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Determinants Affecting User Satisfaction with
Campus Portal Services in Korea

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Abstract

Campus portals have attracted a great deal of interest among universities, as they are considered a source of competition superiority. This is because universities wish to project the impression that they offer the most convenient service and excel in the field of Information Technology—this allows them to attract superior students. The increase in the number of universities currently offering campus portal services, and assessments of user satisfaction with these services, are increasingly recognized as important research subjects.

This study assesses the relationships between end-user satisfaction with campus portal services, and the degree of influence of this factor. In this study, user satisfaction with campus portal services was determined by assessing end user satisfaction factors, in accordance with the method developed previously by Doll and Torkzadeh. Additionally, usability, playfulness, design, and support service were established as preceding factors influencing user satisfaction.

The results of this study showed that user ability, playfulness, design, and support service influence user satisfaction. This study is meaningful in that it provides information and matters for consideration regarding the improvement and maintenance of campus portal services.

Keywords: **campus portal; end-user computing satisfaction; user satisfaction**

INTRODUCTION

In an information-oriented era, the acquisition and use of information via IT is a crucial factor in the quality of the lives of individuals in a global society. It has become a reality that one must acquire the basic knowledge required for a knowledge-information society, and thus nations must promote education-information oriented policies through web building in order to maintain their global competitiveness (Lee, 2006). It is also essential to be able to communicate with the college community and conduct cyber classes through the intranet in universities, regardless of any specific majors or studies. In school, information resources such as study, education, administration, books, science, and employment are proliferating rapidly, and access to those resources and to their use are becoming much easier.

First of all, a variety of information needs to be provided in a prompt fashion in order to promulgate proper education in schools; a great deal of relevant information is required, both directly and indirectly, in addition to academic information for education and study. However, information system functions based on current educational administration and curriculum generally lack the ability to deal with rapid environmental changes in an effective manner. Therefore, existing information systems must necessarily be upgraded and evaluated on an ongoing basis, in order that universities can retain their competitiveness and improve the quality of their education in this world of unlimited competition--in short, no nation can escape the requirements of open economies,

information-oriented societies, and globalization.

The Ministry of Education and Human Resources has driven universities to improve their competitiveness and to make voluntary efforts toward information-oriented systems by supporting projects that individual universities find difficult to execute; thus far, a host of comprehensive programs for the revitalization of university information systems have been developed and advanced. Additionally, the Ministry has established the '2006 University Information System Revitalization Plan', whereby USD 11 million is to be invested for the purpose of strengthening higher education competitiveness through university information systems--this program also supports the development of e-learning center buildings, education system operation, administration systems, expanded national university information systems, and information support systems to foster a safe and reliable information environment. This program, and other related programs, are expected to improve university information systems and help them to be strong and competitive in education, science, and study. Due to such governmental efforts, many universities are currently in the process of building web-based service systems via internet homepages, and providing students with a variety of information by connecting vast information resources linked to campus networks. Additionally, individualized-comprehensive information services are being materialized via the maximization of user convenience by a campus information network, which has been simplified by unifying partial and individual operating systems (ETNEWS, 2006a, 2006b). Although university information systems are generally classed as information service systems that provide variable applications in comprehensive education information, library information, and administrative information, current campus portals provide opportunities as information gateways and user interfaces for linking with individual groups, through which campus internal and external users can access a great variety of information and applications with individualized and customized services through the internet. Thus, it is clear that such systems have synthesized not only educational function-offering services, such as the education processes of entering and registration, scores, scholarships, education funding, and online class connections, but also functions of web search, information sharing, B2B applications such as individual specific search services, and generated results (Roach, 2000; Zhou, 2003).

By building campus portal services, universities have found it easier to provide all information resources and services, such as education information and administrative support services, which have been simplified and individualized in safe, consistent, and customized ways--additionally, it is now possible for administrators to access a great quantity of unified and concentrated information, and simultaneously manage that information.

