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ANTECEDENTS OF INFORMATION SYSTEMS HABIT IN SPORADIC USE OF LEARNING SYSTEMS: PERSONALIZATION AND PEER EFFECTS

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Abstract

Research on Information Systems (IS) habit formation has been focused mostly on IS habit's effect on IS continuance. Antecedents of IS habit formation, as reported in the literature, are primarily on users' prior behavior and comprehensiveness of usage. Most of the literature focus on analyzing the relationship between users' IS usage behavior and IS habit. Limited work has been reported to investigate genuine and practical ways to develop IS habit, as well as to address the issue of sporadic IS usage, which leads to different interpretations on IS habit and continuance. This study purports to address the theoretical gap on issues related to IS habit antecedents and sporadic IS usage habit in the educational context. Adopting an empirical survey in universities' (sub-degree and postgraduate settings) learning systems usage, data from cross-sectional survey on learning systems usage on per-course basis is analyzed. Theoretically, our results suggest that IT functionality design (personalization) and social factor (peer effect) have strong and positive relationship on IS habit with respect to the sporadic usage nature of course based learning systems. Practically, we suggest some dimensions for teachers on curriculum design that facilitate IS habit development, e.g., maintaining an online community with substantial student peer input at the early stage of a course.

Keywords: Information System Habit, Learning System, Sporadic Information Systems, Personalization, Peer Effect.

1 INTRODUCTION

Research in Information Systems (IS) post adoption has generally emphasized on the effect of conscious (e.g., rational and emotional) behavior on Information System (IS) users' post adoption behavior. As one of the most influential theories on IS post adoption behavior, Expectation Disconfirmatory Theory (EDT) (Bhattacharjee 2001) advocates that satisfaction (emotional behavior) and perceived usefulness (rational behavior) are two strong predictors of post adoption behavior (i.e., IS continuance). However, recent literature suggests that effect of conscious behavior on IS continuance may be overestimated in IS research (Ortiz de Guinea and Markus 2009). Therefore, an emerging trend of IS post adoption research is to investigate the effect of unconscious behavior on users' IS continuance intention and actual behavior.

During the last decade, effect of unconscious (e.g., automatic) behavior affecting IS users' post adoption behavior has been underestimated in the IS continuance literature. Only until recent years, unconscious IS behavior research has gained the attention from the IS research community. One example of such IS automatic behavior research is the IS habit model (Limayem et al. 2007), advocating that IS habit moderates the link between IS continuance intention and actual IS continuance. IS habit is formed by two favorable conditions, high comprehensiveness of usage (i.e., extent to which an individual makes use of different functionalities/ applications under a single IS) (Limayem et al. 2007), as well as high frequency of past behavior. These two favorable conditions, however, are only hard index to indicate user behavior. The fundamental question on how IS habit can be developed is still unanswered.

In the context of educational IS, e.g., learning systems, the nature of IS utilization can vary significantly across different institutions and different subjects. Literature on IS continuance in the educational context, e.g., Limayem and Cheung (2008), generally assesses utilization of learning systems at the institutional level. Wilson et al. (2010) argue that some IS are used on a sporadic nature (i.e., to support needs that occurring infrequently in life, e.g., dealing with infrequent incidents in healthcare, employment and home sales). Therefore, measurement on users' behavior (e.g., IT usage behavior) adopted from traditional IS research may not reflect the nature of sporadic IS use. Taking a course based view of learning systems usage, the sporadic nature of course based learning site can be reflected by its specific goals to support one course and its relatively short duration (typically one term/ semester) when compared to the institutional-wide learning systems behavioral research. Despite the distinct nature of evaluating learning systems on the institutional and course levels, the sporadic view of learning systems usage is always neglected in the literature.

The purpose of this paper is to address two theoretical gaps in existing IS habit literature on (1) identifying pre-requisites of IS habit formation; and (2) evaluating learning system users' behavior with a sporadic course based view. Specifically, the research questions are (1) What are the antecedents of IS habit in learning systems; (2) In what ways do these antecedents affect IS habit formation; and (3) Does IS habit have a direct relationship with IS continuance in the case of sporadic IS?

