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Perceived Interaction in Online Classes and Technology Acceptance Model to Student Satisfaction

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【Abstract】

This paper examines an augmented technology acceptance model, which includes perceived interaction as a mediator in the relationships between the technology acceptance model (perceived ease of use, perceived usefulness) and student satisfaction in online classes, and its impact on student satisfaction. Data has been collected from 842 undergraduate students in online universities. The data is analyzed by using factor analysis and structural equation modeling techniques. The results demonstrate that perceived ease of use, perceived usefulness, and perceived interaction serve as predictors for student satisfaction in online classes. Perceived usefulness has a positive relationship with perceived interaction while perceived ease of use has no effect on interaction.

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Key words: technology acceptance, online class, student satisfaction, perceived interaction, participation, communication tool, structural equation model

Ⅰ. INTRODUCTION

The recent emergence of information and communication technology (ICT) allows colleges and universities to offer online degree programs to meet the need of students. With the help of ICT, the number of online courses and programs has increased drastically in recent years. According to a recent report on Korean education (Korean Educational Development Institute, 2008), 15 universities currently offer online baccalaureate degree programs such as Seoul Digital University (http://www.sdu.ac.kr/), Seoul Cyber University (http://www.iscu.ac.kr/), and Korea Digital University (http://www.kdu.edu/), with the total enrollment of 81 thousand students as of 2008 (Table 1). In addition to the universities that offer online undergraduate degree programs, traditional colleges and universities are also increasing online class offerings and turning into hybrid mode institutions. For example, the Korea Open Course Ware (KOCW, http://www.kocw.net/) provides services with sharing online course content. Note that KOCW has networked with 38 universities and shared 611 online courses in 2008. There is no doubt that the enrollment of online students will be increasing though several debates still flourish on whether the online class enhances student learning outcome and would be more cost effective for institutions. Most colleges and universities want to offer a wide range of degree programs that include undergraduate, graduate, and professional certificates in thee online format in coming years.

<Table 1> Enrollment for Online Degree Programs in Higher Education

(unit: thousand)

Year	2005	2006	2007	2008
Student enrollment in higher education	3548	3545	3558	3562
Student enrollment in online higher education	53	64	72	81

Source: Korean Educational Development Institute (2008)

Discussions of the use of ICT in teaching have received quite a bit of attention in

academic journals in recent years. For example, O'Donoghue, Singh, and Dorward (2001) reported the merits of ICT in classes; Leon and Parr (2000) exampled how instructors can use technology in classes; Basile and D'Aquila (2002) assessed student attitudes toward the use of the Internet in classes (e.g., Jason, Kennedy, & Taylor, 2001). In addition to pedagogical merits, students frequently report positive experiences with online classes(Lawson, 2000).

There is, however, lack of articles that empirically evaluated learning outcome of online classes. There are many factors that affect the learning outcome such as excellent teaching, course design, technical support and appropriate assessment. The focus has been shifted to student satisfaction though it is not the only component that evaluates the learning outcome of online classes. Student satisfaction is more important than ever before in online classes. While promoting the quality of online programs, higher education institutions consider student satisfaction as one of the key principles (Moore & Kearsley, 2005; Roach & Lemasters, 2006). High level of student satisfaction leads lower attrition rates, an increase in student enrollment, and more productive learning outcome (Schwitzer, Ancis, & Brown, 2001).

Much research has been conducted on online education (Hagel & Shaw, 2006; Liao, 2006; Muilenburg & Berge, 2005). The literature emphasizes the importance of research for improving students' online class experiences (Levin & Wadmany, 2006; White, 2005). In designing and delivering online classes, student satisfaction and perceptions should be central. It is clear that student satisfaction is central to educators and institutions in the online class environment. There is a need to understand better predictors that affect student satisfaction in online classes. There are many published studies on student satisfaction. However, earlier studies tended to focus on student satisfaction measured for once only at the end of a course with questionnaires.

Online education involves a student-centered approach, in which the instructor takes the role of the facilitator and students engage in social learning (Maor, 2003; Mitchell, Chen, & Macredie, 2005). One of the main concerns is that students who are learning at a distance from the instructor and other fellow students may suffer from lack of student interaction. The social learning theory describes the process of learning as highly social and embedded in the lives of students. Much of the theory centers on communities and dynamic groups that students participate in various ways. With the pervasiveness of the Internet and online education networks, online discussion groups on the Internet become a new form of dynamic groups that students

communicate. However, students have little or no means of communication with each other; even those who have the means of communication in online classes may not receive any encouragement to do so. Both students and instructors are affected if they do not have enough communication with each other. The instructor is unable to judge student progress and is unable to meet successfully the need of students. In addition, if communication between students and the instructor is not timely, much of the value of feedback on lectures, assignments, and tests is lost (Hentea, Shea, & Pennington, 2003).

The social nature of educational practice influences student motivation to learn, ways of participation, and how new learning format shapes community membership. The online class environment is social context just as is the traditional face-to-face environment. However, the social activities and contacts are mediated by technology and communication tools in the online environment. Researchers studying the online class environment explore the social nature of learning in a variety of ways: students' use of communication tools (Hara & Kling, 2000); students' perception toward sense of presence (Picciano, 2002); and the relationship between students' feeling toward sense of belonging and their amount of social interaction (Rovai, 2002c). Little is known, however, about how usage of communication tools, sense of presence, and interaction are interconnected in the way they influence student satisfaction.

