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Predicting the use of web-based information systems: self-efficacy, enjoyment, learning goal orientation, and the technology acceptance model

Mun Y. Yi*, Yujong Hwang

Moore School of Business, University of South Carolina, Columbia, SC 29208, USA

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Abstract

With the growing reliance on computerized systems and increasing rapidity of the introduction of new technologies, user acceptance of technology continues to be an important issue. Drawing upon recent findings in information systems, human computer interaction, and social psychology, the present research extends the technology acceptance model by incorporating the motivation variables of self-efficacy, enjoyment, and learning goal orientation in order to predict the use of Web-based information systems. One hundred nine subjects participated in the study, which was conducted in a field setting with the Blackboard system, a Web-based class management system. A survey was administered after a 2-week trial period and the actual use of the system was recorded by the Blackboard system over 8 weeks. The results largely support the proposed model, highlighting the important roles of self-efficacy, enjoyment, and learning goal orientation in determining the actual use of the system. Practical implications of the results are provided.

Keywords: User acceptance of technology; Technology acceptance model; Self-efficacy; Enjoyment; Learning goal orientation; Objective use

1. Introduction

Organizations cannot realize any return on their investments in information systems (IS) unless the systems are actually used by their intended users. Despite

*Corresponding author. Tel.: +1-803-777-4351; fax: +1-803-777-6876.
E-mail address: myi@moore.sc.edu (M.Y. Yi).

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their sizable cost, IS have been found underutilized or sometimes abandoned because of the lack of user acceptance (McCarroll, 1991; King, 1994; Gillooly, 1998). The utilization of technology has been a shared key concern between IS (Kwon and Zmud, 1987; DeLone and McLean, 1992) and HCI (human–computer interaction) researchers (Nickerson, 1981; Carroll and Rosson, 1987). With the growing reliance on computerized systems and increasing rapidity of the introduction of new technologies, understanding the factors that promote effective utilization of IS continues to be a vital issue for researchers and practitioners.

Over the last two decades, a significant body of research has focused on identifying various factors that influence user acceptance behavior, advancing several theoretical models. In particular, the technology acceptance model (TAM), introduced by Davis and his colleagues (Davis, 1989; Davis et al., 1989), has received considerable attention (see Lucas and Spitler, 1999 for a recent review) and has become established as a parsimonious yet powerful model for explaining and predicting usage intentions and acceptance behavior. TAM theorizes that an individual's actual system usage is determined by behavioral intention, which is in turn jointly determined by perceived usefulness and perceived ease of use. Perceived usefulness is the extent to which a person believes that using the technology will enhance his or her job performance, and perceived ease of use is the extent to which a person believes that using the technology will be free of effort (Davis, 1989). Behavioral intention is defined as the extent to which an individual intends to perform a specific behavior (Davis et al., 1989). TAM posits that the impact of other external variables on behavioral intention is fully mediated by these two beliefs of usefulness and ease of use.

Recent findings on intrinsic motivation and self-efficacy in social psychology indicate that enjoyment, goal orientation, and self-efficacy play important roles in determining a person's behavior. Prior research on technology acceptance behavior examined the effects of self-efficacy and enjoyment on ease of use (Venkatesh, 2000), but did not assess their roles within the full nomological net of TAM. Goal orientation, while it has been recognized as being important in understanding individual differences in motivated behavior, has not received much attention with regard to technology acceptance. Drawing upon recent findings in IS, HCI, and social psychology, the present research extends TAM by incorporating the motivational variables of self-efficacy, enjoyment, and learning goal orientation in order to predict the use of Web-based IS. Given that the Web is a relatively new technology and is a richer environment than any other traditional information technology in meeting various personal needs, we expect that these motivational variables will play critical roles in influencing individuals decision to use a Web-based technology.

Although most prior research on TAM relied on subjective (self-reported) measures of system use, an objective measure (e.g., actual system access frequency recorded by the computerized system) has many advantages over a self-reported measure. Computer-recorded, objective measures can rule out the reporting biases due to selective recall (Davis et al., 1992) and inaccurate estimation

(Collopy, 1996). Moreover, using an objective measure avoids inherent methodological problems such as common-method bias, hypothesis guessing, and indistinguishable causation, associated with retrospective self-reported measures (Fichman, 1992; Straub et al., 1995; Szajna, 1996). Thus, the present research undertook an empirical assessment of the proposed research model in a Web-based system usage context utilizing an objective, computer-recorded usage measure.

2. Research model and hypothesis

Fig. 1 presents the proposed research model. TAM originally included attitude as a mediator between the personal belief constructs and behavioral intention (Davis et al., 1989), but later dropped it from the model because it was found to be a weak mediator (Davis et al., 1992; Szajna, 1996; Venkatesh and Davis, 2000). Consistent with that change, the proposed model does not include the attitude construct. The dotted box in Fig. 1 shows the relationships between the constructs proposed by TAM (Davis et al., 1989; Venkatesh and Davis, 2000). The proposed model incorporates three intrinsic motivation constructs that may significantly influence the existing variables of TAM. The specific elements of the model and related hypotheses are further detailed below.