Thus, the concept of university information services has been expanded and generalized to include internet portal services, and the increase in interest regarding web-based campus portal services has compelled each university to invest vast resources on the purchase of campus-wide information systems, their development, and their practice (Lee, 2006; Bajec, 2005). However, there have not been enough domestic studies regarding campus portal issues, which remain quite limited, while the interest of universities in the introduction of portal technology is increasing. (Lee, 2008).

This study assesses user satisfaction with university students' portal services for a

consistent assessment of campus portal services being operated, in terms of a maintenance and improvement management of the service. This study will facilitate increases in campus portal use by virtue of a causal model analysis on major factors for user satisfaction improvement, and will evaluate factors for the design of campus portal services, focusing on the end users. Additionally, this study is expected to facilitate future upgrades or re-designs of campus portal systems.

THEORETICAL BACKGROUND

1) Campus Portal Services

In the mid-1990s when the Web was introduced to universities, the primary applications were rather limited, and university homepages were developed exclusively as gateways to different databases (Jafari, 2003). However, this has changed significantly, and university web sites have progressed further and become more sophisticated, matured considerably, and developed into comprehensive forms, referred to variously as "portals", "enterprise portals", and "enterprise information portals". Although there is currently no general agreement as to the definition of a portal, it can be described as a simplified-individualized interface by which all information resources and service can be accessed in a safe, consistent, and customized fashion (Bajec, 2005). According to Eisler (2003), this provides opportunities not only to offer individual and customized user interfaces for the approach of all inside and outside information, but also to make connection points and information gateways for individual groups.

In fact, even if the concept of portal is generally associated with mass market website systems like Yahoo or Google, campus portals can also be understood as a comprehensive system providing education functions including educational registration, scores, and scholarship education financing, as well as on-line class linking and B2B functions for students interfacing with web-based school homepages (Roach, 2000). The platforms of these portal sites are generally described as variants of search engines, but can be differentiated from general search engines in that they are customized for individuals, and users can continue to search for specific information and acquire results in advance via fixed methods (Zhou, 2003). Dias (2001), who previously pieced together various definitions of enterprise portals, defined them as information systems designed to assist and manage decision-making to facilitate cost reduction, improvements in productivity and competitiveness, building desire for information in information environment meeting staff, interacting with internal and external information resources, and distributing and managing them. This definition differs from that of the portal in the context of hub information linked to an intranet or digital directory with regard to user desire, internal and external information resources, and cost reduction (Brakel, 2003). Hence, campus portal services can be considered a comprehensive information service by which searching function can be provided for the modern university's variety of information resources and specific external information, including many customized communities and personal e-mail accounts.

Universities are attempting to strengthen campus portal development in phases, adopting new policies to attract students and enhance their competitiveness. Specifically, universities wish to be informed through campus portals that they retain the lead in information technology, and provide the most convenient services (Zazelenchuk and Boling, 2003). In early days, beginning with UCLA, Delaware University, and Buffalo

University--and more recently, Minnesota University, and Louisiana State University are building successful campus portals (Connolly, 2000; Ethridge *et al.*, 2000; Frazee, 2001; Kvavik and Handberg, 2000). Providing OneStart portal service, Indiana university allows students to use all associated software and services continually through a "front door," with only one interface (Thomas, 2001).

Universities in Korea are also building joint-integrated information communication networks with professional system integrators and developing systems for the management of expansive systems of education, administration, study, employment, etc. for students escaping from the previous concept of information service, focusing principally on education management
In 1995, Ewha University built and operated a campus integrated information system, called ETIS (Ewha Total Information System) with LG-EDS (currently called LG-CNS) for the first time; Seoul National University, Chosun University, Busan University, and Korea University are also currently proceeding rapidly with integrated networks for education information. Korea University has established a knowledge management system, KUPID (Korea University Portal to Information Depository), and has introduced a portal service through which students can access all homepages, including the school intranet (by single ID connection), and utilize many searching services and e-mail services, as well as a vast community of knowledge. Additionally, Yonsei University now has a Portal Service, and KAIST also recently built the KAIST Portal 2.0 Service, providing a Single Sign-On service which supports an integrated user certification service that allows users to enjoy multi-software system resources with provided interface authority. In this regard, the introduction of campus portal services permits active communication, information sharing, and ready and fast access without the several steps required for connection among all campus members, which is expected to improve work performance in all university sectors (Lee, 2008).