Previous literature about online education has shown that failure to achieve sense of community and feeling of isolation negatively affect acceptance of online classes and student satisfaction(Vonderwell, 2003; Woods, 2002). New knowledge is needed to understand how students experience the social aspects of online classes and how the tools and methods of online classes can foster social interaction. In order to understand how student satisfaction is affected by social interaction, the present study seeks to build a model that contribute to the social nature of online experience and influence student satisfaction in the online class environment. Path analysis is used to determine the extent to which key elements including perceived ease of use, perceived usefulness and perceived interaction explain student satisfaction in online classes.

The research questions of this study are as follows: (1) To what extent does perceived interaction influence student satisfaction in online classes? (2) How well does a combined path model between technology acceptance model and perceived interaction explain student satisfaction in the online class environment?

Ⅱ. LITERATURE REVIEW

1. Online Education and Student Satisfaction

The terms "online education" and "distance learning" have been applied interchangeably by many researchers. Sloman (2001) defined online education as a hybrid mode that taking into account the connectivity with information and students. Salmon (2000) emphasized the social aspects of learning in online education. It is characterized by the separation of instructors and students in space and/or time, the self-control of learning by students rather than the instructor at a distance, and non-contiguous communication between students and the instructor, mediated by communication tools and web technology. The underpinning technology is the end-user computing and the use of the Internet. In this article, online education is a form of learning connected by the Internet and web technology, delivered by the way of end-user computing, and facilitated by the form of social learning.

Many reports of online education demonstrated positively its impact and potential. Talent-Runnels et al. (2006) reported relative equivalence in test outcome with face-to-face classes. Students appreciate the flexibility and convenience offered by online classes (Abrahamson, 1998; Rahm & Reed, 1998). However, some students express being more satisfied with face-to-face classes (Allen, Bourhis, Burrell, & Marbry, 2002; Klesius, Homan, & Thompson, 1997). Carr (2000) reported 10-20 % higher dropout rates in online classes over traditional face-to-face classes. She reported that a high dropout percentage in online classes was resulted from poor support of institutions, dissatisfaction with teaching methods, unfamiliarity with the technology used, and student feeling of isolation. Hara and Kling (2000) also reported that online students were frustrated by the communication and technical difficulties that impeded interaction.

Arbaugh (2000) argued that the lack of social interaction was a factor that depresses student satisfaction in online classes. This dissatisfaction in online classes can be seen in high rates of attrition in online classes (Chyung, 2001). Students need to feel involved and develop relationships with other students in online classes (Rovai, 2002a). Following from the social nature of learning, learning and cognitive development are recognized as substantially constituted through social interaction (Wenger, 1996).

2. Technology Acceptance Model and Student Satisfaction

Today's technology environment has introduced a productivity paradox. In other words, the issue is not whether there is too much technology available in institutions today, but rather, the issue is that users are not embracing the technology that is available. Much research from the last 20 years has considered how to improve user acceptance through the application of the technology acceptance model (TAM: Davis, 1989; Davis, Bagozzi, & Warshaw, 1989). Based on the theory of reasoned action, TAM suggests that user acceptance of technology is driven by users' beliefs about the consequences of that usage. In particular, TAM predicts that users embrace new technology when their perceptions of the ease of use and the usefulness of the technology are positive (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989). According to Davis (1989), perceived ease of use and perceived usefulness are the two main factors affecting users' acceptance behaviors. Davis defined perceived ease of use as the degree to which an individual believes that using a particular system would be free from physical and mental efforts. He defined perceived usefulness as the degree to which an individual believes that using a particular system would enhance his or her job performance.

The first factor, perceived ease of use, represents the level of difficulty a user expects to have in integrating the technology into his or her routine. The second factor, usefulness of technology, represents whether the technology will enhance his or her performance in completing a job. Usefulness then assumes not only that the technology will enhance performance but also that the user can perceive both the enhancement and its impact. TAM suggests a user must be able to perceive both ease of use and usefulness before he or she will adopt new technology. While TAM has been validated by many researchers (Gefen, Karahanna, & Straub, 2003; Lederer, Maupin, Sena, & Zhuang, 2000) and applied to a wide range of technology, there continues to be ambiguity about how to use the theory to improve user acceptance behavior. For example, it is not clear how perceived ease of use plays a role in the decision of technology acceptance. Several studies (e.g., Venkatesh & Davis, 1996; Venkatesh, Morris, Davis, & Davis, 2003) suggest perceived ease of use is a critical antecedent to technology acceptance. However, other studies (e.g., Szajna, 1996; Venkatesh, 1999) suggest perceived ease of use has no effect on the decision of technology adoption. Other researchers reported that the role is indirect through intermediary impact of perceived usefulness (Keil, Beranek, & Konsynski, 1995; Morris & Dillon, 1997). It is not easy to resolve the contradictions of these studies. ICT has

experienced rapid growth in education industries while online classes over the Internet have become easier to use and more consistent.

There is, however, no disagreement in the literature that perceived usefulness influences technology adoption and usage. The impact of this factor has been demonstrated in numerous studies and has not been questioned seriously by any study. The literature also questions which factors impact perceived usefulness in the continued usage of technology. For example, Karahanna, Straub, and Chervany (1999) reported that attitudes and adoption decisions are not static. Rather, the adoption process is complex and dynamic with relevant factors changing over time. In addition, Karahanna and Straub (1999) found that technology use must not only be useful but of high quality. Venkatesh and Davis (2000) reported that user's beliefs about usefulness are impacted by interaction between the relevance of technology to one's purpose and the quality of outcome from the technology. Adapting TAM to examine student satisfaction and technology adoption in online classes, Lin (2005) found that student intention to use technology affected their learning outcome in the online class environment.