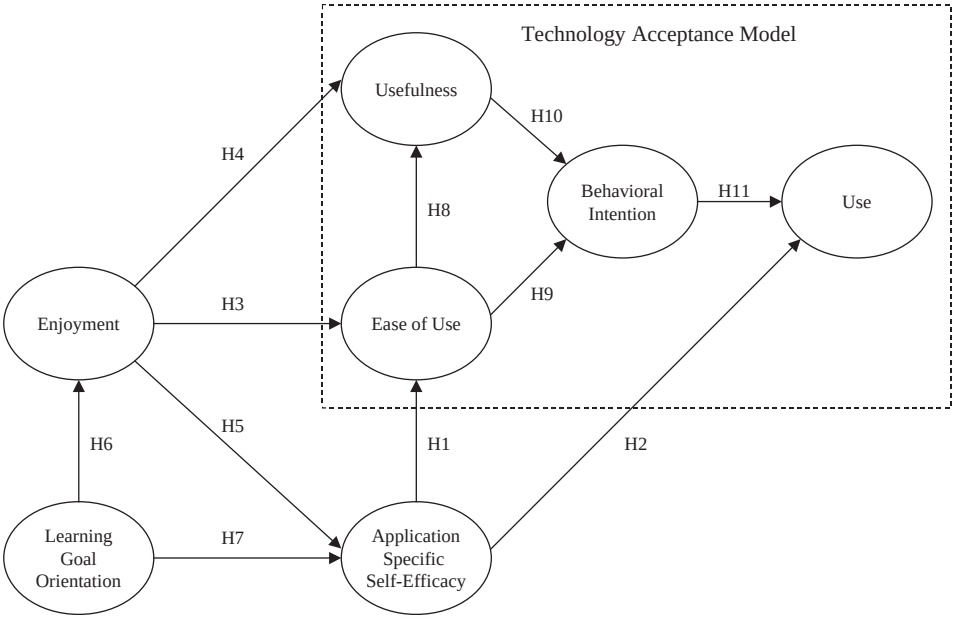

Fig. 1. Proposed research model.

2.1. Self-efficacy

Social cognitive theory (Bandura, 1977, 1986) posits that people are neither driven by inner forces, nor simply by external stimuli. Instead, human behavior is explained via a model of triadic reciprocality in which behavior, cognitive and personal factors, and environmental events all operate interactively as determinants of each other. A key regulatory mechanism in this dynamic relationship that affects human behavior is self-efficacy, people's judgments of their capabilities to perform a given task. The theory postulates that "psychological procedures, whatever their form, alter expectations of personal efficacy" (Bandura, 1977, p. 79), which in turn determines what actions to take, how much effort to invest, how long to persevere, and what strategies to use in the face of challenging situations. Many empirical studies have validated this proposition in a wide variety of settings such as employee attendance management (Frayne and Latham, 1987), complex decision making (Wood and Bandura, 1989), computer skill acquisition (Gist et al., 1989; Mitchell et al., 1994), and user acceptance of technology (Agarwal et al., 2000; Venkatesh, 2000).

According to Marakas et al. (1998), computer self-efficacy (CSE) is a multi-level construct operating at two distinct levels: at the general computing level (general CSE) and at the specific application level (application-specific self-efficacy). General CSE is defined as an individual judgment of efficacy across multiple computer domains and application-specific self-efficacy is defined as an individual perception of efficacy in using a specific application or system within the domain of general computing. Prior research on user acceptance of technology focused on examining the effects of general CSE on perceived ease of use (e.g., Venkatesh and Davis, 1996; Venkatesh, 2000), exploring its role as an anchor for the subsequent development of ease of use perceptions. Recently, Agarwal et al. (2000) proposed a model with both general CSE and application-specific self-efficacy. The results showed a stronger relationship between specific CSE and ease of use ($\beta = 0.43$) than between general CSE and ease of use ($\beta = 0.20$), empirically demonstrating a more direct and powerful effect of application-specific self-efficacy on the ease of use perception. This indicates that users regard the system easier to use when their conviction in their own efficacy regarding the target system is higher and that application-specific self-efficacy is a more powerful, direct determinant of ease of use than general CSE is. Consequently, we relate application-specific self-efficacy to ease of use in the model and hypothesize that:

H1. Application-specific self-efficacy will have a positive effect on ease of use.

Social cognitive theory (Bandura, 1977, 1986) posits self-efficacy as a direct determinant of individual's behavior. Within the domain of IS, two studies that applied social cognitive theory to user acceptance of technology found strong relationships between CSE and system use at $r = 0.45$ (Compeau and Higgins, 1995b) and $r = 0.43$ (Compeau et al., 1999). TAM postulates that actual system use is determined by behavioral intention, consistent with the theory of reasoned action (Fishbein and Ajzen, 1975) from which TAM is derived. The effect of CSE on actual

use over and above behavioral intention is largely unknown. Reconciling the two streams of research based on social cognitive theory and theory of reasoned action, the present study examines the effects of both self-efficacy and behavioral intention on actual system use. The present study operationalizes system use as an objective computer-recorded measure, and hypothesizes that:

H2. Application specific CSE will have a positive effect on actual use of the system.

