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December 2005

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Drivers of University Students' Continued Use of Advanced Internet-Based Learning Technologies

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Abstract

Despite the growing interest in Internet-based learning technologies and the application of advanced Internet technologies in education, research investigating the use of advanced Internet-based technologies has been very scarce. The objective of this study is to gain a better understanding of factors influencing student continued usage of this learning technology. Since frequently performed behaviors tend to become habitual and thus automatic over time. If individuals are in the habit of using a particular system, the predictive power of intentions is attenuated. Thus, we extend Bhattacherjee's IS continuance model (2001) by postulating habit as a moderator of the relationship between intentions and continued behavior. Results present strong support for the existing links of IS continuance model, as well as the moderating effect of habit. The implications are noteworthy for both researchers and practitioners.

1.   Introduction

The Internet creates a new medium for education and training. Students can make use of the Internet to access and download teaching materials including both text and video. Also, with the use of online chat room or video conferencing, students can communicate with their instructors and fellow students. Despite the growing interest in Internet-based teaching and the application of advanced Internet technology in education, research investigating the use of advanced Internet-based technologies remains scarce. Limayem and Hirt (2003) stated that previous studies on Internet-based education focused primarily

on learning outcomes and learning processes, but rarely explored factors that drive students' adoption of Internet-based learning technologies as well as those that encourage their continued use.

Understanding student adoption of Internet-based learning technologies is important, as teachers are reluctant to invest their time and effort in this new medium if they are not confident that students will find the new medium acceptable (Lee et al. 2005). However, IS adoption is just the first step toward overall IS success. An IS implementation can truly be considered as "a success" when a significant number of users have moved beyond initial adoption and used the information systems on a continued basis. Thus, there is a need to identify the factors that encourage students continue using the Internet-based learning technologies.

In recent years, several theories and models have been proposed for the purpose of explaining and predicting IS continuance. A great deal of research examined IS post adoption by extending the acceptance model in a longitudinal setting and employed the same set of acceptance variables to explain IS continuance. (e.g. Karahanna et al. 1999, Venkatesh et al. 2000). However, Venkatesh and Davis (2000) found that the explanatory power of technology acceptance model decreases across time. The result presents an interesting question concerning the variability of factors driving IS adoption and IS continuance. Prior research assumed that IS usage behavior is primarily determined by intention. Though this assumption has been validated in IS adoption literature, it may not explain IS continued usage behavior equally well in the case of IS post-adoption. As Quelette and Wood (1998) urged, frequently performed behaviors tend to become habitual and thus automatic over time. If individuals are in the habit of using a particular system, the predictive power of intentions is attenuated. In other words, the stronger the habit, the weaker the effect of intentions on continuous usage. Thus, we believe that habit exerts a moderating effect on the relationship between intention and actual continued usage.

In this study, we adopt a contingency approach and examine the role of habit in determining IS continuance in general, and student continued usage of Internet-based learning technologies in particular. Based on the work of Bhattercherjee (2001), we developed a theoretical model explaining university students continued use of advanced Internet-based learning technologies. We then tested the model in a longitudinal setting with 505 students using the Blackboard system. In the next section, we introduce our research model. Then, we describe research design and methodology. After discussing the findings, we conclude the paper by highlighting the implications for both research and practice.

2. Research Model

Realizing the need to better understand continued IS usage behavior, Bhattacherjee (2001) developed an IS continuance model in line with the expectation confirmation theory and presented a new set of variable specific to IS post adoption. In this study, we examine student continuance usage of Internet-based learning medium by extending Bhattacherjee's IS continuance model (2001). Figure 1 depicts our research model for explaining student continued usage of Internet-based learning technologies.
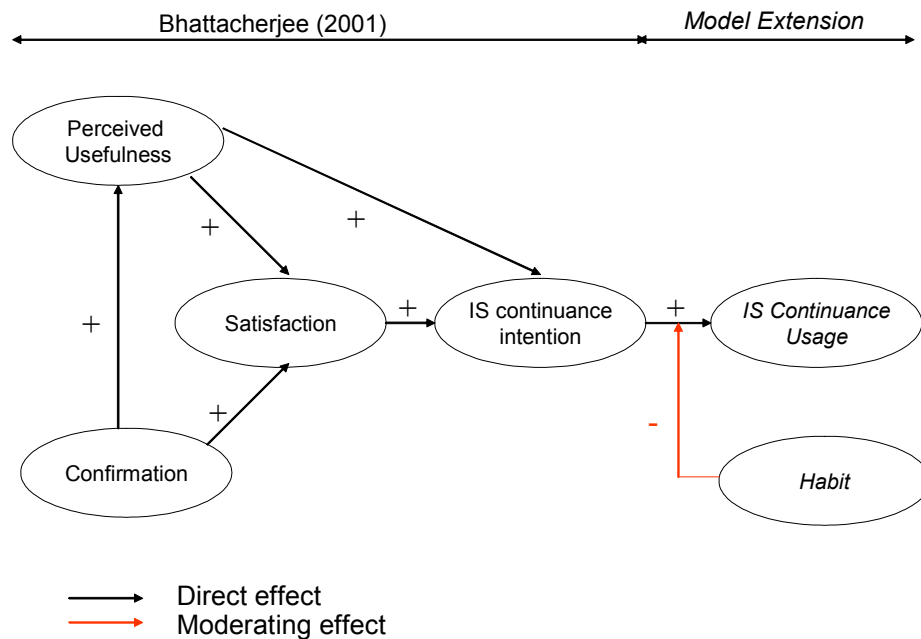
Figure 1: Research Model