2) User Satisfaction
Information system researchers have proposed measuring satisfaction levels perceived by users as a surrogate measure for information system effectiveness (Baroudi, Olson and Ives, 1988; Conrath and Mignen, 1990; Ginzberg, 1978; Hamilton and Chervany, 1981; Ives and Olson, 1984; Powers and Dickson, 1974). The basic hypothesis regarding user satisfaction is that it is not an effective system if the user is not satisfied with the system; conversely, it is considered an effective system if the user is content with it. User satisfaction for information systems including computers is a very important issue, as the number of computer users in organizations who rely on computers for their work are increasing dramatically, and thus it is increasingly necessary to evaluate their effectiveness (Harrison and Rainer, 1996). Delone and McLean(1992), who previously developed a successful model for information systems, reported that user satisfaction might be one of the most extensively utilized single measures among measuring tools for the evaluation of the success of information systems.

The construct of user satisfaction has been manipulated in many different ways. Some studies have defined user satisfaction on a single-item scale, but this approach has been criticized, as it leaves many questions as to reliability and the lack of information about user satisfaction and dissatisfaction. Thus, the general trend has been to measure user satisfaction on a multiple-item scale (Ives *et al.*, 1983). In previous studies, factors used for the construction of user satisfaction include accuracy and relevance to information

system contents, format and mode related to information expression, training, documentation, development procedure, system maintenance, and system contents associated with the organization's support for the development and maintenance of the system   (Ives *et al.*, 1983). Other factors include frequency, timeliness, reliability, assistance, adequacy, accommodation, communication, access, appreciation, and flexibility (Bailey and Pearson, 1983). Each study for user satisfaction factors adopts suitable scales for each feature of the study (Lee, 2006).

According to Bailey and Pearson (1983), user satisfaction is measured by the weighted sum of user's positive and negative reactions to an information system, and the user's positive perception is the most important factor for consideration--systems with a high score for this factor are considered to be high in user satisfaction. Namely, this is defined as the sum of positive or negative feelings and attitudes that influence specific circumstances. They drew out 36 preliminary items from literature studies and determined a final 39 items concerning user satisfaction after middle managers' reviews; the questionnaires developed via these processes can be reliable and relevant measurement tools and the development of a valid and appropriate user satisfaction scale is an important step. Ives, Olson and Baroudi (1983) previously re-verified the relevance of Bailey and Pearson (1983)'s model and found that it did not have a study purpose or contain relevant preliminary knowledge, and that the object of the study was production managers who could be separately surveyed by mail; this mail survey was executed over two times in order to prevent the halo effect associated with questionnaires. In the first assessment, 39 existing items were evaluated, in the second, 4 items of overall user satisfaction were assessed and the anticipated relevance was reviewed. Also, excluding the 6 less affected items via factor analysis, they finally reduced the number of assessment items of user satisfaction to 33 items without relevance reduction and demonstrated that measurement with two evaluation standards does not affect the reliability measurements for 4 assessment items.

Galetta and Lederer (1989) defined user satisfaction as recognition and attitude, Melone (1990), as the user's attitude as a tendency reacting favorably or unfavorably on processes related to computer systems, applied systems, system administrators or applied system use. Rainer and Harrison (1993) referred to end user satisfaction as the individual attitude toward the computer-related activities or computer use required to achieve work.

Generally, research papers for information system refer to system users as "end users"-- which generally means users that interact with applied software in order to approach information or prepare reports (Doll and Torkzadeh, 1988). Similarly, systems analysts, programmers and operators are less involved in user support, whereas the user tends to feel more responsibility in the application area of end-user computing environments. Accordingly, when students access campus portal services, they are the end users, by virtue of the fact that they are using information systems. Carr (1988) previously reported that typical computing operations of the end user included spreadsheet application programs, database management, word processing, programming, data analysis, graphics, communication, data research, and memory support. Thus, campus portals are considered to be end-user computing systems, as similar services are provided in campus portals, and it is possible to apply existing measurement methodology for the determination of end-user computing satisfaction.

