instruction. Learning performance in teaching SDL is possibly lower than the cramming educational style that is based on objectivist educational philosophy. The teacher in SDL remains available as an assistant and guide, not as a unilateral knowledge source and messenger.

According to educational engineering theory, self-regulated learning is required for academic performance in SDL.

Self-regulatory efficacy is closely related to a learner's intended effort for learning subjects [9]: it is a systematic management process that is in connection with one's own thoughts, emotions, and behavior regarding one's personal goals and achievements [25]. According to SRE, the learners use the strategic relationship between self-regulation learning in reaching their chosen self-learning goal: to develop, revise, and complement the learning strategy via self feedback. The learner must make a constant effort to sustain learning motivation [31]. A lack of learning strategy is one of the important variables that explains why learners have difficulty [3].

In e-Learning, many researches have confirmed that the themes of a related learner are a key factors regarding academic achievement and satisfaction levels [21]. E-Learning strategy is needed for self-directed learning and self-directed learning is needed for instructional design strategy, goals, based on self-directed learning.

2.2 The relationship between service quality, information quality, and LMS quality

The effects of e-Learning are measured with an ISS model. Because it is also part of an information system. The e-Learning success [ELS: 19] model evaluates e-Learning effectiveness based on the information systems success [ISS] model, including constructivism and self-regulatory efficacy.

The learning management system [LMS] is applicable to information process system that understand learning content and the supports all sorts of matters related to learning. Learning content is the product created through the LMS in the ELS model. The interaction between teacher and students via correspondence is applicable to the human service process in the ELS model [19].

For students, the LMS can be a critical factor in e-learner satisfaction, by offering subjects through e-Learning. This is because e-Learning can be conducted through a variety of methods and offers unique forms for each and every lesson.

E-Learning is similar to traditional brick-and-mortar education in that classroom and educational facilities transfer learning content , but the effect on learner satisfaction is not related to attending lectures of a given subject [19].

Learning content has different qualities according to each teacher's and producer's ability or character. Therefore, learning content is a critical factor, and direct assessment factor for learner's satisfaction, unlike the system quality.

It is similar logic that direct factors decide learner satisfaction in the case of offline learning content. Learner can request human services to resolve a difficulty, an inconvenience or a technical problem that can be generated when using a system because the LMS is one of many information systems.

Therefore, every e-Learning organization should have a department that can resolve technical problems and sustain management separately [19].

Learners, as users, appeal to the teacher even for support with technical problems such as using the LMS, in addition to guidance and help about the learning content.

Therefore, the teacher's service quality plays a more important role than staff's service quality in the general information system department. This is similar to the situation between service staff and a head cook who prepares food. Generally, guest confronts the staff with their problems and the staff resolves it [19].

3. Research model and hypothesis

3.1 Research model

The research model, which is presented in this paper, is shown in (Figure 1). It is a modified information systems success model, our model considers an information system's attributes self-regulated learning attributes, and supports education engineering in e-Learning.

LMS quality is composed of independent variables, perceived usefulness and perceived ease of use of the LMS, satisfaction of learning content, and interaction between teacher and learner. The important variable is SRS. This is based on e-learner's computer self-efficacy that is self assessment about self-efficacy, and computer usage offered by e-Learning.

The dependent variable is the learner's satisfaction after experiencing e-Learning.