2.2. Enjoyment

Enjoyment refers to the extent to which the activity of using a computer system is perceived to be personally enjoyable in its own right aside from the instrumental value of the technology (Davis et al., 1992). Prior research proposed enjoyment as a determinant of behavioral intention (Davis et al., 1992; Venkatesh et al., 2002) and as a determinant of ease of use (Venkatesh, 2000; Venkatesh et al., 2002). According to Davis et al. (1992, p. 1112), extrinsic motivation refers to "the performance of an activity because it is perceived to be instrumental in achieving valued outcomes that are distinct from the activity itself," whereas intrinsic motivation refers to "the performance of an activity for no apparent reinforcement other than the process of performing the activity per se." Davis et al. (1992) and recently Venkatesh and Speier (2000) classified enjoyment as a type of intrinsic motivation and perceived usefulness as a type of extrinsic motivation.

Comparing two training methods (traditional training vs. game-based training), Venkatesh and Speier (2000) and Venkatesh (1999) found that the game-based training method aimed at enhancing intrinsic motivation resulted in higher enjoyment and higher ease of use perceptions than the traditional training method. Later, Venkatesh (2000) showed that the effect of enjoyment on ease of use became stronger as users gained more direct experience with the system. Venkatesh et al. (2002) also reported that enjoyment (intrinsic motivation) had no direct effect on behavioral intention over and above ease of use and usefulness. These findings indicate that the ease of use perceptions are influenced by the degree to which people perceive using the system to be personally enjoyable. Consequently, we hypothesize that:

H3. Enjoyment will have a positive effect on ease of use.

The effect of enjoyment on perceived usefulness is relatively unknown. Davis et al. (1992) found that usefulness and enjoyment were significant determinants of behavioral intention, but the effect of enjoyment on perceived usefulness was not examined. Venkatesh (2000) showed that enjoyment influenced usefulness via ease of use, without assessing its direct effect on usefulness over and above ease of use. It is well known that, when people are intrinsically motivated, they become productive and effective (Csikszentmihalyi, 1990). Usefulness is a construct that measures how people believe their productivity and effectiveness have been improved due to the use of the technology. Agarwal and Karahanna (2000) found a multi-dimensional

construct called cognitive absorption, a state of deep involvement with software, had a significant influence on usefulness over and above ease of use ($\beta = 0.52$ for the link between cognitive absorption and usefulness, $\beta = 0.20$ for the link between ease of use and usefulness). Enjoyment was one of the sub-dimensions of cognitive absorption with the highest loading score. Assuming other things being equal, the system should be perceived to be more useful as the system is considered to be more enjoyable. Thus, we hypothesize that:

H4. Enjoyment will have a positive effect on usefulness.

Venkatesh (2000) proposed self-efficacy and enjoyment as determinants of ease of use, but did not address their interrelationship. Agarwal et al. (2000) demonstrated the significant role of application specific self-efficacy in determining the ease of use perceptions, but without including enjoyment in their nomological net. According to social cognitive theory (Bandura, 1977, 1986) and subsequent self-efficacy theory (Bandura, 1997), the self-efficacy belief is different from outcome expectation, an individual's estimate about the consequences of the performance, which can be in the form of social recognition, applause, awards, and self-satisfactions. In contrast with the outcome expectation, which is external outcome-oriented, the self-efficacy perception is a reflection of one's internal motivation based on his or her ability. Emotional arousal is an important source of the self-efficacy formation (Bandura, 1977, 1986, 1997). People partially rely on their state of physiological arousal in forming judgments of their level of anxiety or vulnerability to stress. They read their emotional arousal as ominous signs of vulnerability to dysfunction or low performance. Thus, anxiety experienced by subjects in relation to task performance situation tends to generate further anxieties through the process of anticipatory self-arousal (Sarason, 1975). In contrast, the sense of enjoyment in using a given system should reduce anxiety and help people feel confident about their ability to successfully execute the requisite actions. Therefore, we hypothesize that:

H5. Enjoyment will have a positive effect on application-specific self-efficacy.

2.3. Learning goal orientation

The construct of goal orientation has received increasing attention recently outside of the IS and HCI domains. Goal orientation refers to typically two types of goals people can hold during task performance: learning goal orientation and performance goal orientation (Nicholls, 1984). Individuals with a learning goal orientation approach a task to understand something new or to enhance their level of competence. They believe ability as an incremental skill that can be continually improved by acquiring knowledge and perfecting competencies (Wood and Bandura, 1989). They look for challenging tasks that provide chances to enhance their knowledge and competencies, and regard errors as a natural part of a learning process. Individuals with a performance orientation, in contrast, see ability as a fixed entity that reveals their intellectual capacity. They pursue performance goals to demonstrate their competence, prefer tasks that minimize errors at the expense of

acquiring new skills, and are concerned about their ability and performance relative to others. Learning goals have been related to a number of adaptive outcomes, including higher levels of efficacy, task value, interest, positive affect, effort and persistence, learning strategies, as well as better performance (Printrich, 2000). Individuals with a high learning goal orientation pursue an adaptive response pattern in which they persist, escalate effort, and report enjoying the challenge. With a performance goal orientation, individuals pursue a maladaptive response pattern in which they withdraw from the task, make negative ability attributions, and report decreased interest in the task. In terms of valence, research has shown that learning oriented individuals react to challenges with positive affect, pride, and intrinsic motivation (Dweck and Leggett, 1988). The more challenging a task becomes, the more it is perceived as an opportunity to build competence. Thus, in the context of adopting a new technology, individuals with a learning goal orientation are expected to enjoy the challenge of learning new features of the technology and develop self-confidence in using the technology. Therefore, we hypothesize that:

H6. Learning goal orientation will have a positive effect on enjoyment.
H7. Learning goal orientation will have a positive effect on application-specific self-efficacy.