Among typical studies of end-user computing satisfaction, Doll and Torkzadeh (1988) defined user satisfaction in terms of emotional attitude, and developed 12 EUCSI (end user computing satisfaction instrument) questionnaires for their research. The construct of user satisfaction as measured by EUCSI has 5 dimensions: content, accuracy, format, ease of use, and timeliness. Verifications regarding reliability and validity on measure for end-user satisfaction have been well-established in several studies associated with these (e.g. Torkzadeh and Doll, 1991; Hendrickson *et al.*, 1994). In studies concerning web-based information systems or web sites reflecting recent internet environments (Abdinnour-Helm *et al.*, 2005; Herring, 2001; Xiao and Dasgupta, 2002; Zviran *et al.*, 2006), Doll and Torkzadeh demonstrated that EUCS is a relevant measure for user satisfaction measurement applications. Therefore, these 5 dimensions can be important factors of a construct for measuring satisfaction with campus portal services.

3) Influencing Factors of User Satisfaction

User satisfaction is affected by several characteristic variables. Alter (1978) said that the computing ability of an information system user can make for smoother communication between the system developer and user and reduce aversion to the use of information systems in accomplishing their work. That is, if the computing ability of the information system user is generally high, satisfaction with an information system can also be high, as the extraction and acceptance of information requirements are easy, and user participation can be actively achieved in the progress or use of system development. On the other hand, if the user lacks computing ability, satisfaction can also be low, as the user will tend to be reluctant to introduce the system, and there will be less system application planning.

Srinivasan (1985) clarified that system user ability can give users a strong motivation to use systems, which is related to the accuracy of report content and ease of comprehension. On the basis of preceding research, Igbaria (1990) established preceding variables that are individual characteristics such as age, sex, social position, education level, computing education, computer experience, convictions such as an uneasy feeling about computers and user attitudes, task characteristics such as task structure and task diversity, and organizational characteristics reflective of support.

Huizingh (1999) established a framework of contents and design, in order to analyze and assess a website. The proposed contents included information, features, and services provided on the website and design as a method to entice website visitors to utilize such contents. Liu and Arnett (2000) proposed information and service quality, system use, playfulness, and system design as necessary factors for website success. By studying the literature relevant to information systems, Griffiths, Johnson, and Hartley (2007) indicated that user satisfaction is influenced by a variety of factors, including visual appeal.

In Doll and Torkzadeh (1988)'s study of user satisfaction with commercial web site, in which a measure for end user computing satisfaction was utilized, Zviran, Glezer, and Avni (2006) assessed the relationship between user-based design and website usability and user satisfaction. Li (1997) included service quality as a factor influencing information system performance from the personal perspective, and Pitt *et al.* (1995) reported that service quality is an intangible measurement criterion associated with

information systems. The computation department takes charge of the general management of information systems and provides users with education, training, consulting, etc. Recently, with increasing complexity in information systems, the computation department has been compelled to provide a host of different services, such as hardware and software installation, and network support. Support service provided by the department is a crucial component of information system evaluation (Moad, 1989). User satisfaction can be affected by support services for system users.

EMPIRICAL ANALYSIS

1) Research Model and Hypotheses

In order to construct the campus portal satisfaction factors, this study applied 5 factors of EUCS (end user computing satisfaction), assuming that university students are the end users who directly interact with applied software for information access and printed reports, as previously defined by Doll and Torkzadeh (1988). Because campus portals provide services similar to those of end user computing systems, they can be considered end user computing systems, and thus existing measurement methodology for the evaluation of end user computing satisfaction can be applied. Additionally, EUCS can be a construct for user satisfaction measurement in studies for web-based information systems reflective of the internet environment.

