

e-러닝 수용에 있어 신뢰의 역할: 신뢰 수준에 따른 비교

The Role of Trust in Adoption of e-Learning in South Korea: Comparison of High and Low Trust Levels

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요 약

오늘날 인터넷의 발전과 더불어, 대학 교육에 있어 e-러닝은 매우 중요한 교과목으로 자리를 잡게 되었다. 이에 따라 학교 당국에서는 보다 양질의 교육 콘텐츠 질 개발과 e-러닝을 수강하는 학생들의 e-러닝을 통한 만족도와 학습효과를 증대하기 위해 많은 노력을 하고 있다. 본 연구에서는 기술수용모델을 이용해 학생들의 e-러닝 수용에 대한 연구를 수행하였다. 특히, 온라인 환경에서의 신뢰는 기술수용에 있어 매우 중요한 영향을 미치는데, 본 연구에서는 학생들의 e-러닝 수용에 있어 신뢰 수준에 따른 e-러닝 수용 과정을 분석하였다. 본 연구 결과는 e-러닝에 대한 수용의 심도 깊은 이해를 통해 보다 좋은 e-러닝 시스템을 구현과 e-러닝 전략 개발에 유용한 시사점을 제시해 줄 것이다.

키워드 : e-러닝, TAM, 신뢰, 구조방정식, 비교 연구

I. Introduction

In the digital era, e-learning has secured its place as an educational method that is favored by people from diverse backgrounds (Rosenberg, 2001). Students consider e-learning with profound interest because it enables them to study without the limitations of time and space, thus providing utility and

convenience. To meet students' needs, educational administrators are constantly working to enhance e-learning services. Fundamentally, e-learning is based on interaction between professors and students via the Internet environment. This characteristic of e-learning allows administrators and staff in charge of e-learning services to provide various lecture materials and lecture videos to students via the Internet. Moreover, institutions supervising e-learning are continuously trying to implement diverse measures to enhance learning efficiency and efficacy.

Nowadays, e-learning class offerings are moving to the forefront, swiftly becoming as prominent an

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area of educational practice as off-line learning. Therefore, many universities are making efforts to maximize e-learning outcomes by analyzing the students' (who in this case are the consumers) e-learning adoption patterns for the purpose of eventually being able to provide them with high quality online education. As a result, e-learning adoption has been an important issue for several researchers (Liu *et al.*, 2009; Wang and Wang, 2009; Teo, 2009; Teo *et al.*, 2008; Ngai *et al.*, 2007).

This research adopted TAM as a theoretical model to analyze how and why university undergraduate students implement e-learning. TAM is a theoretical model that Davis (1989) suggested as an apparatus to analyze the acceptance process for new technology, thereby providing strategic implications about those willing to accept and use new technology. Specifically, it analyzes how perceived ease of use and perceived usefulness influences the attitude and actual use of a given technology. Until now, TAM has been applied to explain the acceptance process of diverse new technologies such as spreadsheets, Internet banking, information control systems, Enterprise Resource Planning (ERP) systems, e-shopping systems, e-mail services, radio frequency identification (RFID) technology, and wireless Internet (Liu and Louvieris, 2006; Yang, 2005; Lai and Li, 2005; Lee, 2008; Arning and Ziefle, 2007; Han *et al.*, 2006; Chen, 2008; Selim, 2003; Amoako-Gyampah, 2004; Kim, 2006; Hsu and Lu, 2004; Hong *et al.*, 2006; Wu and Li, 2007; Shih, 2003; Gefen, 2004; Huang, Lu and Wong, 2003).

This study will investigate e-learning adoption by students using TAM. A few studies have applied TAM to the e-learning adoption process (Ong and Lui, 2006; Saade and Bahli, 2005; Selim, 2003; Teo, 2009; Teo *et al.*, 2008; Ngai *et al.*, 2007; Liu *et al.*, 2009; Wang and Wang, 2009). Among stud-

ies on e-learning, the study of Ngai *et al.* (2007), which utilizes TAM, is most similar to this research. By applying TAM, this study affirms the need for technical support to achieve successful e-learning, adopting technical support as an independent variable that influences perceived usefulness and perceived ease of use.

In this study, an analysis according to level of trust was done by applying TAM to e-learning. Trust acts as an important factor regarding online consumer behavior (Kim *et al.*, 2008). In particular, trust plays an important role in consumers' acceptance of e-commerce. For instance, consumer use of e-commerce increases when the level of trust is high, while the opposite condition occurs if the level of trust is low (Kim *et al.*, 2008; Zhang, Zambrowitz, Zhou, and Roderer, 2004; Kim, Lee, and Nam, 2008). From this, it can be concluded that securing trust toward e-learning among students provides a shortcut to increasing consumer satisfaction and to maximizing acceptance. The study of Baeney and Hansen (1994) recognized the importance of trust in assuring comparative advantage, pointing out the role of trust according to three levels; high trust, middle level trust, and low trust. Lim *et al.*, (2009) suggested strategic implications to activate health infomediary business by analyzing the difference between high trust and low trust, when online users access health information. Therefore, it is hoped that this study will provide useful suggestions by executing the analysis according to level of trust toward e-learning, followed by an investigation of the effect that trust enhancement has on students' e-learning adoption.

This study consists of five sections. Section 1 is the introduction, which accounts for the necessity and purpose of this research. Section 2 explains the theoretical background, established by analyzing pre-

vious studies. Section 3 explains the research model and issues, as well as the research variables and the preparation process for the research investigation. Section 4 explains the analysis of basic information and partial least squares (PLS) regression analysis for the testing of this research model. The final section, section 5, presents the conclusion, clarifying the research implications, limitations, and future directions.