3.2 Hypothesis

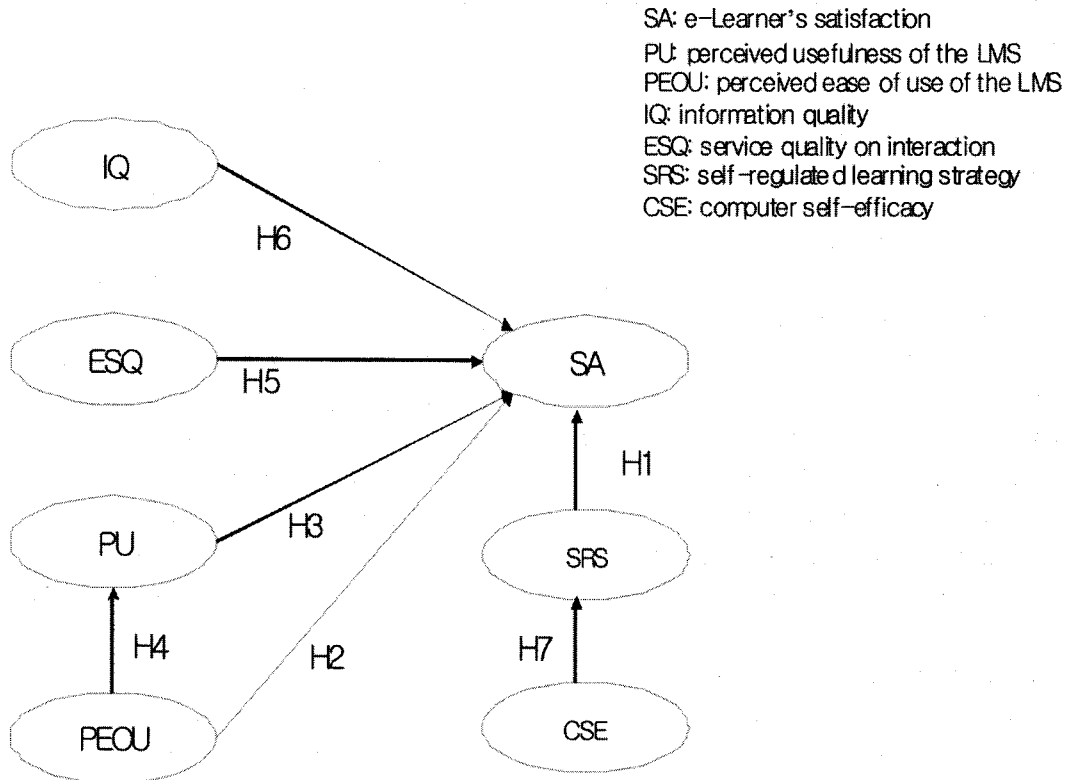### 3.2.1 The ISS model and self-regulated learning strategy

According to the consumer behavior theory, satisfaction is measured through a customer's response regarding fulfillment, and judgment concerning product or service. Satisfaction also includes fulfillment of one's performance [22]. For judgment, fulfillment of one's performance is reference with which to be compared with standard. References are needed in order to compare with results or outcomes so as to judge satisfaction [1].

In the information system view, consumers or customers of consumer behavior theory view, system users are users who use the system directly, unless they have a technical background [13]. Similar to consumer behavior theory, end user satisfaction is the user's attitude towards the specific computer application system they utilized [14], or their level of satisfaction is justified by a perceived and emotional assessment regarding of fulfillment level concerning experienced performance via the information system [1].

E-Learning is also regarded as an information system. E-Learning satisfaction should correlate with end user based on information system satisfaction. Learning is compared with an offline course. Satisfaction for e-Learning and assessment of the information system are compared with consumer behavior theory.

Traditionally, in the field of information systems, it has been assumed that user information system satisfaction obtained higher performance than unsatisfied users [2]. For

SA: e-Learner's satisfaction
PU: perceived usefulness of the LMS
PEOU: perceived ease of use of the LMS
IQ: information quality
ESQ: service quality on interaction
SRS: self-regulated learning strategy
CSE: computer self-efficacy

(Figure 1) Research model

instance, according to the research of Gatian [15], there is a powerful relationship among user satisfaction, decision making performance and also, in the information systems success model of DeLone and McLean [13], satisfaction was an effective variable regarding working efficiency or at the decision-making level.

It is inferred that for e-Learning, a learner's satisfaction will be positively related to academic performance. In self-regulated learning, the learner uses the strategic relationship between self-regulation learning in order to reach his chosen self learning goal, and to develop, revise, and complement the learning strategy via self feedback.

The learner must make a constant effort to sustain learning motivation [31]. SRE's higher level learners will be concerned with the substance and quality of the learning content more than that of the SRE's lower level learners. SRE's lower level learners will be interested in easily accessible information and focused understanding. SRE's lower level learners will have a preference to understand methods about given learning content [19].