2.4. Ease of use, usefulness, and behavioral intention

TAM posits that behavioral intention is a determinant of actual system use, and that behavioral intention is determined by two salient beliefs, perceived usefulness and perceived ease of use. Further, perceived ease of use is a determinant of perceived usefulness because, assuming other things being equal, users consider a system more useful when it is more effort-free. These relationships have been examined and supported by many prior studies (Davis, 1989, 1993; Davis et al., 1989; Venkatesh and Davis, 1996; Venkatesh and Davis, 2000). The present study revalidates those relationships in a Web-based context with the following hypotheses:

H8. Ease of use will have a positive effect on usefulness.
H9. Ease of use will have a positive effect on behavioral intention.
H10. Usefulness will have a positive effect on behavioral intention.
H11. Behavioral intention will have a positive effect on actual use.

3. Method

3.1. Study context and sample

The Blackboard system was the target system of the study. Blackboard is a Web-based comprehensive class management system accessible via the Internet. Students typically use the system to check class assignments or announcements, communicate with their classmates, and retrieve their grades. They can also use the system to

access course materials or take an exercise quiz. One hundred nine students (49 females and 60 males) from three sections of an introductory IS course at a large state university in the US voluntarily participated in the study. Most participants (89%) were between 18 and 20 years old. Eighty-eight participants (81%) reported having used computers more than 3 years. About half of the participants (57 out of 109, 52%) had used an Internet-based learning system such as Blackboard before the study. The actual usage of the system collected at the end of the study showed no significant differences between the experienced and novice groups ($F(1, 107) = 0.01$, *ns*). Many participants (61%) had work experience. English was the first language for most participants (95%).

The same instructor, who was unaware of the research hypotheses, taught the three classes. The usage of the Blackboard system was voluntary to the students. The survey was administered in September 2001, 2 weeks after the introduction of the system. Blackboard is a user-friendly technology, thus the 2-week trial period was considered sufficient to be familiar with the features and functions of the system. Data was not collected before the introduction of the system to minimize the possible threats of repeated testing and hypothesis guessing to internal validity (Cook and Campbell, 1979). Prior research also indicates that user responses are not system-specific before direct experience (Venkatesh and Davis, 1996). Actual usage data was gathered for the consecutive 8-week period, from the system introduction point.

3.2. Measures

Most of the constructs in the research model were measured with the items adapted from prior research. All the questionnaire items used an 11-point Likert-type scale where 0 = completely disagree, 5 = neither agree nor disagree, and 10 = completely agree. The TAM constructs of usefulness and ease of use were adapted from Davis (1989) and Yi and Davis (2001). The instrument consisted of four items for the usefulness construct and four items for the ease of use construct. The usefulness items were "Using the Blackboard system would improve my performance in this course," "Using the Blackboard system would increase my productivity in this course," "Using the Blackboard system would enhance my effectiveness in this course," and "I find the Blackboard system would be useful in this course." The ease of use items were "Learning to use the Blackboard system is easy for me," "I find it easy to get the Blackboard system to do what I want it to do," "My interaction with the Blackboard system is clear and understandable," and "I find the Blackboard system easy to use." Behavioral intention was measured with the following statements: "I intend to check announcements in the Blackboard system frequently," "I intend to download files from the Blackboard system frequently," and "I intend to visit other Web sites using the Blackboard system frequently." The actual use of the system was operationalized as the access frequency (Taylor and Todd, 1995) and recorded by the Blackboard system.

Application-specific self-efficacy was measured by four items adapted from prior research (Johnson and Marakas, 2000; Marakas et al., 1996). Participants were

asked to indicate their agreement with the following statements: "I believe I have the ability to download the file from the Blackboard system to my floppy disk," "I believe I have the ability to send e-mail using the Blackboard system," I believe I have the ability to use the Blackboard system to communicate information to others," and "I believe I have the ability to use the favorite Web site link on the Blackboard system." Enjoyment was adapted from Davis et al. (1992). The enjoyment items were "I have fun using the Blackboard system," "Using the Blackboard system is pleasant," and "I find using the Blackboard system to be enjoyable." Learning goal orientation was measured by five items adopted from the instrument developed by Brett and VandeWalle (1999). The five items were "I am willing to select a challenging work assignment that I can learn from," "I often look for opportunities to develop new skills and knowledge," "I enjoy challenging and difficult tasks where I'll learn new skills," "For me, developing my work ability is important enough to take risks," and "I prefer to work in situations that require a high level of ability and talent."

A pilot study was undertaken to ensure that the items were adapted appropriately to the study context. The questionnaire was administered to 42 students in one section of the same introductory IS course taught by one of the authors before the main study. The data obtained from the pilot study was analyzed for reliability, construct validity, and response completeness. The reliability and validity of the scales were consistent with prior research. Some adjustments were made to the questionnaire items. For example, application-specific self-efficacy items were reworded to arrive at their final wording described above.