II. Theoretical Background

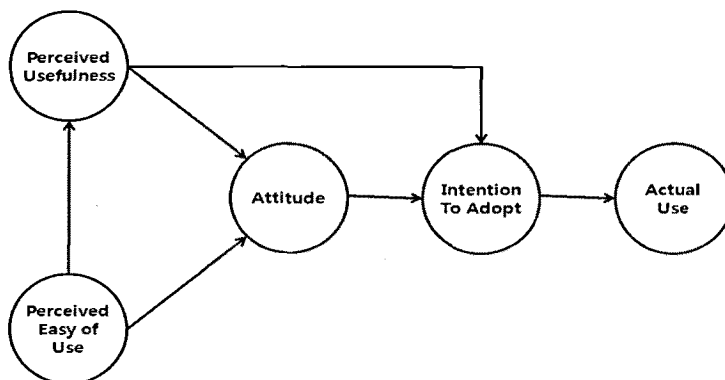
2.1 TAM

The TAM model suggested by Davis (1989) is based on a theory of the planning action of human behavior. When information technology becomes accepted, Davis's TAM model, which deems perceived usefulness, perceived ease of use, attitude, intention to adopt, and actual use as core variables, explains the relationships of these factors, as illustrated in <Figure 1>.

Since Davis suggested the TAM model in 1989, advanced studies regarding acceptance of various technologies has been accomplished through its use. A study on meta analysis of TAM confirms this

(Lee *et al.*, 2003; King and He, 2006; Ma and Liu, 2004; Schepers and Wetzels, 2007). TAM meta analysis renews the academic and practical value of the application of TAM, confirming the importance of TAM in analyzing acceptance of future technology. These TAM meta analysis studies demonstrate the expansion and application of TAM. Expansions of exogenous variables that influence perceived usefulness and perceived ease of use, and those of dependant variables that influence actual use, were made, along with applications of additional independent variables that influence research variables and suggestions for situational characteristics that account for diversity in the technology acceptance process.

This section will focus on a few significant TAM studies, since TAM application studies are well demonstrated in the metaanalysis. Lai and Li (2005) applied TAM to a study on acceptance of Internet banking, comparable to the research of Liu and Louteris (2006), which applied TAM to investigate Internet banking acceptance for the purpose of enhancing customer acceptance in the United Kingdom. Yang (2005), who conducted research on factors that affect mobile commerce implementation in Singapore, also adopted TAM, as did Arning and



<Figure 1> Diagram of TAM model

Ziefle (2007), who applied TAM to their PDA acceptance research. Han *et al.* (2006) implemented TAM to examine wireless communication technology implementation, and Hong *et al.* (2006) applied the TAM model to wireless Internet implementation along with a modified version of TAM. Likewise and Chen (2008) adapted TAM to online payment services implementation research. Amoako-Gyampah and Salam (2004) investigated ERP acceptance through expansion of TAM, and Wu and Li (2007) used a modified TAM to analyze user adoption of KMS (knowledge management systems). Kim (2006) applied TAM to acceptance of web based database technology. Finally, Hsu and Lu's (2004) research, which implemented TAM to online game acceptance, presented an expanded TAM that includes social influence and flow experience.

As indicated in the foregoing paragraph, previous studies implementing technology acceptance and adoption prove that the TAM model suggested by Davis (1989) provides a theoretical foundation for many technology acceptance studies. This study positively estimates that TAM applications in the swiftly growing e-learning field will provide important guidelines for its acceptance and use. Therefore, this research will apply TAM to e-learning acceptance.

2.2 The Role of Trust

Trust is an important research issue regarding TAM. Because it plays a most crucial role concerning the outcome of TAM, trust is emphasized in current TAM studies (Pavlou, 2003, Gefen, Karahanna, and Straub, 2003).

The following TAM application studies analyzed the trust variable: Gefen *et al.* (2003) brought forward an expanded form of TAM by including the

trust variable, which was targeted to online shopping. This research drew attention to how trust can determine the frequency of online shopping utilization, consequently providing diverse strategies to cultivate trust. Also, with regard to online shopping, Pavlou (2003) mentioned trust and risk as crucial factors, pointing out that securing trust and reducing risk is of great importance. Lee and Turban (2001) presented a trust building strategy in order to activate utilization of online shopping. Liu *et al.* (2005) investigated the relationships among privacy, trust, and intention to act, according to levels of trust in e-commerce. This investigation confirmed that enhancement of trust also strengthens e-commerce. In coordination with health management, Song and Zahedi (2007) asserted that building trust is essential to activating consumers' use of online health infomediary. Moreover, Luo, and Najdawi (2004) indicated that building trust plays an important role in expanding consumers' intention to adopt health information provided by portal websites. Lim *et al.* (2009) proved that a disparity of health information implementation exists according to level of trust, therefore claiming that a health information expansion strategy that aims at strengthening trust is necessary. Thus, trust has been an important online research issue.

There is no doubt that building online consumers' trust has a direct influence on intention to adopt; consequently, the level of trust corresponds to the influence it maintains on technology acceptance intention. As a result, trust should be appreciated as a core factor modulating technology acceptance intention in TAM studies. Hence, this research will analyze the e-learning acceptance process of students, corresponding to levels of trust, under the assumption that students' trust of e-learning plays a critical role in e-learning acceptance.