Alter (1978) previously noted that user's computing ability can affect user satisfaction with information systems, and Srinivasan (1985) noted that user's computing capability provides users with motivation for system use, associated with accuracy and ease of comprehension of reports. Igbaria and Nachman (1990) demonstrated that personal characteristic factors such as age, computing education, computer use experience and user's attitudes can also influence user satisfaction. Tang (2000) found that perceived user ability is one of the strongest and most decisive factors for successful intranet selection.

In the respect that campus portal service does searches similar to those of an internet web portal, user satisfaction will increase, depending on the user's ability to use internet searching services, as skilled users can perform the necessary work more effectively (Lee, 2008). Thus, students' ability to use campus portal services is anticipated to influence user satisfaction, and the following hypothesis is established:

Hypothesis1: User ability positively affects user satisfaction.

Playfulness and design are among the factors essential for the success of a website as determined by Liu and Arnett (2000), who also found that interface visual factors and construct are indispensible for the evaluation of websites. Zviran *et al.* (2006) and Lee (2008) reported that user-based designs affect user satisfaction in studies of user satisfaction for websites, in which the measure of end user computing satisfaction was utilized. In this regard, it is expected that the crucial factors of playfulness and user-based design would influence user satisfaction in website assessments, and the following hypothesis is established:

Hypothesis 2: Playfulness positively affects user satisfaction.
Hypothesis 3: Design positively affects user satisfaction.

Many existing studies of information systems include personal factors and service quality

as precedent factors that affect performance (Li, 1997). In particular, Pitt (1995) noted that service quality is an intangible measurement scale related to information systems. In universities, information computing departments in charge of information system management provide a variety of services, including not only hardware and software installation and network support, but also education, training, and consulting for users. Accordingly, such support services provided to users perform a key role in campus portal service evaluations (Moad, 1989; Lee, 2008). Thus, in order to provide proper support services for users on the issues associated with campus portal service use will positively affect user satisfaction; thus, the following hypothesis is established:

Hypothesis 4: Support service positively affects user satisfaction

2) Data Collection
In this study, a survey was conducted with business school students of Sahmyook university in order to assess students' satisfaction and its factors relevant to campus portal services. The survey period was from Apr. 2, 2008 to Apr. 18, 2008 and the questionnaires were distributed and collected directly by the surveyors. When questioned, answers were completed after giving brief explanations of the survey objectives and each question. The demographic characteristics of the survey are as shown in Table 1.

Table 1. Demographic characteristics of the respondents (n=281)

		Frequency	Percentage(%)
Gender	Male	168	59.8
	Female	113	40.2
Grade	Freshman	44	15.7
	Sophomore	87	31.0
	Junior	97	34.5
	Senior	53	18.9

Gender distribution of respondents shows 59.8% males and 40.2% females and the school year distribution is as follows: 15.7% freshman, 31.0% sophomores, 34.5% juniors, and 18.9% seniors.

3) Reliability and Validity Assessment
Doll and Torkzadeh (1988) utilized exploratory factor analysis via orthogonal rotation to draw a user satisfaction matrix, and named the 5 factors: content (4 items), accuracy (2 items), ease of use (2 items), timeliness (2 items) and formality (2 items). Measure for end user satisfaction was verified for validity and reliability (Straub, 1989) and also was shown to have external validity and generality (McHaney and Cronan, 1998; Zviran, 2003). Thus, this study assessed user satisfaction on a summated scale of detailed satisfaction factors with 12 items in accordance with Doll and Torkzadeh (1988)'s EUCS. Considering that campus portal services are similar to the current internet portal concepts, user ability was measured with searching ability through internet sites and the ability to use a personal computer (Igbaria, 1990). Playfulness was measured with pleasure and interest for campus portal use, design was measured with interface design and environment familiarity (Liu and Arnett, 2000). Support service was measured with immediate responses and efforts for problem-solving when internet portal services have

problems (Masrek, 2007).

In order to clarify the end user computing satisfaction factors, Doll and Torkzadeh (1988) applied orthogonal rotation, which does not consider correlations between factors, but Gerbing and Anderson (1988) asserted that exploratory factor analysis (EFA) can expose underlying patterns or factor structure among measured data in cases in which there has been insufficient study of the relevant factor model. On the other hand, if a plausible model exists, confirmatory factor analysis (CFA) is utilized for model verification (Bollen, 1989).