3.3. Data analysis

The proposed model and hypothesis testing was conducted using partial least squares (PLS) Version 2.91.03.04 (Chin and Frye, 1998). The PLS approach (Wold, 1982; Falk and Miller, 1992; Barclay et al., 1995; Chin, 1998), like other structural equation modeling (SEM) techniques such as LISREL (Jöreskog and Sörbom, 1993) and EQS (Bentler, 1985), allows researchers to simultaneously assess measurement model parameters and structural path coefficients. Whereas covariance-based SEM techniques such as LISREL and EQS use a maximum likelihood function to obtain estimators in models, the component-based PLS uses a least-squares estimation procedure. PLS avoids many of the restrictive assumptions underlying covariance-based SEM techniques such as multivariate normality and large sample size (Fornell and Bookstein, 1982; Falk and Miller, 1992). Chin (1998, p. 311) advises that "if one were to use a regression heuristic of 10 cases per indicator," the sample size requirement would be 10 times (1) the largest number of formative indicators or (2) the largest number of independent variables impacting a dependent variable, whichever is the greater. In our model, all items are modeled as reflective indicators because they are viewed as effects (not causes) of latent variables (Bollen and Lennox, 1991), and the largest number of independent variables estimated for a dependent variable is only two. Thus, our sample size of 109 is more than adequate for the PLS estimation procedures.

The measurement model in PLS is assessed by examining internal consistency, convergent validity, and discriminant validity (Barclay et al., 1995). Internal consistencies (similar to Cronbach's alpha) of 0.7 or higher are considered adequate (Fornell and Larcker, 1981; Barclay et al., 1995; Compeau et al., 1999; Agarwal and Karahanna, 2000). Convergent and discriminant validity are assessed by applying two criteria: (1) the square root of the average variance extracted (AVE) by a construct from its indicators should be at least 0.707 (i.e., AVE > 0.50) and should be greater than that construct's correlation with other constructs (Fornell and Larcker, 1981; Barclay et al., 1995; Chin, 1998), and (2) item loadings (similar to loadings in principal components) should be at least 0.707, and an item should load more highly on the construct it is intended to measure than it does on another construct. The structural model and hypotheses are assessed by examining the significance of the path coefficients (similar to standardized beta weights in a regression analysis) and the variance accounted for by the antecedent constructs.

4. Results

Table 1 shows the means, standard deviations, internal consistency reliabilities, and correlations among constructs. As recommended, the internal consistency reliabilities were all higher than 0.7 without exception, and the diagonal elements (square root of the variance shared between the constructs and their measures) were all higher than 0.707 and also higher than correlations between target constructs, and other constructs, without exception.

Table 2 presents the factor structure matrix of the study variables. Demonstrating strong convergent and discriminant validity, all items exhibited high loadings (> 0.707) on their respective constructs without exception, and no item loaded higher on other constructs than the one it was intended to measure without

Table 1
Means, standard deviations, internal consistencies, and correlations of constructs

Construct	Mean	S.D.	ICR	1	2	3	4	5	6	7
1. Learning goal orientation	7.12	1.32	0.88	**0.78**						
2. Application-specific self-efficacy	7.86	2.28	0.87	0.30	**0.80**					
3. Enjoyment	6.16	2.32	0.96	0.13	0.28	**0.94**				
4. Ease of use	8.21	1.71	0.96	0.31	0.60	0.54	**0.93**			
5. Usefulness	7.42	1.72	0.95	−0.02	0.18	0.51	0.29	**0.91**		
6. Behavioral intention	6.46	1.88	0.87	0.06	0.23	0.44	0.35	0.52	**0.83**	
7. Use	265.78	135.53	1.00	0.25	0.34	0.06	0.23	0.03	0.26	**1.00**

Note: ICR = Internal consistency reliability. All the constructs are on a scale of 0 (negative) to 10 (positive). Diagonal elements (bold) are the square root of average variance extracted (AVE) between the constructs and their measures. Off-diagonal elements are correlations between constructs. For discriminant validity, diagonal elements should be larger than off-diagonal elements in the same row and column.