Bhattacherjee (2001) suggested that IS continuance intention is predominantly determined by satisfaction and perceived usefulness. In the end-user computing literature, user satisfaction has been widely adopted as an important determinant of IS success (DeLone and McLean 1992, 2003, Rai et al. 2002, Zviran et al. 2003). In the marketing literature, satisfaction is a key to building and retaining a loyal base of long-term consumers. A similar argument can be made in the context of IS continuance where satisfaction with an IS tends to reinforce a user's intention to continue using the system. We therefore hypothesize that student satisfaction with the Internet-based learning technologies has a direct effect on the continued usage of Internet-based learning technologies.

By including perceived usefulness, Bhattacherjee's (2001) model reflects current thinking in the area of IS which holds that perceived usefulness is the only construct consistently influencing user intention across both adoption and post-adoption phases. Perceived usefulness explains the utility values of the system usage. In this specific context, the perceived utility values of Internet-based learning technologies are expected to affect student intention to continue using it. Thus, we postulate a positive relationship between student perceived usefulness of Internet-based learning technologies and the continued usage.

The model also relates satisfaction and perceived usefulness to the degree with which user's expectations about the IS are confirmed. Expectation provides the baseline level against which confirmation is assessed by users to determine their evaluative response or satisfaction. The better they are met, the more useful it appears to users and the more satisfied they are. Extending this line of arguments in the context of student continued usage of Internet-based learning technologies, we hypothesize that confirmation has a direct positive effect on both satisfaction and perceived usefulness of Internet-based learning technologies.

Like most other studies in this area, Bhattacherjee's model relies uniquely on intention as the primary predictor of IS continuance behavior. While not explicitly modeled, the link between intention and IS continuance is clearly implied. However, many frequently performed behaviors tend to become so much part of our lives, that their performance may become freed to some extent from the necessity of making conscious decisions about them. Thus, when behavior becomes habitual, the impact of intention on behavior decreases. Verplanken et al. (1998) have noted that "when a behavior is repeatedly and satisfactorily executed and becomes habitual, [..], it may lose its reasoned character." Such an interaction was also indicated in Triandis' (1980) model of attitude-behavior relationships, where intentions are assumed to predict behavior to the extent that the habit component is weak, or to a lesser degree, when habit is strong. Applied to continued usage, this means that IS habit exerts a moderating (suppressing) effect on the relationship between intention and actual continued usage. Therefore, we extend Bhattacherjee's IS continuance model (2001) by postulating habit as a moderator of the relationship between intentions and continued behavior. In other words, as student's usage behavior of advanced Internet-based learning technologies becomes more habitual, the link between intention and continued usage becomes weaker.

3.   Research Method

The sections below describe a detailed plan for data collection, measurement and data analysis.

3.1   Data Collection

The Internet-based learning system tested in this study is "Blackboard Learning System (www.blackboard.com)." It is a Web-based server software platform that offers industry-leading course management, an open architecture for customization and interoperability, and a scalable design that allows for integration with student information systems and authentication protocols. Blackboard is adopted as a teaching platform of several courses provided by a local university. Students can login to the system to download lecture notes, share documents with their project teammates, and communicate with their fellow students and course instructors.