Previous studies recognized that students' familiarity with technology usage and feeling of how they are supported by communication tools influenced student satisfaction in online classes (Carr, 2000; Hara & Kling, 2000). Gallini and Helman (1995) also reported that online students need to be effective in communicating information particularly that related to fellow students' actions in order to learn successfully. The technology acceptance behavior of students may influence satisfaction with online interaction because technology and communication tools play deterministic roles.

3. Student Satisfaction and Interaction in Online Classes

Student satisfaction in online classes is defined by student-reported feeling about interaction with instructors and fellow students, course structure, institutional support, and flexibility (Sener & Humbert, 2003). Student satisfaction in online classes depends on a number of factors. Borstorff and Lowe (2007) reported that communication with instructors and fellow students is the most important factor to student satisfaction in online classes. Robinson and Hullinger (2008) reported that student engagement is the most critical factor to student satisfaction in online classes. Bambara, Harbour, Davies, and Athey (2009) reported that soft engagement permeates student experience in online classes. Rovai (2002c) reported that online students who had a strong sense of

community and perceived high cognitive learning felt less isolated and had great satisfaction with their academic programs. Dawson (2006) also reported that students who have more interaction with their peers as well as their instructors had high degrees of sense of community and it influences them to have high levels of satisfaction in their online classes.

In the online class environment, the use of technology and communication tools is necessary for interaction and subsequent learning. Using an online course management system without special design provisions can leave student feeling socially isolated. Schwier (2002) reported that the accessibility and use of technology in online classes is critical to facilitate and build a virtual learning community because technology and communication tools provide a gathering space and mediate communication channels for students. It is critical to establish students' sense of community in order to promote their participation and interaction in online classes.

Wenger (1998) defined participation as the social experience of living in the world in terms of membership in social communities. The learning process can be described as how students move from peripheral participants toward becoming core participants in the learning community. This transformation in the way they participate is also represented in how they perceive themselves in the learning community and how they are perceived by fellow students. Thus, participation, learning and membership in a community are intertwined and member identities change through their participation. Since the online class is constituted through sense of community that describes students' sense of belonging and a social bond with others (Rovai, 2003b; Carroll, 2001), student participation and interaction has potential to influence student satisfaction in the online class environment. The active participation of students is often seen as the critical component in forming a learning community and building sense of community in online classes (Wang, Sierra, & Folger, 2003).

Interaction is an important part of student satisfaction in online classes. Research suggests that both quality and quantity of interaction with instructors and fellow students are much more crucial to the success of online classes and student satisfaction than that are in traditional face-to-face classes (Woods, 2002). Fulford and Zhang (1993) reported that students' perception of interaction was a critical predictor of student satisfaction in online classes. Debourgh (1999) also reported the factors that were related to interaction were critically important. These factors are related to promptness of answers to student questions, instructors' encouragement of participation, accessibility of instructors, and promptness of instructors' feedback on

students' work.

Swan (2001) reported that three factors contributed significantly to a level of student satisfaction in online classes. These factors are contact with and feedback from instructors, active discussions with fellow students, and clarity in course design. Studies have shown that interaction and participation are essential for productive learning in online classes (Nicol, Minty & Sinclair, 2003). Additionally, the Internet and multimedia technology continue to play increasing roles in reshaping the way knowledge is delivered, providing valid alternatives to traditional face-to-face classes (Garrison, 2000; Zhang, Perris, & Yeung, 2005). High quality of instructional and institutional support also results in a high level of student satisfaction in online classes. Schwitzer, Ancis and Brown (2001) reported that interactive and engaging student services were critical factors for student satisfaction. Students might interact with student support coordinators and specialists in various forms of communication in addition to interacting with instructors who help students learn the course content.

Ⅲ. METHODOLOGY

1. Research Framework and Hypotheses

Perceived interaction in online classes would be useful to understand how it influences student satisfaction and how it is interconnected in the relationships between perceived ease of use, perceived usefulness and student satisfaction. However, the role of perceived interaction has not been well explored in evaluating online learning outcome. In this respect, it is a meaningful contribution to the literature if this study documents the role of perceived interaction in student satisfaction and in-between technology acceptance. Building on this argument, the research framework is developed in Figure 1. This study will examine five hypotheses:

H1: Perceived ease of use positively influences the perception of interaction in online classes.

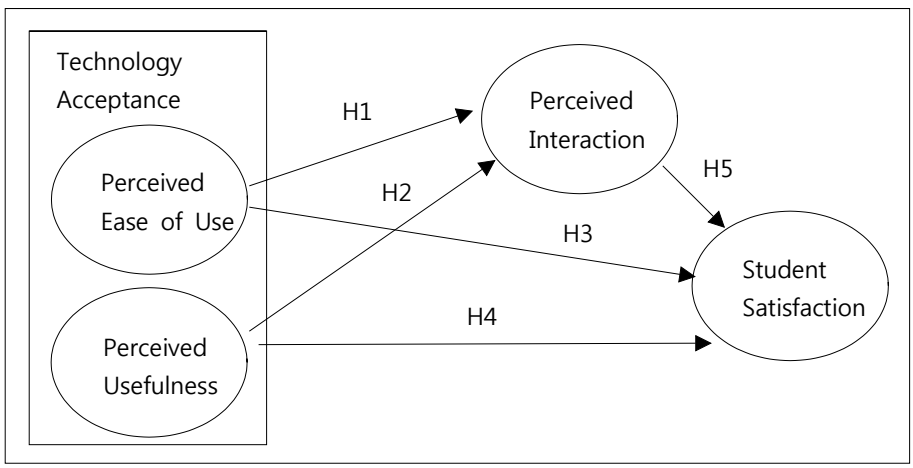
H2: Perceived usefulness positively influences the perception of interaction in online classes.