2.3 E-learning Acceptance

E-learning is a new field in education generated by the development of information technology. E-learning is referred to by several names, such as Internet education, online education, or WebCT. Currently domestic and foreign universities are delivering diverse forms of online education, directed not only to students, but also delivering online business management courses for employees, practical education, and hobby related education for the general public. In order to analyze the research patterns concerning e-learning, this research has inves-

tigated current research patterns presented in well respected journals with reference to information and education. <Table 1> presents the major characteristics of studies on e-learning that have been published in renowned journals.

Judging from information presented in <Table 1>, previous studies on e-learning acceptance sum up TAM applied studies on factors that affect e-learning acceptance by both teachers and students. The table also lists studies of expanded TAM providing factors that influence e-learning acceptance; analysis of gender differences in e-learning acceptance; and analysis of differences in e-learning ac-

<Table 1> Earlier Studies Regarding Online Education Acceptance

Researcher	Research issue
Selim (2003)	TAM applied study on student's acceptance process of web course classes.
Lee (2008)	TAM applied analysis of the role of resources, regarding online study acceptance
Ngai <i>et al.</i> (2007)	TAM model for WebCT process, applying technical support as additional independent variables.
Lee, Cheung, and Chen (2005)	Analysis of the extended TAM with motivation (intrinsic and extrinsic) for explaining adoption of Internet education
Liu <i>et al.</i> (2009)	Factors that influence usage intention of TAM applied online education community.
Ong and Lui (2006)	TAM applied analysis on gender difference of e-learning acceptance.
Saade and Bahli (2005)	TAM applied research on influence of cognitive absorption in e-learning acceptance.
Teo (2009)	Technology acceptance studies on pre education services with teachers.
Teo <i>et al.</i> (2008)	Analysis on teachers attitude towards computers: TAM expansion and application
Wang and Wang (2009)	Web based e-learning system acceptance research
Drennan <i>et al.</i> (2005)	Factors that affect students' attitude on online management education.
Gao (2005)	Hypermedia acceptance research applying TAM
Holmes (1998)	Comparative analysis on information technology application in Japan and U.K.
Hu <i>et al.</i> (2003)	Teachers' acceptance of computers' implementing TAM in schools: Longitudinal study
Sugar <i>et al.</i> (2004)	Teachers' acceptance of new technologies applying TAM
Yuen and Ma, (2002)	TAM applied research on gender difference of teachers' acceptance of new technologies.

ceptance according to countries.

As in preceding studies, it is necessary to keep in mind that analyzing the acceptance process of e-learning is extremely important. The researchers in this study have deducted trust factors from prior studies that have analyzed the importance of trust. It can be positively assumed that trust will play a critical part in general acceptance of the online education field. Thus, the main issue of this research narrows down to e-learning acceptance patterns of university students, according to levels of trust. In this study, several strategic implications that will contribute to the expansion of e-learning acceptance will be discussed.

III. Research Model

3.1 Research Model

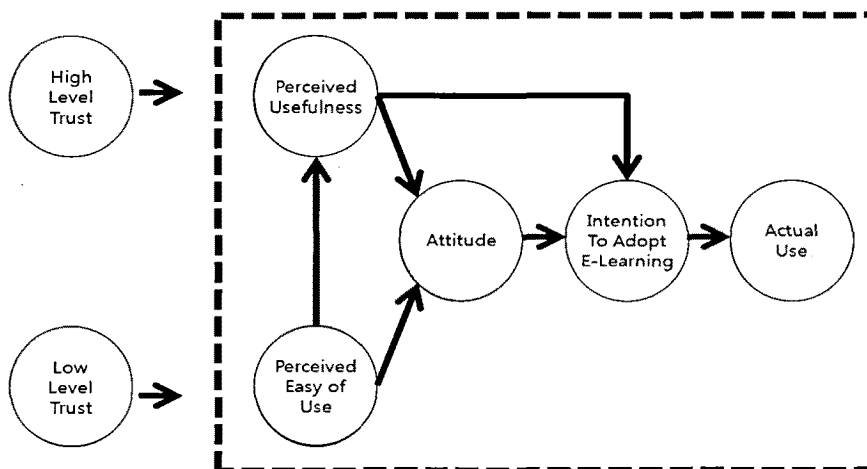
As reported above, this research has applied the TAM model to investigate e-learning acceptance by students. Furthermore, this research was conducted based on levels of trust, in order to provide school administrators with implications for designing strat-

egies that will improve e-learning services. The research model of this study investigates the process by which different levels of trust affect perceived ease of use and perceived usefulness, thereby successfully affecting attitude and actual e-learning adoption. The research model for the present study is shown in <Figure 2>.

3.2 Research Hypothesis

In this research, the e-learning acceptance process of students was analyzed according to different levels of trust. It was confirmed by Davis (1989) that the consumers' perceived usefulness and perceived ease of use with respect to new technology affects attitude, which consequently affects intention to adopt, successfully determining actual use. Therefore this research established the following research issues and research hypotheses based on the TAM model process described above.

- Research Question: Does a difference exist in students' e-learning acceptance process according to levels of trust?



<Figure 2> Research Model

- Hypothesis 1: Students' perceived ease of use of e-learning affects usefulness.
- Hypothesis 2: Students' perceived ease of use of e-learning affects attitude.
- Hypothesis 3: Students' perceived usefulness of e-learning affects attitude.
- Hypothesis 4: Students' perceived usefulness of e-learning affects intention to adopt.
- Hypothesis 5: Students' perceived usefulness of e-learning affects actual use.
- Hypothesis 6: Students' attitude to e-learning affects intention to adopt.
- Hypothesis 7: Students' intention to adoption of e-learning affects actual use.