First year students are chosen as our research subjects, since they have no prior knowledge of the system, making it relevant to study their adoption of advanced Internet-based technologies. The usage of this system is entirely voluntary and students can use other means to download and upload materials and to communicate with their instructor and classmates. In other words, students are not penalized for not using this system. The system was first introduced to the students at the beginning of the semester, and they were then requested to complete an online questionnaire that covered all the measures of the constructs in the research models. Participation in this study is voluntary. In order to encourage participation, an incentive is given to each of the participants in the form of bookstore cash coupons. A total of 505 usable questionnaires were collected.

3.2   Measures

Table 1 lists the measures used in this research. We use items that had been validated by prior research, but modified the wording of the questionnaire in order to fit this particular context of Blackboard usage. Measures for the constructs of IS continuance model is adapted from Bhattacherjee (2001). Habit is assessed using the measures from Limayem

et al. (2003). The formative items measuring IS continuance are taken from Davis (1989) and Steinfield (1985).

Table 1: List of Measures

Constructs	Measures	Sources
Perceived Usefulness		
PU1	Blackboard is of benefit to me.	Bhattacherjee (2001)
PU2	Using Blackboard will improve my grades.	
PU3	The advantages of Blackboard outweigh the disadvantages.	
PU4	Overall, using Blackboard is advantageous.	
Confirmation		
CONFIRM1	My experience with using Blackboard was better than what I expected.	Bhattacherjee (2001)
CONFIRM2	The benefit provided by Blackboard was better than what I expected.	
CONFIRM3	Overall, most of my expectations from using Blackboard were confirmed.	
Satisfaction		
SAT1	How do you feel about your overall experience of Blackboard Use:	Bhattacherjee (2001)
SAT2	(Very dissatisfied/Very satisfied)	
SAT3	(Very displeased/Very pleased)	
SAT4	(Very frustrated/Very contented)	
	(Absolutely terrible/Absolutely delighted)	
Continuance Intention		
CI1	If I could, I would like to continue my use of Blackboard.	Bhattacherjee (2001)
CI2	All things considered, I expect to continue using Blackboard during the next four weeks.	
CI3	All things considered, it is likely that I will continue to use Blackboard during the next four weeks.	
Habit		
HABIT2	Using Blackboard has become automatic to me.	Limayem et al. (2003)
HABIT3	Using Blackboard is natural to me.	
HABIT4	When faced with a particular task, using Blackboard is an obvious choice for me.	
IS Continuance		
	How often did you use Blackboard during the last 4 weeks?	Steinfield (1985)
CU1	(Never/Always)	Davis (1989)
CU2	(Once a month/Once a day)	

3.3   Data Analysis

The analysis of the data is done in a holistic manner using Partial Least Squares (PLS). The PLS procedure (Wold 1985) has been gaining interest and use among researchers in recent years because of its ability to model latent constructs under conditions of non-

normality and small to medium sample sizes (Chin 1998). It allows one to both specify the relationships among the conceptual factors of interest and the measures underlying each construct, resulting in a simultaneous analysis of 1) how well the measures relate to each construct and 2) whether the hypothesized relationships at the theoretical level are empirically true. This ability to include multiple measures for each construct also provides more accurate estimates of the paths among constructs which are typically biased downward by measurement error when using techniques such as multiple regression. Furthermore, due to the formative nature of some of the measures used and non-normality of the data, LISREL analysis was not appropriate (Chin and Gopal 1995). Thus, we choose PLS Graph Version 3.00 (Chin 1994) to perform the analysis.

4. Results

Following the two-step analytical procedures (Hair et al. 1998), we first examined the measurement model and then the structural model. The rationale of this two-step approach was to ensure our conclusion on structural relationship was drawn from a set of measurement instruments with desirable psychometric properties.

4.1 Measurement Model

Convergent validity indicates the extent to which the items of a scale that are theoretically related should be related in reality. Table 2 and Table 3 present information concerning the loadings and weights of the measures of our research model. All our reflective measures fulfilled the recommended levels of the composite reliability (>0.70) and average variance extracted (>0.50). As shown in Table 2, we noticed that all the values of composite reliability and average variance extracted were considered very satisfactory, with composite reliability at 0.91 or above and average variance extracted at 0.77 or above. All our formative measures had significant path loadings at the 0.01 level. As shown in Table 3, the two formative items in the model with weights demonstrated a substantive contribution to their corresponding construct.