According to Thatcher and Pamela [28], personal innovativeness in information technology affects computer self-efficacy.

Regarding these points of view, I put forth the following hypotheses:

Hypothesis-1[H1]: A learner's self-regulated learning strategy in e-Learning will be positively related to satisfaction.

Hypothesis-7[H7]: A learner's computer self-efficacy will be positively related to self-regulated learning strategy in e-Learning.

3.2.2 Quality of e-Learning environment

According to the information systems success model, system quality measures the information system process itself and its effects on user satisfaction [13]. System quality implies the accuracy and efficiency of a system, according to a communication theory based, information systems success model [13].

Regarding an information system theory, system quality is the judgment of the user in dealing with a system familiarly and easily [14; 24]. It is acknowledged that system quality in an information systems success model can be substituted for ease of use [26; 24].

Perceived ease of use can be justified as the perception of how much effort is used, as an important variable in information system attitudes [10; 11].

The LMS is one of many information systems used by learners. The perceived ease of use for the LMS affects satisfaction with an e-learning environment includes the LMS.

E-Learning environment satisfaction includes the LMS, learning content, and service quality of interaction. Satisfaction can be estimated by perceived usefulness and perceived ease of use. Therefore, I suggest the following hypotheses:

Hypothesis-2[H2]: A learner's perceived ease of use regarding the learning management system will be positively related to an e-Learner's satisfaction.

Hypothesis-3[H3]: A learner's perceived usefulness regarding the learning management system will be positively related to an e-Learner's satisfaction.

Hypothesis-4[H4]: A learner's perceived ease of use regarding the learning management system will be positively related to the learner's perceived usefulness regarding the learning management system.

Hypothesis-5[H5]: A learner's assessment of the service quality of interaction between professor and learner will be positively related to an e-Learner's satisfaction.

Hypothesis-6[H6]: A learner's assessment regarding information quality will be positively

related to an e-Learner's satisfaction.

4. Data analysis and results

All students enrolled in one of three e-learning courses at Daegu University participated in the analysis questionnaire. Two-hundred and thirty [230] students completed the analysis questionnaire. The PLS Graph 3.0 software, modified by Chin [7], was used as the analysis tool.

I used the following measurement tools for this study:

For perceived ease of use and usefulness of

by Davis et al. [11].

In the case of information quality for learning content, I used 3 items suggested by Lee et al.[20]. In the case of service quality, I used 6 items suggested by Kettinger and Lee [18]. For computer self-efficacy, I used 4 items suggested by Compeau and Higgins [8]. Regarding e-Learning satisfaction, I used 2 items suggested by Wang [30]. For all analyses, I used a 5-point Likert scale.

Construct reliability is proven as shown in <Table 1>.

The suggested measure model is estimated as a good discriminant validity because the AVE

<Table 1> The convergent validity analysis

Construct	Item	Factor loading	Composite reliability	AVE	Cronbach's alpha
ESQ	ESQ1	0.914	0.872	0.538	0.898
	ESQ2	0.787			
	ESQ3	0.723			
	ESQ4	0.722			
	ESQ5	0.684			
	ESQ6	0.509			
IQ	IQ1	0.854	0.847	0.650	0.738
	IQ2	0.832			
	IQ3	0.726			
PU	PU1	0.897	0.866	0.570	0.865
	PU2	0.852			
	PU3	0.757			
	PU4	0.641			
	PU5	0.579			
CSE	CSE1	0.935	0.872	0.635	0.915
	CSE2	0.850			
	CSE3	0.727			
	CSE4	0.644			
SRS	SRS1	0.887	0.787	0.557	0.879
	SRS2	0.688			
	SRS3	0.641			
SA	SA1	0.882	0.807	0.678	0.530
	SA2	0.761			
PEOU	PEOU1	0.963	0.897	0.814	0.794
	PEOU2	0.838			