As the factor structure of the measurement model for end user computing satisfaction emerged during several previous studies (Doll and Torkzadeh, 1988; Torkzadeh and Doll, 1991; Doll *et al.*, 1994), this study involved a statistical testing via CFA with the five factors' measurement model of first-order, which assumes correlations demonstrating the best suitability, as conducted in the study of Doll *et al.* (1994). Similarly, the second phase of CFA was conducted to assess the suitability for the entire study model, consisting of one second-order factor model and the preceding variables with summated scales averaging the first five factors individually after practicing the first phase of CFA for dependent variables. Additionally, construct reliability and construct validity are assessed at each different level.

First, in order to assess scale reliability, the Cronbach's α coefficient was calculated, which exceeds 0.6 (Nunnally, 1978). Additionally, to assess the construct validity of the scale, convergent validity and discriminant validity were verified. For this, we conducted a five factors analysis for the measurement model.

The results of CFA showed that the χ^2 value was significant, the null hypothesis (Ho: $\Sigma=\Sigma(\theta)$) was dismissed, and it was proven that the theory model is not suitable for the sample data. However, even if the model explains reality well, various conditions for model testing, most notably the sample size, are not sufficient and the χ^2 value can be fairly large. Thus, after reviewing other model fit indices, an empirical conclusion should be made on the basis of theories (Bagozzi and Yi, 1988). Therefore, according to other fit indices, the RMSEA was indicated as 0.05, which is the same as the general standard, 0.05 or less than 0.10, and the model's approximation was mediocre (Steiger and Lind, 1980). The values of GFI, NFI and TLI, CFI are all above the standard value, 0.9, and the model fit was good. PGFI (Parsimony Goodness of Fit Index> 0.5) also exceeded the standard and fit was fine (Mulaik *et al.*, 1989). As is shown in Tables 2 and 4, the standard path coefficients for the measurement items of each construct were all significant (t>1.96).

 In Tables 2 and 4, the standard path coefficients for measurement items were significant (t>1.96), and as shown in Table 3 and Table 5 construct reliability also satisfied the lowest standard (CR>0.6), which is indicative of convergent validity (Anderson and Gerbing, 1988; Bagozzi and Yi, 1988). In order to verify discriminant validity, the squared correlation between two constructs was compared with their respective AVE (Average Variance Extracted) and Table 3 and Table 5 show that the AVE exceeded the squared correlation between two constructs, which indicates that discriminant validity exists and confirms construct validity for each construct (Fornell and Larcker, 1981).

Table 2. Results of first-order CFA

Constructs	Items	Standard path coefficient	t-value	Fit indices
Content	C1	0.83	16.26	χ^2= 80.53 (p 값=0.001) df=44 GFI=0.95 NFI=0.94 TLI=0.96 CFI=0.97 PGFI=0.54 RMSEA=0.05
	C2	0.77	14.56	
	C3	0.75	13.97	
	C4	0.72	13.18	
Accuracy	A1	0.88	16.77	
	A2	0.81	15.02	
Formality	F1	0.64	10.61	
	F2	0.79	13.17	
Ease of use	E1	0.77	12.45	
	E2	0.69	11.21	
Timeliness	T1	0.77	12.54	
	T2	0.69	11.33	

Table 3. Results for construct validity testing of EUCS

Constructs	Mean	Standard deviation	Correlation between constructs				
			Content	Accuracy	formality	Ease of use	Timeliness
Content	4.089	0.915	1.000				
Accuracy	4.210	1.031	0.576***	1.000			
Formality	4.199	0.949	0.530***	0.577***	1.000		
Ease of use	3.936	1.227	0.397***	0.246***	0.413***	1.000	
Timeliness	3.738	1.140	0.475***	0.377***	0.391***	0.527***	1.000
Construct reliability (CR)			0.852	0.834	0.679	0.696	0.696
Average Variance Extracted (AVE)			0.591	0.715	0.517	0.535	0.535