Adopting an empirical study, we conducted an evaluation on student users' behavior on different course sites for different levels of students (associate degree and master's degree) and different modes of study (full time and part time) across two Hong Kong tertiary institutions using Moodle Learning Management System. Base on prior work on IS habit and IS continuance, we hypothesize that (1) IT functionality design and (2) social effects are two antecedents of IS habit in learning systems under sporadic use. Data were collected using cross-sectional survey and later were analyzed with Partial Least Square (PLS) technique.

The contribution of this paper is two-fold. Theoretically, we enrich the existing literature on IS by adding new antecedents of IS habit formation. Additionally, we compare and analyze the relationship between different constructs under ordinary and sporadic IS use. Practically, we propose different

approaches for teachers and learning system designers to facilitate early IS habit formation among students through utilizing available system functionalities and facilitating peer collaboration.

2 LITERATURE REVIEW

Until recently, there has not been much work to address issues related to the effect of unconscious behavior on IS continuance, particularly on ways to develop unconscious usage behavior that positively influences IS continuity. We first present the existing literature on IS habit research, followed by the behavioral research on sporadic use of IS. Then, different attempts to identify the antecedents of IS habit are reviewed. Drawing on different literature on personalized IT application and social capital on IS post adoption research, we finally discuss the potential new antecedents of IS habit.

2.1 Expectation Disconfirmatory Theory and IS Habit

Earliest version of EDT in IS research (Bhattacharjee 2001) complements the classic Technology Acceptance Model (TAM) (Davis 1989) by adding post-adoption emotional factors to predict IS continuance. EDT considers perceived usefulness, positive disconfirmation (i.e., whether expectations on IS are fulfilled) and satisfaction (i.e., a pleasurable or positive emotional state after IS use) as the factors leading to IS continuance.

Later, the effect of unconscious IS behavior (e.g., IS habit) was found to have significant impact on IS continuance. Ortiz de Guinea & Markus (2009) explain unconscious intentions of IT use as “well-learned action sequences may be activated by environmental cues and then repeated without conscious intention”. One of the well-known examples of such unconscious IT use is known as IS habit, defined as the “extent to which people tend to perform IS behavior (use IS) automatically because of learning” (Limayem et al. 2007) (p.705). The power of IS habit in influencing IS continuance is soon acknowledged in some recent work. Venkatesh et al. (2008) report that as time passes, the power of habit in influencing system use is greater than either behavioral intention or behavioral expectation. Kim (2009) points out the importance of IS habit in influencing work productivity: on the positive side, habitual use of desirable technology features increases users’ productivity; on the negative side, mindless repetition of an “old” routine that is no longer effective for work productivity can be detrimental to work performance.

One of the earliest and most comprehensive work on IS habit research is the IS habit model (Limayem et al. 2007), postulating that IS habit has positive relationship with IS continuance. Statistically, IS habit has a direct effect on actual IS continuance, as well as has a moderating effect between IS continuance intention and actual IS continuance. Comparatively, the moderating effect of IS habit is statistically stronger than the direct effect although both effects are significant.

In the context of educational technology, IS habit model has also been replicated in different e-learning settings and empirically validated. Limayem and Cheung (2008) report an empirical study on students’ BlackBoard Learning Management System (LMS) utilization in a Hong Kong tertiary institution. IS habit also shows a moderating relationship between IS continuance intention and actual IS continuance. Antecedents of IS habit, however, are not discussed in this work.

The focus of IS habit model is on the effect of IS habit on IS continuance intention and actual IS continuance. Although antecedents of IS habits have been explored in Limayem et al. (2007), these antecedents are hedonic (e.g., satisfaction), utilitarian (e.g., usage comprehensiveness) and objective measures of usage (frequency of past behavior). The main issue arising from the IS habit model is that the “genuine” cause of IS habit development is still unanswered. In other words, IS habit model does not give any recommendations on how to facilitate the development of IS habits through different means. It only explains what usage patterns and user perceptions would positively affect IS habit development.