Table 2
Factor structure matrix

Scale items	1	2	3	4	5	6	7
1. *Learning goal orientation*							
a. willing to select a challenging	**0.77**	0.25	0.10	0.27	0.00	0.07	0.20
b. look for opportunities to develop	**0.76**	0.19	0.13	0.24	0.02	0.08	0.17
c. enjoy challenging and difficult	**0.88**	0.31	0.14	0.24	−0.01	0.06	0.13
d. developing my work ability	**0.69**	0.17	0.06	0.13	−0.09	0.01	0.23
e. prefer to work in situations	**0.78**	0.23	0.06	0.32	0.00	0.00	0.28
2. *Application-specific self efficacy*							
a. ability to download the file	0.29	**0.77**	0.15	0.38	0.11	0.10	0.33
b. ability to send e-mail	0.26	**0.78**	0.06	0.35	0.16	0.12	0.22
c. ability to communicate	0.24	**0.85**	0.30	0.56	0.20	0.26	0.26
d. ability to use favorite Web site	0.19	**0.78**	0.31	0.56	0.12	0.20	0.29
3. *Enjoyment*							
a. have fun using	0.11	0.24	**0.95**	0.46	0.48	0.47	0.07
b. is pleasant	0.13	0.28	**0.91**	0.56	0.46	0.36	0.04
c. find it to be enjoyable	0.14	0.26	**0.96**	0.51	0.48	0.42	0.07
4. *Ease of use*							
a. is easy for me	0.31	0.61	0.48	**0.91**	0.23	0.37	0.30
b. find it easy to get	0.29	0.49	0.54	**0.95**	0.32	0.35	0.17
c. is clear and understandable	0.28	0.56	0.49	**0.93**	0.23	0.27	0.16
d. find it easy to use	0.27	0.56	0.50	**0.93**	0.28	0.30	0.19
5. *Usefulness*							
a. improve my performance	0.00	0.13	0.41	0.21	**0.91**	0.47	0.03
b. increase my productivity	0.03	0.16	0.47	0.25	**0.93**	0.47	0.02
c. enhance my effectiveness	−0.05	0.11	0.43	0.16	**0.92**	0.45	0.02
d. would be useful	−0.04	0.25	0.51	0.40	**0.87**	0.49	0.03
6. *Behavioral intention*							
a. intend to check announcements	−0.07	0.13	0.33	0.36	0.45	**0.77**	0.16
b. intend to download files	0.11	0.27	0.31	0.21	0.37	**0.85**	0.27
c. intend to visit other Web sites	0.12	0.16	0.45	0.28	0.46	**0.86**	0.21
7. *Use*	0.24	0.34	0.06	0.22	0.03	0.26	**1.00**

exception. Collectively, the psychometric properties of the constructs were considered excellent.

Fig. 2 provides the results of hypothesis testing. As recommended (Chin, 1998), bootstrapping (with 500 subsamples) was performed to test the statistical significance of each path coefficient using *t*-tests. Supporting H1, application-specific self-efficacy had a significant effect on ease of use ($\beta = 0.49$, $p < 0.001$). Supporting H2, application-specific self-efficacy had a significant effect on use ($\beta = 0.30$, $p < 0.001$). Supporting H3, enjoyment had a significant effect on ease of use ($\beta = 0.41$, $p < 0.001$). Supporting H4, enjoyment had a significant effect on usefulness ($\beta = 0.50$,

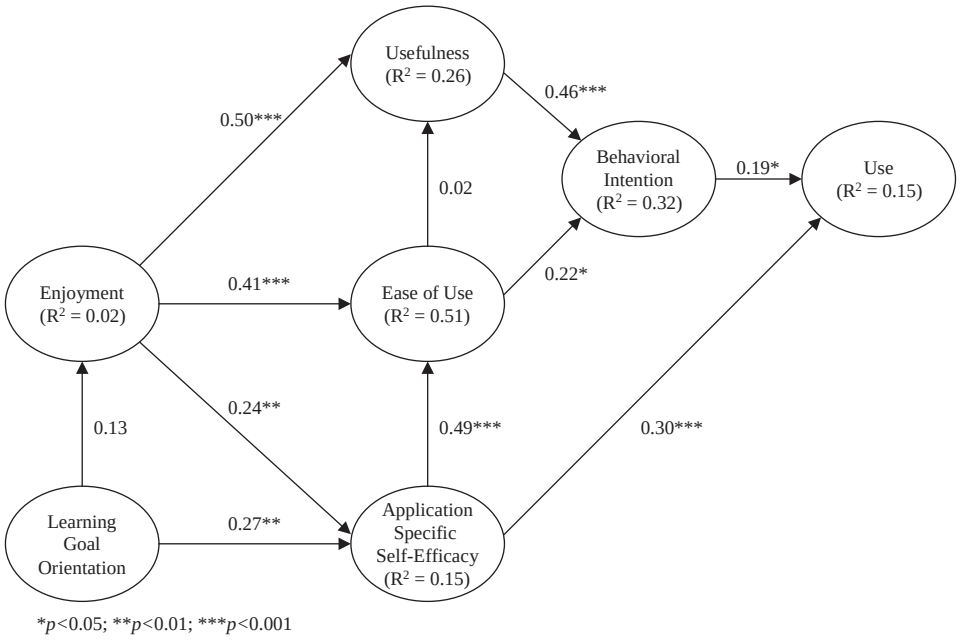

Fig. 2. PLS test of proposed model.

$p<0.001$). Supporting H5, enjoyment had a significant effect on application-specific self-efficacy ($\beta=0.24$, $p<0.01$). Inconsistent with H6, learning goal orientation had no significant effect on enjoyment ($\beta=0.13$, *ns*). The effect was in the hypothesized direction, but the significance level was not within the conventional $p<0.05$. Supporting H7, learning goal orientation had a significant effect on application-specific self-efficacy ($\beta=0.27$, $p<0.01$). The model explained substantial variance in ease of use ($R^2=0.51$), and modest variance in both usefulness ($R^2=0.26$) and application-specific self-efficacy ($R^2=0.15$).