Table 2: Psychometric Properties of Reflective Measures

Construct	Item	Loading
Perceived Usefulness	PU1	0.91
CR=0.93, AVE= 0.77	PU2	0.79
	PU3	0.91
	PU4	0.91
Confirmation	CONFIRM1	0.90
CR=0.92, AVE= 0.80	CONFIRM2	0.92
	CONFIRM3	0.87
Satisfaction	SAT1	0.88
CR=0.93, AVE= 0.77	SAT2	0.88
	SAT3	0.88
	SAT4	0.87
IS Continuance Intention	CI1	0.86
CR=0.91, AVE= 0.78	CI2	0.88
	CI3	0.90
Habit	HABIT 1	0.91
CR=0.92, AVE= 0.80	HABIT 2	0.93
	HABIT 3	0.83

Notes: CR=Composite Reliability, AVE= Average Variance Extracted

Table 3: t-statistics of the Formative Measures

Construct	Item	Weight	St. Error	t-value
IS Continued Usage	CU1	0.48	0.21	2.34
	CU2	0.52	0.14	3.73

Testing for discriminant validity involves checking whether the items measure the construct in question or other (related) constructs. Discriminant validity was verified with the squared root of the average variance extracted for each construct higher than the correlations between it and all other constructs (Fornell and Larcker 1981). As shown in Table 4, each construct shares greater variance with its own block of measures than with the other constructs representing a different block of measures.

Table 4: Correlations between Constructs (Diagonal Elements1)

	PU	CONFIRM	SAT	CI	HABIT
Perceived Usefulness (PU)	0.88				
Confirmation (CONFIRM)	0.64	0.90			
Satisfaction (SAT)	0.51	0.59	0.88		
IS Continuance Intention (CI)	0.67	0.68	0.58	0.88	
Habit (HABIT)	0.57	0.60	0.50	0.69	0.89

Overall, these results provide strong empirical support for the reliability and convergent validity of the scales of our research model.

4.2   Structural Model

Figure 2 presents the results with overall explanatory powers, estimated path coefficients (all significant paths are indicated with an asterisk), and associated t-value of the paths. Tests of significance of all paths were performed using the bootstrap resampling procedure.

As indicated in Figure 2, confirmation and perceived usefulness have significant impacts on satisfaction, with path coefficients of 0.45 and 0.22 respectively. The two constructs account for 38% of the variance in satisfaction. Confirmation also has a significant effect on perceived usefulness ($\beta=0.64$, $t=9.79$) with 41% variance explained. Regarding the antecedents of continuance intention, both satisfaction and perceived usefulness are significant with path coefficient of 0.34 and 0.47 respectively, accounting for 50% variance of continuance intention. As postulated in this study, continuance intention is found insignificant to IS continued usage behavior, whilst habit is found to negatively moderate the link between continuance intention and IS continuance, with path coefficient of -0.68. Overall, the antecedent of IS continuance explains 24% of the variance.

In testing for interaction effects using PLS, we follow the hierarchical process similar to multiple regression where we compare the R-square for this interaction model with the R-square for the "main effects" model, which excludes the interaction construct (Chin 1994). We use the difference in R-squares to assess the overall effect size f^2 for the interaction where .02, 0.15, and 0.35 has been suggested as small, moderate, and large effects respectively (Cohen 1998). As indicated in Table 5, the model in which habit is proposed to moderate the link between intention and continued usage possesses a significantly higher explanatory power than the main effect model, although the effect size for the interaction effect is 0.03 (small). It is important to understand that a small f^2 does not necessarily imply an unimportant effect.

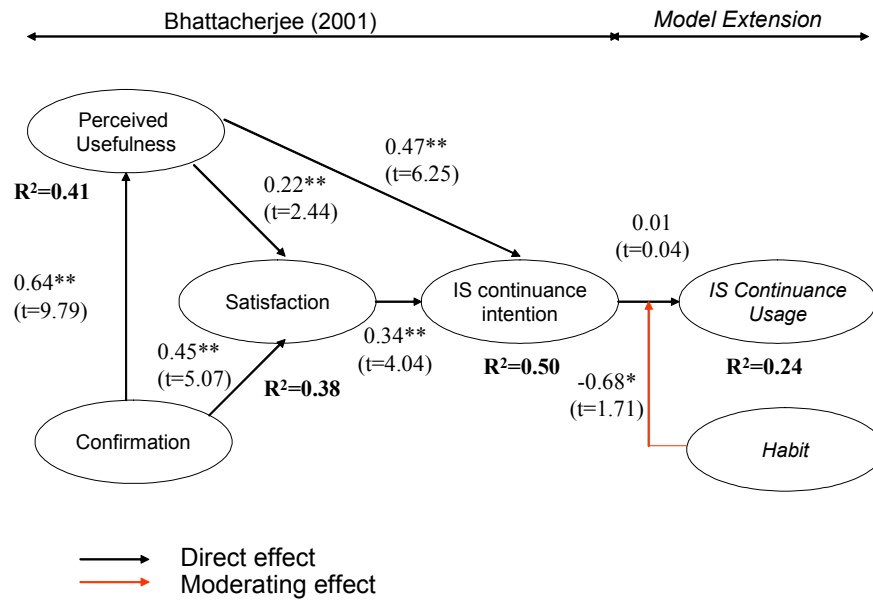1 Diagonal Elements are Square Roots of the Average Variance Extracted