Contemporary work on IS habit progressively addresses the shortcoming on providing the “genuine cause” of IS habit and IS continuance. Recent extension of the IS habit model shows more constructs that are influential to IS habit and IS continuance. Lankton et al. (forthcoming) assert that privacy issues and user experience with a social networking site play a moderating role between IS habit and IS continuance. Some other potential causes of IS habits are trust, playfulness and attraction (i.e., positive beliefs a user holds from their interactive relationship with technology concerning the technology’s qualities and features; overall evaluation or attitude toward a potential relationship with a technology (Clements and Bush 2011) (p.53)).

2.2 Sporadic Versus Frequent Use of IS

Wilson et al. (2010) introduces the term “sporadic use IT” to describe (IT) designed for meeting user needs that are not frequent and recurring. Generally, learning systems e.g., LMS and its mobile version (Mark and Vogel 2009) are considered as educational IS that meets users’ “frequent and recurring” needs (Wilson et al. 2010) (p.186). In other organizational context, examples of IS serving the “frequent and recurring” needs are healthcare, employment, home sales and even online matchmaking (Wilson et al. 2010).

Sporadic use of IS usually include a sub-set of modules provided by these “frequently-used” IS designed to serve users’ “infrequent and non-recurring” needs. For instance, students’ sporadic use of LMS can be triggered by the teacher’s instruction to perform a certain online teaching and learning activity, or to complete an online assessment, or to apply for a financial subsidiary (Wilson et al. 2010) once every year. In other organizational context, Wilson et al. (2010) present some examples of sporadic use of IS:

- Healthcare: first aid of onset of illness, injury or medical condition;
- Employment: enter employment, retirement or personal/ family changes;
- Home sales: report job relocation, personal finances, or family changes;
- Matchmaking: change status of romantic relationships.

The sporadic nature of IS usage suggests that some phenomenon in traditional context of IS research need to be reexamined and reinterpreted. IS habit, for example, is often characterized by the frequency of behavior. Ouellette and Wood (1998) postulate that repeated prior behavior is a predictor of habit formation, but they also admit some habitual behaviors actually do not involve high frequency, such as blood donation, is often mediated by conscious intentions e.g., attitudes and subjective norms, in addition to past behavior. Using frequency of past behavior as a proxy for IS habit, therefore, warrants caution and is being criticized in the IS habit model (Limayem et al. 2007) .

The relationship between past behavior, habit and IS continuance is always underexplored in frequently used and sporadic IS. Ouellette and Wood (1998), as well as Kim and Malhotra (2005), also advocate that past IS behavior has a positive impact on future behavior, i.e., continuance. Comparison across the findings between literature on frequently used IS and sporadic IS reveals that the power of past IS behavior varies in frequently used IS and sporadic IS. Limayem et al. (2007) show that the effect of past IS usage behavior (frequency) on a frequently-used IS (BlackBoard LMS) has a relatively weaker explanatory power on habit, as exemplified by the p-value (marginally at 0.06) on its significance. On the contrary, Wilson et al. (2010) statistically prove that the effect of past IS usage frequency has a significantly higher explanatory power on habit (p-value < 0.001) in the case of sporadic IS.

Although evaluating users’ IS usage behavior is essential under course based settings in an institution and in short organizational on-the-job training programs, little work has been done to address e-learning habit development on a course level with sporadic IS view. Research on learning systems continuance usually position learning systems as a frequently used IS, neglecting its sporadic nature when it is used in a short course, or when every “regular” course has an independent course site. Most literature report results collected from students and teachers, surveying on their overall perception on

e-learning e.g., Chiu et al. (2007) analyze students' views on web based learning continuance intention across different courses; Hung et al. (2011) report teachers' views on web-based learning systems continuance with respect to the general school setting.