H3: Perceived ease of use positively influences the degrees of student satisfaction in online classes.

H4: Perceived usefulness positively influences the degrees of student satisfaction in

online classes.

H5: Perceived interaction positively influences the degrees of student satisfaction in online classes.



<Figure 1> Research Framework and Structural Model

2. Survey and Sample Characteristics

A questionnaire was developed for determining the perceptions toward ease of use, usefulness, interaction, and satisfaction with online classes. A survey was conducted to undergraduate students of Seoul Digital University through a web-based survey method during Spring 2009 semester (March ~ June 2009) in Korea. Eight hundred forty two respondents were chosen at random for in-depth analysis (Table 2). About 64% of the respondents have been enrolled at the university for 2 years or more. About 50% of the respondents did not interact frequently with their peers; even about 20% never communicated with their peers on matters related to online classes such as assignments and tests. About 60% communicated regularly with instructors on matters related to online classes. This was a much lower percentage of interaction to meet requirements of the online class. The respondents showed their satisfaction with current online classes with a mean of 3.851 (S.D. = 0.934) out of a 5 point scale and had intension to continue registering for current online classes at the average of 3.703 (S.D. = 0.958) out of a 5 point scale (see Appendix).

<Table 2> Survey Details and Sample Characteristics

Survey details		
Survey period		March ~ June 2009
Respondents		842 undergraduate students
Sample characteristics		Frequencies(percentages)
Gender	Male	462(54.9)
	Female	380(45.1)
Age	18-22	74(8.8)
	23-29	310(36.8)
	30-39	272(32.3)
	40-49	134(15.9)
	Above 50 years old	52(6.2)
Previous Education	Not answered	22(2.6)
	Secondary (high school)	398(47.3)
	Junior college	206(24.5)
	University	178(21.1)
	Graduate	38(4.8)

3. Measurement Scales

To measure the satisfaction variable, this study used four survey questions: "intension to register for online classes," "likelihood of recommendation online classes," "intension to continue taking online classes," "overall satisfaction with online classes" with responses ranging from 'least likely=1' to 'most likely=5.' Perceived interaction was measured by using three survey questions developed by the authors. Ten survey questions were used to measure student perceptions toward ease of use and usefulness of online classes. Among them, eight questions were borrowed from Davis (1989) and modified for online education research and the other two questions were developed and added by the authors (see Appendix). To ensure the minimization of idiomatic wording, all of the instruments were first translated into Korean and then the results were checked and translated back to English by the authors.

4. Factor Analysis and Reliability Test

Factor analysis with a varimax rotation procedure was employed to identify underlying predictors of student satisfaction with online classes. Then, a statistical test was used to test internal consistency for the survey items. Factor analysis yielded three

factors based on an eigenvalue cut-off of 1. The sums of squared loadings from the three-component have the cumulative value of 81.831% in explaining the total variance of the data. The three components are named as "perceived ease of use (PEOU)," "perceived usefulness (PU)," and "perceived interaction (Interaction)" respectively.

To test the appropriateness of factor analysis, two measures were used. The Kaiser-Meyer-Olkin (KMO) overall measure of sampling adequacy (MSA) was 0.909, which falls within the acceptable level. The Bartlett's test of sphericity was 10002.726 (degree of freedom = 78), significance at p = 0.000, which showed a significant correlation among the survey questions. Further scale refinement was done by examining the item-to-total correlation. This led to the retention of 13 items, which represented the three factors; PEOU factor (5 items, α = 0.931), PU factor (5 items, α = 0.940), and Interaction factor (3 items, α = 0.933) respectively (Table 3).

The analysis of moment structures (AMOS: Arbuckle, 2006) was used for an empirical test of the model. The maximum likelihood estimation (MLE) was applied to estimate numerical values for the components in the model. To diagnose the presence of distribution problems in the data and to gauge their effects on the parameter estimates, bootstrapping (Efron, 1987; Stine, 1989) was employed and 300 bootstrap replications were done. Confirmatory factor analysis was applied to test the validity of the scales in measuring specific constructs of the measurement model. To diagnose possible identification problems, degree of freedom with large standard error variances were evaluated. The identification problem was remedied in accordance with Hayduk's (1987) guidelines.

<Table 3> Results of Factor Analysis for the Survey Questions

Items	Factor loadings	Eigenvalue	Extracted variance	Factor name	Corrected item-total correlation	α
PEOU1	0.827	3.997	30.743	Perceived Ease of Use (PEOU)	0.802	0.931
PEOU2	0.854				0.826	
PEOU3	0.843				0.864	
PEOU4	0.807				0.813	
PEOU5	0.806				0.787	
PU1	0.788	3.920	30.151	Perceived Usefulness (PU)	0.804	0.940
PU2	0.822				0.846	
PU3	0.849				0.858	
PU4	0.862				0.859	

PU5	0.763				0.820	
Interaction1	0.906	2.722	20.936	Perceived Interaction (Interaction)	0.855	0.933
Interaction2	0.912				0.892	
Interaction3	0.829				0.841	
total			81.831			

The Kaiser-Meyer-Olkin Measure of Sampling Adequacy= 0.909
Bartlett's Test of Sphericity, Chi-square= 10002.726, Significance= 0.000
Degree of Freedom= 78
Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization
Measurement and Structural Model

To evaluate the overall goodness-of-fit of the proposed model, the criteria of Bollen (1989, p. 275) was applied. Goodness-of-fit measures were selectively assessed as follows: Chi-square statistic (CMIN), degrees of freedom (DF), CMIN divided by DF (CMIN/DF), root mean square residual (RMR), root mean square of approximation (RMSEA), goodness of fit index (GFI), adjusted goodness of fit index (AGFI), normed fit index (NFI), and parsimony ratio (PRATIO).