the LMS, I used 2 and 5 edited items suggested

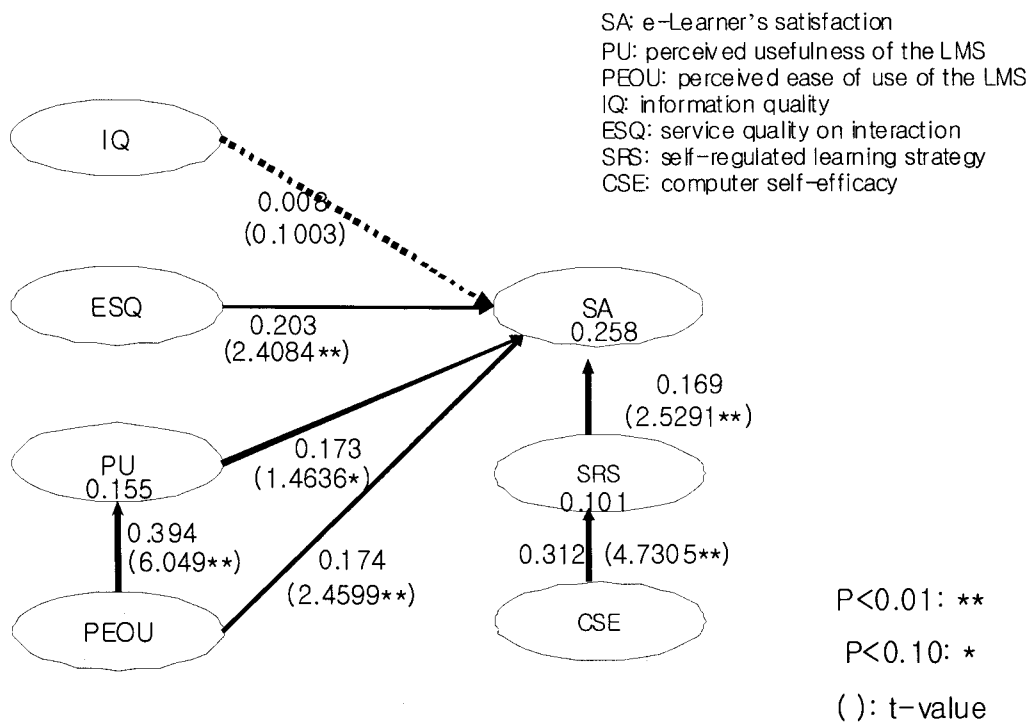<Table 2> The correlation coefficient of construct and AVE

	IQ	ESQ	PU	PEOU	CSE	SRS	SA
IQ	0.650						
ESQ	0.402	0.538					
PU	0.452	0.314	0.570				
PEOU	0.329	0.342	0.394	0.814			
CSE	0.177	0.321	0.184	0.138	0.635		
SRS	0.378	0.357	0.272	0.242	0.312	0.557	
SA	0.289	0.380	0.354	0.354	0.083	0.333	0.678
MEAN	3.2261	3.7348	3.1339	4.0326	3.1174	3.4283	3.6217
VAR	0.9378	1.0998	0.7685	0.9872	1.1799	0.9215	1.2138

Symmetrical value is square root of AVE

value is higher than the correlation coefficient of other constructs as shown in <Table 2>.

All hypotheses are accepted with the exception of H6 [IQ→SA]. (Figure 2) shows all analysis values.

The reason for the H6 [IQ→SA] rejection is explained through the survey of many learner's traits. Generally, learners are not used to judge the consistency with which learning content agrees with a self-purposed learning context. Repeatedly, learners would memorize and understand

SA: e-Learner's satisfaction
PU: perceived usefulness of the LMS
PEOU: perceived ease of use of the LMS
IQ: information quality
ESQ: service quality on interaction
SRS: self-regulated learning strategy
CSE: computer self-efficacy

<Figure 2> Result of PLS analysis

transferred knowledge from a professor and they would show a tendency toward critical learning content respectfully because of the professor's authority.

The reason for the path coefficient of H2 [PEOU→SA], H3 [PU→SA] is explained through the use of the LMS, which promotes an extrinsic motivation. Extrinsic motivation is a behavioral response which corresponds to accomplishing one's objective or making reward through mastery of an activity. On the other hand, intrinsic motivation is a behavioral response that corresponds with the behavior itself [12].