***: p< 0.01

Table 4. Results of second-order CFA

Constructs	Items	Standard path coefficient	t-value	Fit indices
User satisfaction	CO1	0.78	14.26	χ^2=151.43 (p value=0.000) df=55 GFI=0.92 NFI=0.91 TLI=0.91 CFI=0.94 PGFI=0.56 RMSEA=0.079
	AC2	0.64	11.16	
	FO3	0.67	11.73	
	EA4	0.59	10.12	
	TI5	0.67	11.71	
User ability	UA1	0.84	6.44	
	UA2	0.71	6.18	
Playfulness	PL1	0.96	19.70	
	PL2	0.90	17.79	
Design	DS1	0.76	12.35	
	DS2	0.95	15.23	
Support service	SS1	0.39	4.46	
	SS2	1.22	6.31	

Table 5. Results of construct validity of full measurement model

Constructs	Mean	Standard deviation	Correlation between constructs				
			User satisfaction	User ability	Playfulness	Design	Support service
User satisfaction	4.044	0.778	1.000				
User ability	5.103	1.259	0.195***	1.000			
Playfulness	3.182	1.264	0.563***	0.132**	1.000		
Design	3.765	1.174	0.392***	0.120**	0.324***	1.000	
Support service	3.822	0.973	0.260***	0.100*	0.186***	0.323***	1.000
Construct reliability(CR)			0.804	0.752	0.928	0.849	0.878
Average variance extracted (AVE)			0.453	0.605	0.866	0.740	0.820

*: $p < 0.1$, **: $p < 0.05$, ***: $p < 0.01$

4) Hypothesis Testing

Regression analysis was conducted to test the hypothesis regarding the causal relationship between factors affecting the end user--that is, the student's satisfaction. As a result of our regression analysis, the Durbin-Watson value, which is the independence examination of residuals, is convergent to 2. This means that the independence assumption is satisfied.

Noting the results of regression analysis in <Table 6>, the R^2 value indicative of goodness of fit for the presumed regression model was 0.386. As the intercorrelation between constructs in CFA for measurement model analyzed previously was analyzed freely without any restriction, multicollinearity was expected, and collinearity among independent variables was assessed. The general criterion VIF value, indicative of collinearity disturbance, was under 10 and the more accurate criterion, maximum condition index (CI_{max}), was 14.905--a smaller limitation value of 30, which showed that there was little multicollinearity (Belsley *et al.*, 1980).

Table 6. Results of regression analysis

Model	Coefficient of non-standardization		Coefficient of standardization	t-value	Sig.	VIF
	B	Standard error	Beta			
Intercept	1.890	0.192		9.864	0.000***	
User ability	0.061	0.035	0.098	1.769	0.036**	1.027
Playfulness	0.222	0.031	0.359	7.144	0.000***	1.137
Design	0.069	0.035	0.101	1.969	0.000***	1.220
Support service	0.195	0.039	0.257	4.950	0.041**	1.128
R^2=0.386, D-W value =1.832, F=43.455, Sig. F= 0.000***, CI_{max}= 14.905						

**: $p<0.05$, ***: $p<0.01$

Firstly, in relation to the effects of students' user ability on user satisfaction, hypothesis 1 was supported at a significance level of 0.05. To use a Web-based campus portal, basic computer use ability and searching ability should be at proper levels, and user satisfaction can be increased by using the necessary information in a timely fashion.

Although campus portals provide a great deal of good information, the efficacy of campus portals will decrease if user ability does not meet the appropriate level. Needless to say, because the majority of students are familiar with computer use and web-based internet portal site use from their high school days, special education programs should not prove necessary for improvements in use ability. However, it is necessary to post a notice for help topics or manuals for web-based campus portal use in order to effectively achieve user satisfaction.