Christensen et al. (2008) assert that the emerging trend of education and training is to provide "personalized" and "just-in-time" content to learners through e-learning means. Learning systems plays an important role in content delivery, personalized learning support and peer learning support (e.g., through peer collaboration). Evaluating learning systems users' post adoption behavior with respect to the sporadic nature of learning systems, therefore, complements the existing literature by providing data and practical suggestion to develop learner's IS habit in short courses or just-in-time training.

2.3 Exploration of IS Habit Antecedents

Attempts have been progressively made to explore different antecedents of IS habit in contemporary IS post adoption research. Lankton et al. (2010) postulate that in addition to satisfaction and prior IS usage behavior (Limayem et al. 2007), two more antecedents related to attention in IS post adoption context, importance and task complexity, are possibly the new antecedents of IS habit. Attention is associated with importance, i.e., personal relevance related to involvement, interest, salience, and goal-directed arousal capacity, as well as task complexity, i.e., difficulty, ambiguity, and lack of clarity involved in the task. While individuals are facing more "important" tasks, they tend to pay attention and develop habit on these "important" tasks. On the contrary, complex tasks draw much more attention from individuals than simple tasks but individuals tend to develop habits on simple tasks rather than complex tasks.

Nan (2011) brings a new concept on IS habit development through mental activities on the human side, as well as to foster IS habit development through technical implementation. Nan (2011) asserts that mental activities i.e., rational and emotional factors in Technology Acceptance Model (Davis 1989) and EDT (Bhattacharjee 2001) are important predictors of IS habit. Technically, IT functionalities (i.e., the set of functions or capabilities delivered by IT features such as information access) (p.512) play an important role in bottom-up IT use processes, hence have a significant impact on IS continuance or discontinuance. The effect of IT functionalities on habitual development or IS continuance development, however, has rarely been reported in the literature.

One promising direction to look at the potential IT applications that may positively foster IS habit development is on personalized IT application. Mark and Vogel (2009) confirm that personalized applications are useful to learning systems users and tend to develop long term continuity of learning systems usage. Statistic findings reveal that personalization in learning systems has a positive influence on IS continuance indirectly: personalization does not show a direct relationship with IS continuance; indeed, personalization has a positive effect on IS habit development, which then plays a positive relationship on IS continuance.

The second direction to explore new IS habit antecedents is to study the literature on social effects and IS continuance. Hayashi et al. (2004) posit that the sense of social presence positively facilitates the development of IS continuance. One explanation of this positive relationship is that social presence improves users' satisfaction level, which then in turn influences IS continuance positively. Similar findings are also presented in He and Wei (2009), advocating that social effects are essential facilitating conditions to foster long term knowledge sharing behavior in a knowledge management system. It is noteworthy that social factors exerts a stronger effect on post adoption behavior in social media applications, e.g., discussion boards, instant messaging and social networking sites e.g., facebook. Confirmed in Vittek et al.'s (2011) work, social networking is postulated as one of the significant antecedents for long term cyberslacking (i.e., use of Internet and mobile technology during work hours for personal purposes) behavior. Although the literature reports influence of social effects on IS continuance in the emotional or rational domain, we cannot eliminate the possibility that social factors also exert some degree of relationship, either direct or indirect, on IS continuance.

2.4 Summary of Research Gaps

IS habit is a relatively new area to explore. Research on unconscious IS usage is just at the very beginning stage, especially on answering how IS habit can be developed to increase IS continuance. As asserted in Clements and Bush (2011), the major research gap in IS habit research as “how user experiences can be manipulated to generate habitual continuance” (p.51). There is still a lot of “how” and “what” questions unanswered in the literature. The focus of our work is to address the research gaps on technical antecedents and social antecedents of IS habit:

- In the technical domain, what are the IT functionality design features that help develop IS habit? How do they affect IS habit development?
- In the social domain, what are the issues that affect IS habit development? How do they affect IS habit development?

Next, we present our research approach with the path model and steps on hypothesis development.

3 RESEARCH APPROACH

We develop a path model to explain the antecedents of IS habit formation and its effect on IS continuance, based on the literature and the exploratory work by Mark et al. (2010). EDT (Bhattacharjee 2001), IS habit model (Limayem et al. 2007) and the recent work on antecedents of IS habit (Lankton et al. 2010) are used as the underlying theoretical foundations of our research model.