Inconsistent with H8, ease of use had no significant effect on usefulness ($\beta=0.02$, *ns*) over and above enjoyment, indicating that enjoyment was a dominant determinant of usefulness. Supporting H9, ease of use had a significant effect on behavioral intention ($\beta=0.22$, $p<0.05$). Supporting H10, usefulness had a significant effect on behavioral intention ($\beta=0.46$, $p<0.001$). Supporting H11, behavioral intention had a significant effect on use ($\beta=0.19$, $p<0.05$). The model accounted for substantial variance in behavioral intention ($R^2=0.32$), and modest variance in use ($R^2=0.15$). In sum, the model test supported all the hypotheses except H6 and H8. Dropping the two non-significant paths and rerunning the model did not disconfirm or alter the significance of the remaining paths.

A post hoc analysis conducted to eliminate any confounding of results based on participants' prior experience with a Web-based learning program showed no significant effect of prior experience on any of the endogenous model constructs over

and above the other proposed determinants of that construct. In addition, consistent with the research model, there was no direct effect of learning goal orientation, enjoyment, usefulness, or ease of use on system use over and above the effects mediated by behavioral intention and application-specific self-efficacy.

5. Discussion

The results of the study clearly point out the important roles of enjoyment, learning goal orientation, and application-specific self-efficacy in positively influencing the decision to use a Web-based technology and subsequent actual use. The model illuminates the underlying relationships between these motivational variables and the existing TAM variables, providing insights into how the acceptance and use of Web-based IS can be further explained and facilitated. Nine out of eleven hypotheses were supported. These findings significantly extend prior research on user acceptance of technology by linking key motivational variables from social psychology to the well-known TAM variables and empirically validating the relationships.

Application-specific self-efficacy has been shown to exert a significant effect on system use over and above behavioral intention. Prior TAM research showed that self-efficacy was a determinant of perceived ease of use at the general computing level (Venkatesh and Davis, 1996; Venkatesh, 2000), and at the specific application level (Agarwal et al., 2000). These studies did not address the possible direct effect of self-efficacy on system use. Prior self-efficacy research demonstrated that CSE was a determinant of system use (Compeau and Higgins, 1995b; Compeau et al., 1999), but did not include behavioral intention as a determinant of use. Integrating these two streams of research, the current research confirms that both behavioral intention and application-specific self-efficacy are determinants of actual system use, a central dimension of technology acceptance behavior. Moreover, it should be noted that application-specific self-efficacy was more powerful than behavioral intention in determining actual use of the system ($\beta = 0.30$ for application-specific self-efficacy, $\beta = 0.19$ for behavioral intention). It is possible that, even after a 2-week trial period, some individuals did not clearly form their intention to use the system, but they were more certain about their abilities in using the system. Also, intention may change as an individual gathers new information from the use of the system over a period of time (Szajna, 1996). According to Fishbein and Ajzen (1975, p. 370), "to predict the behavior from the initial measure of intention, it may be necessary to consider other variables in addition to the intention." Our findings indicate that application-specific self-efficacy is one of the other variables that should be considered along with behavioral intention. Further research is needed to identify the conditions under which TAM does not fully mediate the effect of self-efficacy on system use, and under which self-efficacy becomes more powerful than behavioral intention in predicting system use.

In the present study, enjoyment was a significant determinant of usefulness whereas ease of use was a non-significant determinant. As shown in Table 1, ease of

use was significantly related to usefulness at $r = 0.29$ ($p < 0.01$). In the presence of enjoyment, however, ease of use no longer had a significant effect on usefulness, indicating that enjoyment is a stronger predictor of usefulness than ease of use is, and that the proportion of the usefulness variance accounted for by ease of use beyond that accounted for by enjoyment is not significant. TAM (Davis, 1989; Davis et al., 1989) theorizes ease of use as a determinant of both usefulness and behavioral intention. Empirical findings on ease of use have been mixed. Davis et al. (1989) found ease of use had a significant effect on behavioral intention and no effect on usefulness immediately after 1-hour introduction to the system, but had a significant effect on usefulness and no effect on behavioral intention 14 weeks later. Venkatesh and Davis (2000) reported consistently significant effects of ease of use on both usefulness and behavioral intention regardless of the time of measurement. Agarwal and Karahanna (2000) found that ease of use did not have a significant effect on usefulness, contrary to their hypothesis. None of these studies examined the potential effect of enjoyment on usefulness over and above ease of use. Our study results suggest that enjoyment might play a more influential role than ease of use in determining the usefulness perception within the Web-based IS context. The finding awaits further empirical validation by future research.

The present study introduces a new variable, learning goal orientation, into the domain of technology acceptance. As theorized, learning goal orientation was found to be a determinant of application-specific self-efficacy. Its effect on enjoyment was not significant, even though it was in the expected direction. Outside of the IS and HCI domains, Phillips and Gully (1997) found that learning goal orientation was positively related to self-efficacy on an academic task at $r = 0.19$ ($p < 0.01$). Ford et al. (1998) reported a significant relationship between learning (mastery) goal orientation and self-efficacy on a complex decision making task at $r = 0.31$ ($p < 0.01$). Consistent with these findings, our study found a significant relationship at $r = 0.30$ ($p < 0.001$) between learning goal orientation and application-specific self-efficacy, indicating that users who are oriented toward learning and mastery of content are more likely to develop a higher sense of confidence in using the specific target system. There has been consistent progress recently toward understanding the effects of individual differences on user acceptance of technology with personal trait constructs such as personal innovativeness (Agarwal and Prasad, 1998), gender (Gefen and Straub, 1997), and computer playfulness (Webster and Martochhio, 1992). Contributing to this stream of research, the present research demonstrates a significant role of learning goal orientation in relation to the formation of application-specific self-efficacy.