Many fit measures represent an attempt to balance between parsimonious and well fitting model, that is, two conflicting objectives- simplicity and goodness of fit. Steiger (1990) stated that "in the final analysis, it may be impossible to define one best way to combine measures of complexity and measures of badness-of-fit in a single numerical index, because the precise nature of the best numerical tradeoff between complexity and fit is a matter of personal taste. The choice of a model is a classic problem in the two dimensional analysis of preference" (p. 179). This study seeks the ground for preferring a simple and parsimonious model instead of complex ones.

5. RESULTS

The results of the data analysis generally achieved acceptable goodness-of-fit measures: the indices of GFI (0.855), AGFI (0.805), which indicate that the fit of the proposed model is about 85% of the saturated model (the perfectly fitting model); the indices of NFI (0.912) and PRATIO (0.838). For NFI, the closer its values are to 1, the better the fit of the hypothesized model over the null model.

Null hypothesis 1. This study empirically tested the hypothesis that "There is no relationship between perceived ease of use and perceived interaction". The result shows that there is no causal relationship between perceived ease of use and

perceived interaction, which is statistically not significant ($p > 0.05$) at a 95% confidence level (Table 4). This suggests that perceived ease of use has no effect on perceived interaction in online classes.

Null hypothesis 2. This study empirically tested the hypothesis "There is no relationship between perceived usefulness and perceived interaction". The result shows that this causal relationship is statistically significant ($p < 0.001$) at a 95% confidence level (Table 4). This suggests that perceived usefulness has a positive effect on perceived interaction in online classes.

Null hypothesis 3. This study empirically tested the hypothesis "There is no relationship between perceived ease of use and student satisfaction with online classes". The result shows that this causal relationship is statistically significant ($p < 0.001$) at a 95% confidence level (Table 4). This suggests that perceived ease of use has a positive effect on student satisfaction with online classes.

Null hypothesis 4. This study empirically tested the hypothesis "There is no relationship between perceived usefulness and student satisfaction with online classes". The result shows that this causal relationship is statistically significant ($p < 0.001$) at a 95% confidence level (Table 4). This suggests that perceived usefulness has a positive effect on student satisfaction with online classes.

Null hypothesis 5. This study empirically tested the hypothesis "There is no relationship between perceived interaction and student satisfaction with online classes". The result shows that this causal relationship is statistically significant ($p < 0.001$) at a 95% confidence level (Table 4). This suggests that perceived interaction has a positive effect on student satisfaction with online classes.

<Table 4> Outputs of Structural Equation Model (SEM) Estimates

Path diagram			Proposed Model (N= 842)	Validation model (Bootstrap, N= 300)
Independent variables		Dependent variables	Estimate (S.E) Cr= critical ratio	Estimate (bias)
H1: Perceived ease of use	→	Interaction	0.045 (0.040) Cr= 1.102	0.040 (-0.005)
H2: Perceived usefulness	→	Interaction	0.545 (0.042)*** Cr= 13.030	0.538 (-0.007)
H3: Perceived ease of use	→	Student satisfaction	0.252 (0.023)*** Cr= 11.099	0.252 (0.000)
H4: Perceived usefulness	→	Student satisfaction	0.533 (0.029)*** Cr= 18.128	0.534 (0.001)
H5: Perceived Interaction	→	Student satisfaction	0.138 (0.021)*** Cr= 6.699	0.137 (-0.001)

***, $p<0.001$ statistically significant at a 95% confidence level.

Proposed model: N= 842, CMIN= 1227.918, DF= 114, Probability level= 0.000, CMIN/DF= 10.771, RMR= 0.231, RMSEA= 0.102, GFI= 0.855, Adjusted GFI= 0.805, NFI= 0.912, PRATIO= 0.838

Overall, the results of the hypothesis test suggest that perceived usefulness positively influences interaction in online classes and the three predictors of perceived ease of use, perceived usefulness, and perceived interaction positively influence student satisfaction with online classes. The results show that perceived usefulness and perceived interaction have strong, positive and direct effects on student satisfaction with online classes.

6. DISCUSSIONS AND IMPLICATIONS

Student satisfaction has been given high attention in online education in recent years due to the growth of online classes and online programs in higher education. There are a number of reasons for the attention given to student satisfaction in online education. First, understanding the factors that affect student satisfaction such as interaction with instructors and peers, ease of use, usefulness, course structure, and institutional support will help online course designers and instructors take necessary measures to increase student satisfaction. Second, it is seen as an important measure of learning outcome and program quality.

The findings showed predictive validity for a measure of interaction in online classes and suggest that the instrument may be a valuable tool in predicting technology acceptance and evaluating learning outcome in online classes. The findings support the use of interaction as a construct to explain activity and outcome in online classes. Interaction proves to be a parsimonious way of modeling the contributions of perceived ease of use and perceived usefulness to how individual students participate in online classes. Interaction also proves to be an important construct for understanding learning outcome in online classes. The findings support literature developing on the role of interaction in online education and are a step toward extending the context of interaction in the online class environment.