In the present research, an analysis according to levels of trust was done with regard to the stated research question, since trust is an important issue for online research and also affects the creation of comparative advantages between companies. Baeney and Hansen (1994) asserted that trust plays an important role in the creation of comparative advantages of companies. Thus, to sufficiently recognize the importance of levels of trust in e-learning acceptance, this research analyzed variables according to high trust and low trust. It is hoped that these results will provide strategic indications for successful e-learning acceptance.

3.3 Research Variables

Selected research variables in this research are based on previous studies. Measurement items related to e-learning acceptance were adopted from prior studies. First, in this study, ease of use, usefulness, attitude, and intention to adopt e-learning variables were selected by applying Davis (1989). In particular, this study collected variables from the

research of Ngai *et al.* (2007) and Wang and Wang (2009), which are previous studies that applied TAM, and adapted them to make them relative to a Korean context. Finally, this research developed trust variables to measure trust on e-learning by altering trust variables from the research of Lim *et al.* (2009), Song and Zahedi, (2007), and Kim *et al.* (2007) on measuring health information implementation of online consumers. The measurement items of <Table 2> are as follows.

3.4 Research Outline

In this study, the survey questionnaires measured by a 7-point Likert type scale, consist of survey items deducted from prior studies (Ngai *et al.*, 2007; Davis, 1989; Lim *et al.*, 2009; Song and Zahedi, 2007; Kim *et al.*, 2007). Also, in order to validate the measurement items in advance, diverse suggestions were collected from several experts (MIS professors, lecturers, and Ph.D. student). Going through a process of amending questionnaires that were evaluated as insufficient of validity, the final survey questionnaires were settled.

Consequently, the completed survey was carried into effect with students in university that had experience taking a e-learning class. The survey was conducted from October, 25, 2009 to November, 5. Out of 200 copies, a final 144 copies were acquired. From 144 copies, 16 copies were exempted for reasons of incoherence and lack of answers, therefore leaving 128 copies to be evaluated through statistic analysis. In this study, SMART PLS 2.0 which is a PLS software that provides a component based structural equation model was implemented. PLS has the merit of deducting useful results out of little data and setting of building theory on exploratory studies, therefore favored in many

<Table 2> Research Variables

Variable	Items	Related studies
Perceived Usefulness (PU)	<ul style="list-style-type: none"> ◦ I believe that studying through e-learning is more effective in formal curriculum. ◦ e-learning improves my academic achievements. ◦ In my case, e-learning is an effective study method. ◦ E-learning is useful for university studies. ◦ I was able to control my studies in general through e-learning. ◦ I recognize that e-learning offers many advantages for me. 	Davis (1989) Ngai <i>et al.</i> (2007)
Perceived Easy of Use (EU)	<ul style="list-style-type: none"> ◦ Operating e-learning is easy for me. ◦ I can obtain things I want through e-learning system (additional data such as lecture excerpts, movies etc.) ◦ Usage process of the e-learning system is clear and easy to understand. ◦ On the whole, I am able to utilize the e-learning system with ease. ◦ On the whole, I am capable of operating the e-learning system with ease. 	Davis (1989) Ngai <i>et al.</i> (2007)
Attitude (A)	<ul style="list-style-type: none"> ◦ I think e-learning is fun. ◦ I believe that e-learning is a beneficial way of studying. ◦ I believe that e-learning provides an attractive studying environment. ◦ Over all, I favor using e-learning as a study method. 	Ngai <i>et al.</i> (2007)
Intention to Use (IU)	<ul style="list-style-type: none"> ◦ I intend to communicate with the professor through on line Q&A, lecture excerpt and online class participation. ◦ I intend to utilize e-learning in the future. 	Davis (1989) Ngai <i>et al.</i> (2007)
Actual Use (AU)	<ul style="list-style-type: none"> ◦ Do you login the e-learning system more frequently than other students? ◦ In average, do you spend more time on e-learning than other students? 	Ngai <i>et al.</i> (2007)
Trust (T)	<ul style="list-style-type: none"> ◦ I believe in the effectiveness of on-line education on the whole. ◦ Online education media is as reliable as off-line education media. ◦ School e-learning education is reliable in terms of attendance management, project management, and grade management. ◦ e-learning education contents(lecture excerpt, lecture movies) are reliable. 	Lim <i>et al.</i> (2009), Song and Zahedi, (2007), Kim <i>et al.</i> (2007)

pioneering studies (Chin, 1998). Therefore, we employed PLS approach for analyzing using small data set.

IV. Empirical Analysis

4.1 Basic Information

The characteristics of the respondents in this study are as the following. First, the gender characteristics were, 92 males covering 71.9% and 36 females, 28.1% of the total. Second, the academic background was identical, all respondents being stu-

dents in university. The Internet usage time was; 36 people (28.1%) using the Internet under 2 hours, 66 people (51.6%) under 4 hours, and 11 people (8.6%) under 6 hours. The age of the respondents were 9 in their teens (7%) and 119 students in their twenties (93%).

4.2 Checking Validity and Reliability

As for the research variables, this research divided groups according to level of trust into group with high trust and group with low trust. For distinction, K-means clustering technique was used.

Results of K-means clustering lead to division of two groups. The characteristics of each group are as in <Table 3>.