To ascertain the generalizability of the results in educational context, a more widely institutionalized educational technology, course management system, is adopted as the learning systems under our research. Course management system is “*probably the most used educational technologies in higher education*” (West et al. 2007) (p.2). Two examples of course management systems widely adopted by institutions worldwide are (1) Moodle; and (2) Blackboard. They have been adopted as the educational technology under a number of studies on learning system users’ behavior, e.g., Landry et al. (2006) and Liaw (2008).

To fully model the sporadic nature of LMS use, our research is designed to reflect individual course site utilization and user behavior. Individual course sites are considered sporadic LMS use because of the following reasons: (1) users access a course site to complete the teaching and learning activities, or assessment tasks, with respect to that specific course only, and access is triggered by the specific activities in the course; (2) collaboration and communication between peer student users in the individual course site mostly include only issues related to that specific course; and (3) the individual course site generally can be archived and kept after the course end so that the “old” students can repeatedly access to the content in the future (Mark and Vogel 2009).

We then present the stages in hypothesis development, followed by the proposed research model.

3.1 Hypotheses Development

We develop the hypotheses through extensive literature review in IS, consumer behavior and education. The objective of our research is to understand how IS continuance is developed through formation of IS habit. Limayem et al. (2007) postulate that habit has a direct effect on actual IS continuance and a moderating effect between IS continuance intention and actual IS continuance. Results show that two effects are both significant although the moderating effect has a relatively stronger explanatory power than the direct effect.

We adopt the former view, i.e., habit has a direct effect on actual IS continuance, as the core of our hypotheses design because the focus of our study is to understand how habit is developed through different ways to foster actual IS continuance. This comes to the first hypothesis:

H1: Habit has a direct effect on learning systems continuance

As a consensus among different literature, frequency of past behavior is a predictor of IS habit (Lankton et al. 2010 ; Limayem et al. 2007 ; Vitak et al. 2011 ; Wilson et al. 2010) although slight variations on interpreting “frequency of past behavior” exist on sporadic IS (Wilson et al. 2010). We also acknowledge the role of frequency of past behavior in IS habit formation, thus forming the second hypothesis:

H2: Frequency of past behavior has a direct effect on IS habit

Our next hypothesis relates to IT artifact design, in the area of personalization, as an antecedent to IS habit. Nan (2011) asserts that IT functionalities are influential to bottom-up IT use processes, which has a significant impact on IS continuance or discontinuance. This is exemplified in the literature on e-commerce and marketing, as reflected by personalized features in e-business systems and its effects on customer loyalty. Rodríguez-Ardura et al. (2008), for example, assert that price is not the most important element in online commerce in a developed market (e.g., Spain) but how online retailing web sites bring extra values to consumers through different IT functionalities is more critical. This is evidenced by the lower level of price dispersion in the online outlets than the traditional market (Brynjolfsson and Smith 2000).

Among the value-added functionalities that induce customer loyalty, personalization is one of the promising areas that develop users’ habit. System design that incorporates personalized features is influential to habit (Lin and Fang 2011). Hong et al. (2008) explain how personalization is influential to habit formation through increasing the switching cost and exit barrier to the IS. Therefore, we form the third hypothesis on personalization and habit as:

H3: Personalization is positively associated with users’ habits of learning system usage

Zhang & Wedel (2009) further report the effect of personalized shopping list on shopping habit in online store. Personalized shopping list creates dependency on shoppers who gradually make more frequent re-purchases with the online store. This is possibly a mediating effect between personalization and IS habit through frequency of past behavior. The fourth hypothesis, therefore, is:

H4: Personalization is positively associated with users’ frequency of past behavior