According to the social theory of learning, members learn by participating in activities and socially interacting with other members of their community. Previous studies have found that students' sense of belonging, and communication styles influence their intentions toward participating in class activities and interacting with others. To understand better how social factors impact students' learning outcome interdependently in online classes this study addressed the influence of interaction on

student satisfaction with online classes. The results indicated that students' perceived interaction had a strong and positive influence on their overall satisfaction with online classes.

However, although students can use various communication tools easily to interact with peers in online classes, their participation and interaction tend to be restrained if there is weak sense of community. This finding confirms the theoretical insights of the social theory of learning in online education. The findings confirm that students' achievements in online classes not only include cognition changes about a subject matter but also their sense of belonging, which in turn influences students' further participation and interaction. The findings also serve to remind system designers of online education that the online course management system needs to be developed for making students easily access to course content and information and for supporting social interaction that may promote sense of community.

Finally, the findings illustrate the positive and direct impact of interaction on student satisfaction with online classes. This result suggests that the more students use the communication tools of online classes, the more they may develop sense of community in the online context. Therefore, instructors of online classes may want to encourage greater use of communication tools in their instructional designs in order to increase sense of community.

There are several methods to encourage student participation and interaction in online classes such as instructional design for collaborative class activities (e.g. group work, team project, group debate, etc.), and the use of different types of communication tools (e.g. chat room, discussion board, blog, etc). It is clear that the online class format, technology used for supporting online class, and instructional design contribute to building sense of community. An explicit design of online classes may encourage students to identify online classes as a learning community and fosters interaction with peers and instructors. The respondents reported high satisfaction with online classes because of the advantages of ease of use and usefulness, and felt interested in using different types of technology for interaction with fellow students and instructors. Active interaction through usage of technology and communication tools seems to be crucial for enabling students to accomplish high learning outcome. How students appreciate communication tools and instructional design that facilitate interaction with peers and instructors predicts the degree of student satisfaction in online classes. The tools and sense of community encourage students to participate in class activities and reinforcing interaction.

IV. CONCLUSIONS

This paper presents the findings from a study investigating the relationship between student satisfaction and perceived interaction in online classes. The findings suggest that perceived interaction in online classes is indicative of student satisfaction. Therefore, additional participation and interaction activities are required to facilitate active interaction and to enhance student satisfaction with online classes.

This study shows the relationships between technology acceptance constructs and perceived interaction and student satisfaction with online classes. Path diagram techniques help uncover the interconnection among constructs. Future research will consider how other factors (e.g. social ability, sense of community, etc) associated with interaction and how behavioral measures of interaction can enhance the model. Additionally qualitative methods will contribute to understanding about potential other factors as well as deepening understanding of what it means to be under different social conditions.

Although the findings extend previous literature on online education by revealing complex relationships among key constructs related to student satisfaction of online education, the findings should be applied with care. First, only self-reported data was used to measure key constructs used in the model. For example, self-reported interaction was used to estimate student interaction and it might not address the meaning of participation. Self-reported interaction can be different from actual participation and the participation perceived by peers in online classes. Further study should strive to include other data forms such as actual logs of participation activity and content analysis of communication. Second, there are still some personal variables (e.g., age, gender, and academic level) and course variables (task types, course structures, and instructor experience) not addressed by this study. Further study should try to explore more about how different age, gender, or course related variables influences the relationships of interaction regarding student online learning experience. Addressing these limitations should increase the generalization of the findings to other education formats.

References

Abrahamson, C. E. (1998). Issues in interactive communication in distance education. College Student Journal, 32 (1), 33-43.

Allen, M., Bourhis, J., Burrell, N., & Marbry, E. (2002). Comparing student satisfaction with distance education to traditional classrooms in higher education: A meta-Analysis. American Journal of Distance Education, 16 (2), 83-97.

Arbaugh, J. B. (2000). Virtual classroom characteristics and student satisfaction with Internet based MBA courses. Journal of Management Education, 24 (1), 32-54.

Arbuckle, J.L. (2006) AMOS (version 6.0). Chicago, IL: SmallWaters.

Bambara, C.S., Harbour, C.P., Davies, T.G., & Athey, S. (2009). Delicate engagement: the lived experience of community college students enrolled in high-risk online courses. Community College Review, 36 (3) (Jan. 2009), 219-238.

Basile, A., & D'Aquila, J.M. (2002). An experimental analysis of computer-mediated instruction and student attitudes in a principles of financial accounting course. Journal of Education for Business, 77 (3), 137-143.

Bollen, K.A. (1989). Structural equations with latent variables. New York: Wiley.

Borstorff, P.C., & Lowe, S.K. (2007). Student perceptions and opinions toward e-learning in the college environment. Academy of Educational Leadership Journal, 11 (2) (May 2007), 13-29.

Carr, S. (2000). As distance education comes of age, the challenge is keeping the students. Chronicle of Higher Education, 46 (23), A39-A41.

Carroll, J. M. (2001). Community computing as human-computer interaction. Behavior and Information Technology, 20 (5), 307-314.

Chyung, S. Y. (2001). Systemic effects of improving the motivational appeal of online instruction on Adult distance education. Paper presented at the 82nd annual meeting of the American Education Research Association (AERA), April 10-14, 2001, Seattle, WA, USA.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13 (3), 319-340.

Davis, F.D., Bagozzi, R.P., & Warshaw, P.R. (1989). User acceptance of computer technology: A comparison of two theoretical models. Management Science, 35 (8), 982-1003.