According to Gefen and Straub [16], it is known that perceived ease of use has a lower effect on the purpose of information systems, and it is not an intrinsic motivation.

The reason for information systems use regarding extrinsic motivation concerns the learning method through the LMS, rather than learning itself.

5. Conclusions

In this paper, I have reported findings from a large cross-sectional study involving the LMS, computer self-efficacy, and self-regulated learning strategies.

First, I suggested a model that measures e-Learning effectiveness and decided an interdisciplinary method was needed, one that was in view of web based information systems, constructivism education philosophy, as well as service management theory-related learning.

This study suggested a theory model of assessment regarding learning environmental satisfaction offered by e-Learning, based on the ISS model, with the adoption of a self regulated learning strategy.

Second, a learner's self-regulatory learning

strategy is a very important variable related to e-Learner's satisfaction. Furthermore, a learner's computer self-efficacy is also a very critical component too.

Third, e-Learner's satisfaction requires quality of interaction assessments. Many researchers have emphasized the importance of interaction or the quantitative side of interaction, but they did not consider how to use it. That is, they did not emphasize the assessment method for quality of interaction. This has a significant effect on learner's satisfaction, as was shown in this study.

This study stresses the importance of qualitative assessment and interaction through the LMS.

Finally, system quality, that is perceived usefulness and perceived ease of use, is also an important variable in e-Learning.

References

[1] Au, N., Eric, W. T. N., and Cheng, T. C. E. "A Critical Information System Satisfaction Research and a New Research Framework," *Omega.* Vol. 30, 2002, pp. 451-478.

[2] Bailey, J. E., and Pearson, S. W. "Development of a Tool for Measuring and Analyzing Computer User Satisfaction," *Management Science*, 1983, 530-545.

[3] Balajthy, E. "Hypertext, Hypermedia, and Meta Cognition: Research and Instructional Implications for Disabled Readers," *Reading, Writing, and Learning Disabilities,* 6, 1990, pp. 183-202.

[4] Bandura, A. *Social Foundations of Thought and Action: A Social Cognitive Theory,* Englewood Cliffs. NJ: Prentice-Hall, 1986.

[5] Bandura, A. *Self-Efficacy: The Exercise of Control,* W. H. Freeman and Company. 1997.

[6] Bong, M. M. "Self-efficacy and Self

-regulated Learning: The Implication of Research Related in Education Engineering," *Journal of Educational Technology*, Vol. 14, No. 1, 1998, pp. 97-118.

[7] Chin, W. W. *The Partial Least Squares Approach to Structural Equation Modeling. In Modern Methods for Business Research*, G. A. Marcoulides(ed.). Mahwah. NJ: Lawrence Erlbaum Associates, 1998, pp. 295-336.

[8] Compeau, D. R., and Higgins, C. A. "Application of Social Cognitive Theory to Training for Computer Skills," *Information Systems Research*(6: 2), 1995, pp. 118-143.

[9] Corno, L., and Mandinach, E. B. "The Role of Cognitive Engagement in Learning from Instruction," *Educational Psychologist*, 18, 1983, pp. 88-108.

[10] Davis, F. D. "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly*, Vol. 13, No. 3, 1989, pp. 319-340.

[11] Davis, F. D., Bagozzi, R. P., and Warshaw, P. R. "User Acceptance of Computer Technology: A Comparison of Two Theoretical Models," *Management Science*, Vol. 35, No. 8, August, 1989, pp. 982-1003.

[12] Deci, E. L. *Intrinsic Motivation*. Plenum Press, New York, 1975.

[13] DeLone, W. H., and McLean, E. R. "Information Systems Success: The Quest for The Dependent Variable," *Information Systems Research*, Vol. 3, No. 1, 1992, pp. 60-95.

[14] Doll, W. J., and Torkzadeh, G. "The Measurement of End-User Computing Satisfaction," *MIS Quarterly*, Vol. 12, No. 2, 1988, pp. 259-274.

[15] Gatian, A. W. "IS User Satisfaction A Valid Measure of System Effectiveness," *Information & Management*, Vol. 26, Issue 3, March, 1994, pp. 119-131.