Some researchers have cautioned operationalizing the user acceptance construct through self-reports of time use (Straub et al., 1995; Collopy, 1996; Szajna, 1996). Prior research revealed that computer-recorded use was different from self-reported use (Straub et al., 1995; Collopy, 1996), and the TAM independent variables predicted self-reported use more strongly than computer-recorded use (Straub et al., 1995; Szajna, 1996). Our study avoided the problems associated with self-reported use such as common-method variance, selective recall, inaccurate estimation, and hypothesis guessing by employing computer-recorded objective use. Also, it should

be noted that behavioral intention and other variables were taken first, and then after six weeks from that point, the complete actual use data was collected. Thus, the temporal precedence required for establishing a causal relationship (Cook and Campbell, 1979) was ensured to accurately trace the effect of intention on system use. The results from our study confirm that TAM still holds well for computer-recorded objective use, but the size of explained variance is modest even with an additional predictor (i.e., application-specific self-efficacy).

Several limitations of the present study should be noted. First, the proposed model shows how the motivational variables of self-efficacy, enjoyment, and learning goal orientation affect the TAM variables of usefulness, ease of use, behavioral intention, and actual system use. As is true with virtually any model of complex behavioral phenomena, the current model is almost certainly incomplete. The possible inclusion of other motivational variables to further extend the proposed model should be actively pursued by future research. For example, computer playfulness and computer anxiety, not included in the current model, were proposed as determinants of perceived ease of use (Venkatesh, 2000). The two variables have been found to mediate the effect of system experience on perceived ease of use (Hackbarth et al., 2003). Although these variables of enjoyment, anxiety, and playfulness seem to be conceptually similar, all tapping intrinsic motivation, a recent empirical study (Venkatesh, 2000) has shown that they are indeed distinct and that, as with enjoyment, anxiety and playfulness function as distal determinants of system use, achieving their effects indirectly through ease of use and usefulness. Further, the model does not allow for an empirical evaluation of the usability of the site. While it was our intention to focus on the intrinsic motivation of the user, future research might extend the model by incorporating various Web site usability and other design factors (Nielsen, 1993; Shneiderman, 1998; Palmer, 2002) and delineating their effects on the motivational and TAM variables.

Second, the current study did not survey user responses at multiple times. While our approach is consistent with prior studies on user acceptance of technology (Davis, 1989; Compeau and Higgins, 1995b; Agarwal et al., 1996; Agarwal and Karahanna, 2000), and avoids methodological problems associated with the multiple administration of the same instrument (Cook and Campbell, 1979), our approach does not capture the changes that may have occurred as a result of continued use of the system after the trial period of 2 weeks. In addition, we did not measure self-reported use. Given the methodological problems with the self-reported usage measure and the recommendations made for the use of objective measures (Fichman, 1992; Straub et al., 1995; Collopy, 1996; Szajna, 1996), we elected to use an objective, computer-recorded measure. While this should be considered as one of the strengths of our study design, the current data does not allow us to compare computer-recorded use with self-reported use. Future research may compare the measures of self-reported and computer-generated using the proposed model.

Finally, with regard to external validity, support for the study findings should be tested in different contexts. The present study was conducted with young college students who had considerable computer experience. The target technology was a Web-based information system that supports class management and communication

via the Internet. Given that prior studies validated TAM across a variety of technologies and study settings and that those relationships between the TAM variables were strongly replicated in our study, the significant relationships found in the present study are expected to be maintained. However, the findings should be validated in other settings by future research beyond the specific conditions of this study such as subject characteristics and technology type to ensure generalizability of the study findings.

Our findings have practical implications. The present study demonstrates the critical roles of application-specific self-efficacy, enjoyment, and learning goal orientation in determining actual usage of a Web-based information system. Organizational or training interventions that boost application-specific self-efficacy, enjoyment, learning goal orientation should be able to promote and facilitate the usage of a similar type of system. We found that application-specific self-efficacy has a direct and powerful effect on actual use over and above user intention to use the system. Enjoyment was found to positively influence usefulness, ease of use, and application-specific self-efficacy. Within the context of computer training, behavior modeling training (Compeau and Higgins, 1995a; Simon et al., 1996) and observational learning processes (Yi and Davis, 2003) have been linked to increased self-efficacy, and game-based training (Venkatesh, 1999; Venkatesh and Speier, 2000) has been related to heightened enjoyment. These interventions and learning processes have potential to facilitate the successful acceptance of the technology. Finally, learning goal orientation had a positive effect on application-specific self-efficacy. Practitioners should create an environment where conceiving one's ability as a fixed entity is discouraged, accepting challenging goals is encouraged, and making errors while learning is regarded as a normative part of skill acquisition. Collectively, the findings from the present study suggest that practitioners should provide a working and learning environment where self-efficacy, personal enjoyment, and learning goal orientation are supported and fostered in order to facilitate successful acceptance of technology. Overlooking these motivational variables could have detrimental effects on the user acceptance of information technology.

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