Dawson, S. (2006). A study of the relationship between student communication interaction and sense of community. The Internet and Higher Education, 9 (3),

153-162.

DeBourgh, G. A. (1999). Technology is the tool, teaching is the task: Student satisfaction in distance learning. Paper presented at the Society for Information Technology & Teacher Education International Conference, February 28-March 4, 1999, San Antonio, TX, USA.

Efron, B. (1987). Better bootstrap confidence intervals. Journal of the American Statistical Association, 82, 171-185.

Fulford, C. P., & Zhang, S. (1993). Perceptions of interaction: The critical predictor in distance education. The American Journal of Distance Education, 7 (3), 8-21.

Gallini, J. K., & Helman, N. (1995). Audience awareness in technology-mediated environments. Journal of Educational Computing Research, 13, 245-261.

Garrison, R. (2000). Theoretical challenges for distance education in the 21st century: A shift from structural to transactional issues. The International Review of Research in Open and Distance Learning, 1 (1), 1-17.

Gefen, D., Karahanna, E., & Straub, D. (2003). Trust and TAM in online shopping: An integrated model. MIS Quarterly, 27 (1), 51-90.

Hagel, P., & Shaw, R. N. (2006). Students' perceptions of study modes. Distance Education, 27 (3), 283-302.

Hara, N., & Kling, R. (2000). Students' distress with a web-based distance education course, CSI Working Paper, Indiana University, retrieved June 22, 2008 from http://rkcsi.indiana.edu.ezproxy.bu.edu/archive/CSI/WP/wp00-01B.html.

Hayduk, L.A. (1987). Structural equation modeling with LISREL: Essentials and advances. Baltimore: Johns Hopkins University Press.

Hentea, M., Shea, M. J., & Pennington, L. (2003). A Perspective on Fulfilling the Expectations of Distance Education. Paper presented at the Proceeding of the 4th conference on Information technology curriculum, Lafayette, Indiana, USA.

Jason, L.A., Kennedy, C.L., & Taylor, R.R. (2001). Development and evaluation of a web-based classroom. Journal of Instructional Psychology, 28(3), 155-160.

Karahanna, E., & Straub, D.W. (1999). The psychological origins of perceived usefulness and perceived ease-of-use. Information & Management, 35 (4), 237-250.

Karahanna, E., Straub, D.W., & Chervany, N.L. (1999). Information technology adoption across time: A cross-sectional comparison of pre-adoption and post-adoption beliefs. MIS Quarterly, 23 (2), 183-213.

Keil, M., Beranek, P.M., & Konsynski, B.R. (1995). Usefulness and ease of use: Field

study evidence regarding task considerations. Decision Support Systems, 13 (1), 75-91.

Klesius, J., Homan, S., & Thompson, T. (1997). Distance education compared to traditional instruction: The students' view. International Journal of Instructional Media, 24 (3), 207-220.

Korean Educational Development Institute (2008). Brief statistics on Korean Education. Statistical Materials SM2008-9-2. Retrieved October 1, 2009, from http://cesi.kedi.re.kr/index.jsp

Lawson, T.J. (2000). Teaching a social psychology course on the web. Teaching of Psychology, 27 (4), 285-289.

Lederer, A.L., Maupin, D.J., Sena, M.P., & Zhuang, Y. (2000). The technology acceptance model and the World Wide Web. Decision Support Systems, 29, 269-282.

Leon, R.V., & Parr, W.C. (2000). Use of course home pages in teaching statistics. The American Statistician, 54 (1), 44-48.

Levin, T., & Wadmany, R. (2006). Listening to students' voices on learning with information technologies in a rich technology-based classroom. Journal of Educational Computing Research, 34 (3), 281-317.

Liao, L. (2006). A flow theory perspective on learner motivation and behavior in distance education. Distance Education, 27 (1), 45-62.

Lin, Y. (2005). Understanding students' technology appropriation and learning perceptions in online learning environments, Unpublished doctoral dissertation, University of Missouri, Columbia.

Maor, D. (2003). The teacher's role in developing interaction and reflection in an online learning community. Computer Mediated Communication, 40 (1/2), 127-137.

Mitchell, T. J. F., Chen, S. Y., & Macredie, R. D. (2005). The relationship between web enjoyment and student perceptions and learning using a web-based tutorial. Learning, Media and Technology, 30 (1), 27-40.

Moore, M. G., & Kearsley, G. (2005). Distance education: A systems view (2nd Ed.), Belmont, CA: Wadsworth.

Morris, M.G., & Dillon, A. (1997). The influence of user perceptions on software utilization: Application and evaluation of a theoretical model of technology acceptance. IEEE Software, 14 (4), 56-75.

Muilenburg, L.Y., & Berge, Z. L. (2005). Student barriers to online learning: A factor

analytic study. Distance Education, 26 (1), 29-48.

Nicol, D., Minty, L., & Sinclair, C. (2003). The social dimensions of online learning. Innovations in Education & Teaching International, 40 (3), 270-280.

O'Donoghue, J., Singh, G., & Dorward, L. (2001). Virtual education in universities: A technological imperative. British Journal of Educational Technology, 32 (5), 511-523.

Picciano, A.G. (2002). Beyond student perceptions: Issues of interaction, presence, and performance in an online course. Journal of Asynchronous Learning, 6 (1), 21-40.

Rahm, D., & Reed, B. J. (1998). Tangled Webs in Public Administration: Organizational issues in distance learning. Public Administration and Management: An Interactive Journal, 3 (1), Retrieved October 1, 2009, from http://www.pamij.com/rahm.html.