[16] Gefen, D., and Straub, D. W. "The Relative Importance of Perceived Ease of Use In IS Adoption: A Study of E-Commerce Adoption," *Journal for Information Systems*, Vol. 1, Article 8, 2000.

[17] Heo, G. and Rha, I. J. "Optimal Flow Experience in Web Based Instruction," *Korea Association of Computer Education Papers*, Vol. 6, No. 2, 2003, pp. 71-79.

[18] Kettinger, J. W., and Lee, L. L. "Pragmatic Perspectives on The of Information Systems Service Quality," *MIS Quarterly*, Vol. 21, No. 2, 1997, pp. 223-240.

[19] Lee, J. K. "The Effect of E-Learning Environmental Quality and Self-efficacy on Effectiveness of an E-Learning," *Business Administration Doctoral Dissertation*, Daegu University, 2004.

[20] Lee, Y. W., Strong, D. M., Kahn, B. K., and Wang, R. Y. "AIMQ: A Methodology for Information Quality Assessment," *Information and Management*, Vol. 40, 2002, pp. 133-146.

[21] Lyman, B. G. "Learning Strategies for The Internet: Playing Catch Up," *Proceedings of 1998 Ed-media conference* [CD-ROM], 1998.

[22] Oliver, R. L., and Swan, J. E. "Consumer Perception of Interpersonal Equity and Satisfaction in Transactions: A Field Survey Approach," *Journal of Marketing*, Vol. 53, 1989, pp. 21-35.

[23] Piccoli, G., Ahmad, R., and Ives, B. "Web-Based Virtual Learning Environments: A Research Framework and A Preliminary Assessment of Effectiveness in Basic IT Skills Training," *MIS Quarterly*, Vol. 25, No. 4, 2001, pp. 401-426.

[24] Rai, A., Lang, S. S., and Welker, R. B. "Assessing The Validity IS Models: An Empirical Test and Theoretical Analysis," *Information Systems Research*, Vol. 13, No. 1, 2002, pp. 50-69.

[25] Schunk, D. H. *Learning Theories In Educational Perspectives.* Prentice Hall. 2000.

[26] Seddon, P. B., and Kiew, M. Y. "A Partial Test and Development of The Dclone and Mclean Model of IS Success," *The Proceeding of International Conference of Information Systems,* Vancouver, Canada, 1997, pp. 99-110.

[27] Sloan-C, 2004. Entering the Mainstream: The Quality and Extent of Online Education in The United States, 2003 and 2004.
http://www.sloan-c.org/resources/survey.asp

[28] Thatcher, J. B., and Pamela, L. P. "An Empirical Examination of Individual Traits as Antecedents to Computer Anxiety and Computer Self-efficacy," *MIS Quarterly,* Vol. 26, 2002.

[29] Venkatesh, V. and Davis, F. D. "A Model of The Antecedents of Perceived Ease of Use: Development and Test," *Decision Sciences,* 27(3), 1996.

[30] Wang, Y. S., 2003. "Assessment of Learner Satisfaction with Asynchronous Electronic Learning Systems," *Information and Management,* Vol.41, No.1, p. 75.

[31] Zimmerman, B. J. "Self-regulated Learning and Academic Achievement: An Overview," *Educational Psychologist,* 25(1), 1990, pp. 3-17.

이 종 기 (Jong Ki Lee)

• 1985 인하대학교 경영학 학사 (경영학 전공)
• 2000 경북대학교 경영학 석사 (MIS 전공)
• 2005 대구대학교 경영학 박사 (생산·MIS 전공)
• 2007 현재 경북대학교 경영학부 BK21 연구교수 재직 중
• 전 경운대학교 컴퓨터공학과 및 한성디지털대학교 겸임교수 역임
• 주식회사 쌍용 재직, 미래로 컴퓨터 대표 역임
• 관심분야: 이러닝, 학습활동관리시스템, 정보품질, ERP, MOODLE
• 주요논문: "The relationship of e-Learner's self-regulatory efficacy and perception of e-Learning environmental quality"의 Computers in Human Behavior 저널(SSCI) 게재 등 다수.