This research conducted a reliability and validity analysis on the group with high trust and the group with low trust with respect to e-learning, through PLS method. Regarding the SEM of PLS analysis, reliability was evaluated through CSRI (Composite Scale Reliability Index). Generally if the CSRI value is over 0.7, it can be concluded that reliability is attained (Fornell and Larker, 1981).

Furthermore, validity is evaluated through factor loading and cross loading. If the factor loading and AVE square value is over 0.7 or below to 0.7., it can be said that validity is attained (Fornell and

Larker, 1981; Barclay *et al.*, 1995; Chin, 1998). In this study, the statistic analysis results of the research variables indicated that, in general, the CSRI value is above 0.7 and also the loading value over 0.7 or below to 0.7. The value of AVE value and factor loading is partially appeared below 0.7. However, these items tested prior research as a useful items and showed reliability and validity (Ngai *et al.*, 2007). Therefore, for testing our research model, we adopted these items as research items.

In addition, this research conducted a correlation analysis and discriminant validity analysis. The correlation coefficient of the research variables used in this study was below 0.8, indicating sufficient discriminant validity (Kennedy, 1988).

<Table 3> K-means Clustering

	Cluster	
	1	2
trust1	7	1
trust2	7	1
trust3	7	1
trust4	7	1
iteration calculation	Changing point of central cluster	
iteration calculation	1	2
1	4.059	3.467
2	.000	.000
a. iteration calculation = 2, initial distance from central point: 12.000		
	cluster	
	1	2
trust1	5	3
trust2	5	3
trust3	5	3
trust4	5	3
cluster	1	64.000
cluster	2	64.000
Available		128.000
not available		.000

<Table 4> Reliability-Group with High Trust Level

	AVE	Composite Reliability	Cronbachs Alpha	Communality
Actual Use (AU)	0.807	0.893	0.766	0.807
Attitude (A)	0.775	0.932	0.902	0.775
Ease of Use (EU)	0.747	0.946	0.932	0.747
Intention to Use (IU)	0.907	0.951	0.898	0.907
Usefulness (U)	0.574	0.870	0.824	0.574

<Table 5> Reliability-Group with Low Trust Level

	AVE	Composite Reliability	Cronbachs Alpha	Communality
Actual Use (AU)	0.862	0.926	0.850	0.862
Attitude (A)	0.673	0.891	0.838	0.673
Ease of Use (EU)	0.618	0.906	0.875	0.618
Intention to Use (IU)	0.883	0.938	0.867	0.883
Usefulness (U)	0.605	0.882	0.851	0.605

<Table 6> Factor Analysis-Group with high trust level

	Actual Use (AU)	Attitude (A)	Ease of Use (EU)	Intention to Use (IU)	Usefulness (U)
EU1	0.400	0.508	0.770	0.544	0.167
EU2	0.366	0.565	0.850	0.528	0.263
EU3	0.288	0.638	0.903	0.585	0.457
EU4	0.363	0.713	0.897	0.595	0.384
EU5	0.388	0.650	0.861	0.629	0.322
EU6	0.392	0.632	0.897	0.630	0.366
U1	0.415	0.348	0.111	0.252	0.677
U2	0.180	0.330	0.211	0.184	0.679
U3	0.099	0.571	0.519	0.486	0.811
U4	0.230	0.265	0.189	0.214	0.805
U5	0.299	0.350	0.213	0.263	0.804
A1	0.593	0.858	0.639	0.694	0.416
A2	0.390	0.829	0.633	0.562	0.461
A3	0.484	0.919	0.640	0.738	0.483
A4	0.536	0.911	0.630	0.759	0.523
IU1	0.433	0.727	0.641	0.949	0.428
IU2	0.495	0.769	0.650	0.956	0.366
AU1	0.927	0.564	0.363	0.492	0.225
AU2	0.869	0.451	0.397	0.372	0.303

〈Table 7〉 Factor Analysis-Group with Low Trust Level

	Actual Use (AU)	Attitude (A)	Ease of Use (EU)	Intention to Use (IU)	Usefulness (U)
EU1	0.206	0.469	0.690	0.380	0.174
EU2	0.315	0.488	0.876	0.334	0.202
EU3	0.253	0.496	0.830	0.251	0.260
EU4	0.026	0.431	0.747	0.281	0.303
EU5	0.235	0.619	0.818	0.275	0.118
EU6	0.177	0.479	0.740	0.425	0.203
U1	0.241	0.086	-0.108	0.147	0.550
U2	0.078	0.559	0.388	0.416	0.861
U3	0.250	0.438	0.184	0.333	0.806
U4	0.078	0.455	0.168	0.237	0.840
U5	0.192	0.221	0.039	0.248	0.791
A1	0.079	0.796	0.583	0.321	0.512
A2	0.030	0.878	0.540	0.338	0.415
A3	-0.037	0.805	0.430	0.382	0.391
A4	0.334	0.798	0.521	0.565	0.423
IU1	0.301	0.480	0.400	0.943	0.339
IU2	0.236	0.453	0.368	0.936	0.396
AU1	0.965	0.073	0.214	0.318	0.171
AU2	0.891	0.227	0.294	0.185	0.153

〈Table 8〉 Discriminant Validity Analysis-Group with High Trust Level

	Actual Use	Attitude	Ease of Use	Intention to Use	Usefulness
Actual Use (AU)	1.000				
Attitude (A)	0.571	1.000			
Ease of Use (EU)	0.419	0.721	1.000		
Intention to Use (IU)	0.488	0.786	0.677	1.000	
Usefulness (U)	0.287	0.535	0.389	0.415	1.000