In relation to the effects of playfulness on user satisfaction, hypothesis 2 was supported at a significance level of 0.01. In order to attract the interest of campus portal users, a variety of information should be provided, and user satisfaction can be increased by providing necessary information in a timely manner. Overcoming information education and employment and various bulletin-centered information, universities must foster voluntary participation and strengthen active communication functions, both of which can also be factors enhancing users' interest. Therefore, active use of campus portals will serve as an opportunity to provide users with more information and give them satisfaction at the same time.

In relation to the effect of design on user satisfaction, hypothesis 3 was supported at a significance level of 0.01. Designs of the interface environment of campus portals that are familiar to students can increase user satisfaction. In this regard, universities should periodically upgrade campus designs, and provide users with an intimate service environment by building interface environments similar to those of commercial internet portals.

In relation to the effect of support services on user satisfaction, hypothesis 4 was supported at a significance level of 0.05. Proper and immediate response conducted by the computing department for all inquiries, including problems generated during campus portal service use, can positively influence user satisfaction. It is also necessary to build a support service system for prompt replies and problem improvement, as the majority of students post complaints about the inconveniences of campus portals, as well as their suggestions, in bulletins.

CONCLUSION

In this study, we assessed the relationships between students' user satisfaction with campus portal services and the factors influencing it. In order to measure the dependent variable, user satisfaction, Doll and Torkzadeh(1988)'s measure for end user computing satisfaction, the adequacy and generalization of which was proven in existing studies, was utilized. User ability, playfulness, design, and support services were established as factors that affect user satisfaction--and also showed that user ability, playfulness and support services significantly influence user satisfaction.

Korean universities are currently engaged in the construction of integrated information-communication networks and the development of an expansive system for the management of education, administration, study, and enrollment for students escaping from the previous concept of information systems for education management.
Universities can strengthen campus portal development in a step-by-step manner with novel methods to attract students and by securing competitiveness by giving the

impression that they are taking the lead in information technology, as well as by providing the most convenient service through campus portals.

However, periodic assessments for user inconvenience are an imperative activity in the success of operating systems, as problems generated during the use of web-based information system like campus portal are rarely seen in advance (Darby, 1992; Fleck and McQueen, 1999). Therefore, it is crucial to improve systems by measuring students' subjective satisfaction and the primary factors affecting it, and reflecting on the results of assessments in order to help actualize the information-oriented revitalization efforts of each university via campus portals. In other words, customer-centered portal system design, periodic assessments, and constant improvement and immediate service support systems must be built.

Like enterprises, universities are dealing with the information-oriented requirements inherent to global competitiveness reinforcement, building university information-communication networks as basic required tools, and providing campus portal services to realize their success.

Therefore it is expected that universities should be able to construct competitive portal services with limited resources, and apply the user satisfaction model evaluated in this study to assess their effects as after-service management methods. In fact, there has been only minimal study conducted for the assessment of campus portals, as the majority of studies of web-based information systems have addressed enterprise or commercial information systems, success factors for internet portals, effectiveness, and acceptance intentions thus far. Therefore, this study constituted a model for the assessment of end users--that is, student satisfaction considering different circumstances from enterprises and measured synthesis satisfaction, all factors which comprise user satisfaction. This study did not measure general satisfaction or single item for user satisfaction. In addition, the preceding factors were constructed considering overlap or similarity (Seddon and Kiew, 1994; Lee, 2006) between the measurement items of factors for user satisfaction and the measurement items of preceding factors, as well as the result of the test of the hypotheses for the model; as a result, this study model was shown to be satisfactory.

LIMITATIONS AND FURTHER RESEARCH

This study was conducted using university students as the main end users of campus portal services. The primary reason that the previous campus-wide information systems of universities have been transformed into web-based campus portals is because universities wish to have their students understand information competitiveness and build useful information systems. However, the requirements of users of campus portals differ widely, as constituent members in universities include not only regular college students, but also graduate students, administration staff, professors, and lecturers. Therefore, it is most advisable to assess all such constituents of universities in future studies, but it will also be meaningful to select cases of successful campus portals, and plan a study on all members of the university, within the constraints of reasonability. It will also be necessary to compare the sizes of according universities for future studies, because university size and financial status, as well as interest and investment, vary widely.

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