Figure 2: Results

Table 5: Hierarchical Test

	R-Squares
Main Effect Model	0.22
Interaction Effect Model	0.24
f-squares2	**0.03**

5. Conclusions and Discussion

Motivated by a need to better understand the underlying drivers of student continued usage of Internet-based learning technologies, this study extended Bhattacherjee's IS continuance model (2001) and tested the moderating effect of habit on the relationship between intentions and continued behavior. The measurement model is confirmed with adequate convergent and discriminant validity in respect of the measurement of all the constructs in the research model. All path coefficients in the research model are found statistically significant (except the path from IS continuance intention to IS continuance). The result showed that habit exhibits a strong moderating effect on the relationship between intention and IS continued usage. These results have several implications for theory and practice.

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2 f-squares = [R^2(Interaction Effect Model) - R^2(Main Effect Model)]/[1 - R^2(Main Effect Model)]

5.1 Limitations of This Study

Before moving on to highlight the implications for research and practice, we would like to address the limitations of this study. First, caution is in order before generalizing these results to other Internet-based learning technologies. Though we are convinced that Blackboard has all the necessary characteristics of modern Internet-based learning technologies, its specificity might have biased the results of this study. Second, prior research has empirically demonstrated that difference between self-reported measures of IS usage versus computer-record measures. In this study, students may over-reporting their usage behavior to give a more politically correct impression which is a rather common phenomenon (Straub et al. 1995). Finally, building upon IS continuance model, the rational models of human behavior, our model has neglected the socio-cultural or political impacts on student usage of Internet-based learning technologies. This may be the reason that our research model only explains 24% of the variance. Further refinement of this model by including other important variables that affect IS continuance is warranted.

5.2 Implications for Research

Bhattacherjee's (2001) IS continuance model attempts to predict IS continuance better by using variables (satisfaction, confirmation) that are in greater temporal proximity to post-adoption behavior. Building on the argument that if a person is in the habit of continuously using an IS, there would seem to be no need to perform the conscious planning as assumed by traditional intention-based models, our research model however further expands upon his work by adding the moderating effect (IS habit) on IS continuance intention and IS continuance usage. Our study not only enriches the IS continuance literature using a moderation perspective, but also reaffirms the theoretical argument that the strength of intention to predict continuance is weakened by a high level of IS habit. In addition, this study is one of the very few attempts to investigate student continued usage of Internet-based learning technologies using an extended IS continuance model. In so doing, this research broadens the boundaries of IS continuance model and contributes to the emerging IS post-adoption literature.

5.3 Implications for Practice

In addition to the theoretical contribution just mentioned, our findings lead to several important recommendations to instructors, academic institutions and Internet-based learning technologies designers. Specifically, as perceived usefulness remains the most important determinant of user satisfaction and continuance intention, system designers and instructors should exhibit the usefulness of Internet-based learning technologies by highlighting their unique features in facilitating the learning process. For instances, they can promote the idea that Internet-based learning technologies facilitate the access to lecture materials anywhere, anytime, in and out of the classroom. During the training, instructors should emphasize that these technologies enable a self-paced and interactive learning, more instruction time with fewer resources, and the access to the most updated information on the topics being studied. However, instructors should refrain from "over-stating" the benefits of Internet-based technologies, as confirmation also plays an important role in determining student's perceived usefulness and satisfaction with the system. If students have very high expectations of the system, these expectations might not be easily met, and resulting in discontinuance use of the system. Finally, our results show that when students gain more experience with the system, there is a shift in importance from a consciously-driven behavior to a habitual behavior. Thus, instructors

should try during the first few weeks of the academic term to get students into the habit of using the system. These can be achieved by making use of discussion forums that facilitate in-class and off-class discussion, and making the lecture notes and other materials available for downloading by the students. Once the habit of using the Internet-based learning system increases, usage behavior becomes more automatic, and this may lead to a more sustainable continuance.

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