〈Table 9〉 Discriminant Validity Analysis-Group with Low Trust Level

	Actual Use	Attitude	Ease of Use	Intention to Use	Usefulness
Actual Use (AU)	1.000				
Attitude (A)	0.138	1.000			
Ease of Use (EU)	0.260	0.637	1.000		
Intention to Use (IU)	0.287	0.497	0.409	1.000	
Usefulness (U)	0.175	0.534	0.265	0.390	1.000

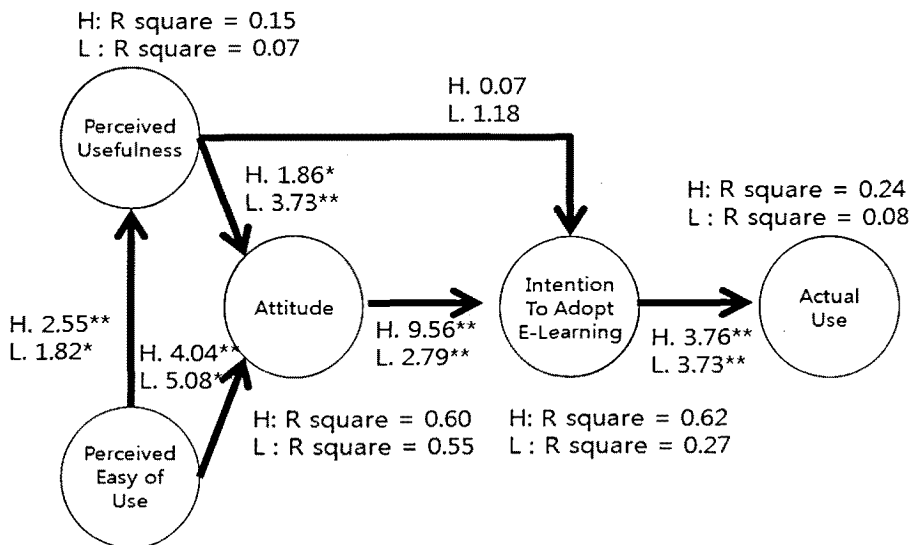
4.4 Testing Hypotheses

This research carried out a PLS analysis with regard to trust levels, to figure out the characteristics of e-learning acceptance. We uses bootstrap analysis for evaluating path coefficient and testing SEM. According to Chin (1988), PLS model generally uses 1000 frequency of bootstrap option. In this study, we adopted on 1000 frequency of bootstrap option for testing research model.

The results of PLS analysis are shown in <Figure 3> and <Table 10>. The hypothesis that ease of

use of e-learning significantly affects usefulness (T-statistics = 2.547) and attitude (T-statistics = 4.036) was adopted. The hypothesis that attitude of e-learning significantly affects usefulness (T-statistics = 9.555) was adopted. The hypothesis that usefulness significantly affects attitude (T-statistics = 1.862) and didn't affects intention to use (T-statistics = 0.077). Also, the hypothesis that intention to adopt affects actual use (T-statistics = 3.757) was adopted.

Through testing of the hypotheses, most of the hypotheses of e-learning acceptance were adopted,



<Figure 3> PSL Results

<Table 10> The result of PLS-Group with High Trust Level

Hypo.	β	T-Statistics	Result
A → IU	0.790	9.555***	Accept
EU → A	0.604	4.036***	Accept
EU → U	0.389	2.547***	Accept
IU → AU	0.488	3.757***	Accept
U → A	0.300	1.862*	Accept
U → IU	-0.008	0.077	Reject

Note) *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

〈Table 11〉 The result of PLS-Group with Low Trust Level

Hypo.	β	T-Statistics	Result
A → IU	0.404	2.795 ^{***}	Accept
EU → A	0.533	5.079 ^{***}	Accept
EU → U	0.265	1.820 [*]	Accept
IU → AU	0.287	1.969 ^{**}	Accept
U → A	0.393	3.732 ^{***}	Accept
U → IU	0.174	1.182	Reject

Note) ^{***} p-value < 0.01, ^{**} p-value < 0.05, ^{*} p-value < 0.1.

similar to those of TAM model, except for the hypothesis that usefulness affects actual intention to adopt e-learning. This implies that other factors might influence actual intention to adopt e-learning. For instance, the fact that e-learning permits students to study without going to school and frees them from the limitations of indoor classes appears to have considerable significance.

With respect to groups with low trust, results of TAM application on e-learning acceptance verified the hypothesis that ease of use influences usefulness (T-statistics = 1.820) and attitude (T-statistics = 5.079). The hypothesis that attitude of e-learning significantly affects intention to use (T-statistics = 2.795) was adopted. As for the group with high trust, likewise, the hypothesis that usefulness influences attitude (T-statistics = 3.732) was verified, although the hypothesis that usefulness influences intention to use (T-statistics = 1.182) was not. Furthermore, the hypothesis that intention to adopt affects actual use was adopted by (T-statistics = 1.969).

The analyzed characteristics of the group with low trust of e-learning were similar to those of the group with high trust. The empirical results indicated that trust toward e-learning was similar to TAM analysis results, with usefulness not significantly influencing actual use. This indicates that for students taking e-learning courses, only usefulness

fails to influence their acceptance. Therefore, additional strategic plans should focus on other factors, exclusive of usefulness, to reinforce e-learning acceptance.