Roach, V., & Lemasters, L. (2006), Satisfaction with online learning: A comparative descriptive study. Journal of Interactive Online Learning, 5 (3), 317-332.

Robinson, C.C., & Hullinger, H. (2008). New benchmarks in higher education: student engagement in online learning. Journal of Education for Business, 84 (2) (Nov-Dec 2008), 101-108.

Rovai, A. P. (2002a). Building Sense of Community at a Distance. International Review of Research in Open and Distance Learning, 3 (1), Retrieved October 1, 2009, from http://www.irrodl.org/index.php/irrodl/article/viewFile/79/153.

Rovai, A. P. (2002c). Sense of community, perceived cognitive learning, and persistence in asynchronous learning networks. The Internet and Higher Education, 5, 319-332.

Rovai, A. P. (2003b). Sense of community in a higher education television-based distance education program. Educational Technology Research and Development, 51 (2), 5-16.

Salmon, G. (2000). E-moderating: The key to teaching and learning online. London: Kogan-Page.

Schwier, R. (2002). Shaping the metaphor of community in online learning environments, Retrieved October 1, 2009, from http://cde.athabascau.ca/ISEC2002/papers/schwier.pdf.

Schwitzer, A., Ancis, J., & Brown, N. (2001). Promoting student learning and student development at a distance: Student affairs principles and practices for televised instruction and other forms of distance learning (2nd Ed.), Lanham,

MD: American College Personnel Association: University Press of America.

Sener, J., & Humbert, J. (2003). Student satisfaction with online learning: an expanding universe. In J. Bourne & J. C. Moore (Eds.), Elements of Quality Online Education: Practice and Direction (pp. 245-260). Needham, MA: Sloan Center for Online Education.

Sloman, M. (2001). The e-learning revolution. London: CIPD.

Steiger, J.H. (1990). Structural model evaluation and modification: An interval estimation approach. Multivariate Behavioral Research, 25, 173-180.

Stine, R.A. (1989). An introduction to bootstrap methods: Examples and ideas. Sociological Methods and Research, 18, 243-291.

Swan, K. (2001). Virtual interaction: Design factors affecting student satisfaction and perceived learning in asynchronous online courses. Distance Education, 22 (2), 306-331.

Szajna, B. (1996). Empirical evaluation of the revised technology acceptance model. Management Science, 42 (1), 85-92.

Tallent-Runnels, M. K., Thomas, J. A., Lan, W. Y., Cooper, S., Ahern, T. C., Shaw, S. M., & Liu, X. (2006). Teaching Courses Online: A Review of the Research. Review of Educational Research, 76 (1), 93-136.

Venkatesh, V. (1999). Creation of favourable perceptions: Exploring the role of intrinsic motivation. MIS Quarterly, 23 (2), 239-260.

Venkatesh, V., & Davis, F.D. (1996). A model of the antecedents of perceived ease of use: Development and test. Decision Sciences, 27 (3), 451-481.

Venkatesh, V., & Davis, F.D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. Management Science, 46 (2), 186-204.

Venkatesh, V., Morris, M.G., Davis, G.B., & Davis, F.D. (2003). User acceptance of information technology: Toward a unified view. MIS Quarterly, 27 (3), 425-478.

Vonderwell, S. (2003). An examination of asynchronous communication experiences and perspectives of students in an online course: a case study. The Internet and Higher Education, 6 (1), 77-90.

Wang, M., Sierra, C., & Folger, T. (2003). Building a dynamic online community among adult learners. Education Media International, 40 (1/2), 49-61.

Wenger, E. (1996). Communities of practice: the social fabric of the learning organization. HealthCare Forum Journal, 39 (4), 20-26.

Wenger, E. (1998). Communities of practice: Learning, meaning and identity.

Cambridge, UK: Cambridge University Press.

White, C. (2005). Contribution of distance education to the development of individual learners. Distance Education, 26 (2), 165-181.

Woods Jr., R.H. (2002). How much communication is enough in online courses? Exploring the relationship between frequency of instructor-initiated personal email and learners' perceptions of and participation in online learning. International Journal of Instructional Media, 29 (4), 377-394.

Zhang, W., Perris, K., & Yeung, L. (2005). Online tutorial support in open and distance learning: Students' perceptions. British Journal of Educational Technology, 36 (5), 789-804.

<국문초록>

원격교육환경에서 기술수용모델과 상호(相互)작용이 고객만족에 미치는 영향

이 정 완* · 김 영 이**

본 연구의 목적은 기술수용모델이 원격교육환경에서 인지된 상호(相互)작용에 미치는 영향을 탐색하고, 확장된 기술수용모델이 원격교육환경에서의 고객만족에 미치는 영향을 총체적으로 탐색하고자 하였다. 자료는 2009년 봄 학기에 원격교육대학에 등록된 842명의 학생들로부터 수집하였다. 또한 수집된 자료는 요인분석과 구조방정식 모형을 이용하여 분석하였다. 자료 분석 결과, 인지된 유용(有用)성이 원격교육환경에서의 인지된 상호(相互)작용과 유의한 관계를 가지고 있으며, 인지된 용이(容易)성, 유용(有用)성, 그리고 인지된 상호(相互)작용이 모두 고객만족에 유의한 영향을 미치는 것으로 나타났다.

주제어 : 기술수용모델, 원격교육, 고객만족, 상호(相互)작용, 대화(對話)참가, 통신(通信)도구, 구조방정식

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