In addition, the impact of the perceived usefulness in the group with high levels of trust weakly affects attitude. In the low trust group, the perceived usefulness strongly impacts attitude. Except for the above described relationships, the relationship of the other hypotheses shows that the impact of a strong influence of high trust groups has emerged.

It can be concluded that attitude, intention to adopt, and actual use has greater influence if the trust level is high, whereas usefulness proves otherwise. Provided that high trust equals high expectations, actual usefulness usually does not satisfy the expectations of the group with high trust, leaving usefulness for the group with low trust as having greater influence on attitude and intention to adopt.

V. Conclusion

5.1 Implications and Discussion

This research has empirically tested students' e-learning acceptance by applying a TAM model of investigation. Specifically, considering trust as a crucial influencing factor with regard to e-learning

acceptance generalization, the analysis was conducted according to high levels of trust and low levels of trust. Results of the empirical analysis indicated that the application of TAM to the students' e-learning field had similar results to the TAM model suggested by Davis (1989). In particular, this research provided contrasting features of e-learning acceptance in terms of trust levels, producing implications for schools that look forward to expanding e-learning and increasing its usefulness. The implications of this research are as described in the following paragraphs.

First, when it comes to e-learning acceptance in universities, ease of use produced contrasting characteristics between different trust levels while also arising common features. Especially, trust assigned significant influence to usefulness, intention to adopt, and actual use. Therefore, reinforcing trust is crucial for university administrators who hope to improve e-learning acceptance and satisfaction of students. For instance, for trust levels with high trust, ease of use and usefulness were characteristics between acceptance and ease of use and usefulness for trust levels with low trust had a low influence on attitude. This indicates that, for trust levels toward e-learning leads to a low intention to adopt, and eventually, to actual use. Therefore, a strategy to reinforce e-learning would be an necessary prerequisite to ensure generalized e-learning acceptance. For example, a process of e-learning confirmation participation in e-learning class, provides new rush hiity educational materials, creates a transparent trading system, and provides scientific evaluation criterion would consist as some strategic methods to gain students' trust. Therefore, efforts to reinforce e-learning will promote the success of e-learning.

Second, the cause and effect relationships between TAM variables in this study were different

from Davis's (1989) results. In other words, ease of use affected intention to adopt, thereby influencing e-learning generalization. However, usefulness did not affect intention to adopt. Consequently, efforts should be directed toward generalizing e-learning acceptance, such as creating convenient e-learning websites and providing practical student manuals. Also additional measures should be carried out to enhance the merits of e-learning for purposes other than studying. For example, additional materials that would contribute to diverse studies or trust reinforcement plans that reflect e-learning characteristics are two methods that could produce additional e-learning usefulness.

Third, although e-learning acceptance and generalization is a substantial issue for universities, actual satisfaction of the students should also be factored in. This research falls short regarding a determination of the influence that actual use of e-learning has on satisfaction. However, it can be assumed that an increase in actual use does indicate high satisfaction of students. Thus, the e-learning management body should develop web courses that will interest students and come up with diverse marketing strategies to increase log in frequency and expand implementation. Therefore, the actual reflection of this study's results will contribute to e-learning generalization and an increase in student satisfaction.

5.2 Limitations and Future Research Directions

This research has some limitations. First, one limitation lies with the fact that the survey was conducted within only one university. In reality, acceptance of e-learning participation has regional differences. Compared with students who attend the

university from nearby, those who travel from far regions to attend generally favored e-learning for the space and time merits it provides. Therefore, future studies should factor in the situational characteristics of the respondents within the sampling process.

Second, e-learning is a general education media that is utilized not just by students, but also by the general public (Hu, Clark, and Ma, 2003; Rosenberg, 2001). Accordingly, a limitation of this study is that a generalization of the empirical results was restricted to students. Therefore, future studies should gather empirical results from a diverse general public, rather than limiting the study respondents only to students.

Third, this study conducted an actual adoption examination by applying Davis's (1989) TAM method to acceptance of e-learning. Recently, TAM-related studies have appeared that extended TAM and UTAUT (Unified Theory of Acceptance and Use of Technology) to antecedent consequences, contingency variables, and so forth (King and He, 2006; Venkatesh and Davis, 2000; Venkatesh, Morris, Davis and Davis, 2003). This research focuses on levels of trust regarding TAM expansion and, therefore, fails to account for other diverse situational characteristics. For example, e-learning acceptance demonstrates different e-learning acceptance processes according to various situational factors such as technological supplements and gender characteristics (Ngai *et al.*, 2007; Ong and Lui, 2006). Therefore, future studies should reflect more diverse situational characteristic variables regarding e-learning acceptance.

Forth, in this study, the K-means cluster analysis was used to specify for two groups along with the level of trust. We choose PLS technique in this study because PLS has greater power for small

sample sizes. However, we must consider the limitation that this study does not provide the results of path coefficient differences because PLS does not have support for path coefficient differences while AMOS supports this function (Byrne, 2001). Thus, future studies with larger sample size need to test path coefficient differences of variable affecting e-learning adoption along with the level of trust using AMOS.

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〈Appendix〉 T-test Result

	Case Number	N	Ave.	S.D.	S.E. of Ave.
U1	1	64	2.94	2.092	.262
	2	64	2.02	2.374	.297
U2	1	64	3.83	1.507	.188
	2	64	2.61	1.255	.157
U3	1	64	3.97	1.436	.180
	2	64	2.84	1.394	.174
U4	1	64	4.30	1.580	.198
	2	64	2.69	1.344	.168
U5	1	64	4.61	1.629	.204
	2	64	2.77	1.294	.162
U6	1	64	4.25	1.543	.193
	2	64	2.55	1.284	.160
EU1	1	64	4.38	1.431	.179
	2	64	2.64	1.314	.164
EU2	1	64	5.69	1.379	.172
	2	64	4.86	1.772	.221
EU3	1	64	5.09	1.318	.165
	2	64	3.89	1.534	.192
EU4	1	64	4.77	1.423	.178
	2	64	3.77	1.477	.185
EU5	1	64	5.38	1.409	.176
	2	64	4.06	1.708	.213
A1	1	64	5.42	1.295	.162
	2	64	4.72	1.704	.213
A2	1	64	4.64	1.526	.191
	2	64	3.06	1.308	.163
A3	1	64	4.81	1.446	.181
	2	64	3.17	1.229	.154
A4	1	64	4.73	1.546	.193
	2	64	3.23	1.434	.179
IU1	1	64	4.81	1.521	.190
	2	64	3.13	1.431	.179
IU2	1	64	4.72	1.578	.197
	2	64	3.09	1.519	.190
AU1	1	64	4.73	1.546	.193
	2	64	3.13	1.558	.195
AU2	1	64	4.64	1.462	.183
	2	64	3.09	1.630	.204

Note) 1. High trust group, 2. Low trust group.

	Group	Levene homoscedasticity test		t-test of Average homogeneity						
		F	p-value	t	D.F	p (2tail)	Dif. of Ave.	S.E. of Dif.	95% trust interval	
									upper	lower
U1	1	.023	.880	2.331	126	.021	.922	.396	.139	1.705
	2			2.331	124.042	.021	.922	.396	.139	1.705
U2	1	.084	.773	4.971	126	.000	1.219	.245	.734	1.704
	2			4.971	122.001	.000	1.219	.245	.733	1.704
U3	1	.000	.995	4.497	126	.000	1.125	.250	.630	1.620
	2			4.497	125.889	.000	1.125	.250	.630	1.620
U4	1	.195	.659	6.206	126	.000	1.609	.259	1.096	2.123
	2			6.206	122.822	.000	1.609	.259	1.096	2.123
U5	1	1.713	.193	7.089	126	.000	1.844	.260	1.329	2.358
	2			7.089	119.855	.000	1.844	.260	1.329	2.359
U6	1	2.998	.086	6.788	126	.000	1.703	.251	1.207	2.200
	2			6.788	121.971	.000	1.703	.251	1.206	2.200
EU1	1	.047	.830	7.143	126	.000	1.734	.243	1.254	2.215
	2			7.143	125.091	.000	1.734	.243	1.254	2.215
EU2	1	5.783	.018	2.951	126	.004	.828	.281	.273	1.383
	2			2.951	118.830	.004	.828	.281	.272	1.384
EU3	1	.942	.334	4.759	126	.000	1.203	.253	.703	1.703
	2			4.759	123.207	.000	1.203	.253	.703	1.704
EU4	1	.091	.764	3.901	126	.000	1.000	.256	.493	1.507
	2			3.901	125.821	.000	1.000	.256	.493	1.507
EU5	1	2.558	.112	4.743	126	.000	1.313	.277	.765	1.860
	2			4.743	121.597	.000	1.313	.277	.765	1.860
A1	1	8.457	.004	2.628	126	.010	.703	.268	.174	1.233
	2			2.628	117.557	.010	.703	.268	.173	1.233
A2	1	1.535	.218	6.282	126	.000	1.578	.251	1.081	2.075
	2			6.282	123.111	.000	1.578	.251	1.081	2.075
A3	1	.860	.356	6.917	126	.000	1.641	.237	1.171	2.110
	2			6.917	122.797	.000	1.641	.237	1.171	2.110
A4	1	.388	.535	5.692	126	.000	1.500	.264	.979	2.021
	2			5.692	125.295	.000	1.500	.264	.978	2.022
IU1	1	.092	.762	6.465	126	.000	1.688	.261	1.171	2.204
	2			6.465	125.533	.000	1.688	.261	1.171	2.204
IU2	1	.058	.811	5.934	126	.000	1.625	.274	1.083	2.167
	2			5.934	125.818	.000	1.625	.274	1.083	2.167
AU1	1	.188	.665	5.866	126	.000	1.609	.274	1.066	2.152
	2			5.866	125.991	.000	1.609	.274	1.066	2.152
AU2	1	.808	.370	5.651	126	.000	1.547	.274	1.005	2.089
	2			5.651	124.541	.000	1.547	.274	1.005	2.089

Note) 1. assume of homoscedasticity, 2. didn't assume of homoscedasticity.

The Role of Trust in Adoption of e-Learning in South Korea: Comparison of High and Low Trust Levels

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Abstract

Today, as potential uses of the Internet continue to grow, e-learning in university an education course has taken on an important role. Accordingly, to provide good e-learning services, university officials attempt to develop high quality educational content in their courses. In this study, we investigate e-learning adoption by students using the extended technology acceptance model (TAM). In particular, trust in the online environment plays an extremely crucial role in student willingness to adopt e-learning. Therefore, in this study, we analyzed the relationships of perceived ease of use, perceived usefulness, attitude, and actual use on students' level of trust using a partial least squares (PLS) approach. This study suggests valuable implications for developing e-learning strategies and implementing e-learning.

Keywords: *e-Learning, TAM, Trust, PLS, Adoption, Comparison Analysis*

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