The final set of hypotheses relate to the social interaction between learning system users. The effect of peer influence on habitual development has long been validated in other disciplines, e.g., psychology and healthcare. A classic example of peer influence and habit is on smoking. Aloise-Young et al. (1994) point out that peer effect is a significant factor for adolescents to develop smoking habit, as a way to enter a desired friendship group dominated by smokers. In the context of IS, peer effect also exerts a strong motivation for users, especially in online communities, to participate. The strong effect of collective social effect of IS habit development in an online community, which brings the sense of “being together”, is reported in Gan et al. (2009). This comes to our fifth hypothesis:

H5: Peer effect is positively associated with users’ habits of learning system usage

Another approach of viewing the casual relationship between peer effect and IS habit is the mediating effect of past behavior. Ouellette & Wood (1998) asserts that perceived social pressure is a key to past behavior in daily life e.g., physical exercise, leading to high frequency of past behavior. This comes to our last hypothesis:

H6: Peer effect is positively associated with users’ frequency of past behavior

Next presents our proposed research model.

3.2 Research Model

The interrelationships between the three constructs in our research, i.e., actual IS continuance, frequency of past behavior, personalization and peer effect are outlined in Figure 1 below.

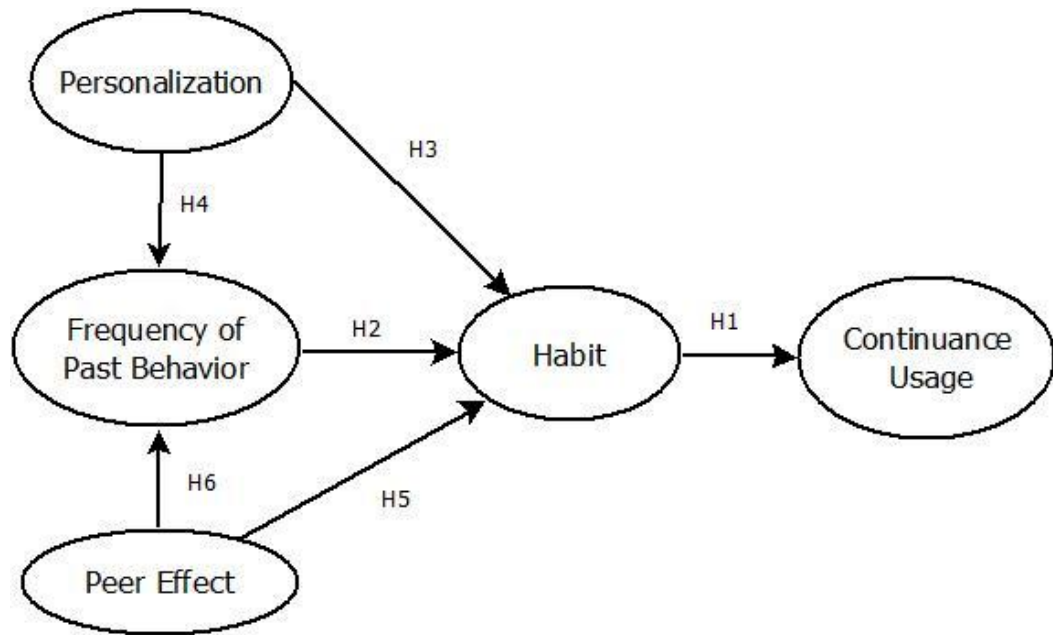


Figure 1. Research framework on IS habit, personalization, peer effect and frequency of past behavior

4 RESEARCH METHODOLOGY

To collect evidence for verifying and supporting the hypotheses, cross-sectional self-administered questionnaire survey was conducted in December 2011. Cross-sectional data were collected from different cohorts of students from different levels across two tertiary institutions in Hong Kong, through self-reported questionnaires, to validate the proposed structural model. The respondents consist of students in two elective courses in a taught Master's program (75 postgraduate students who were first (full/ part time) or second-year (part time) students in Information Engineering), and two first-year courses in an associate degree program (77 full time sub-degree students in Business Administration).

4.1 Data Collection

Paper questionnaires, instead of electronic survey platform, were administered due to technical and privacy constraints. First, online participation was considered as a critical component in the final assessment (10% of the final grade). This survey collects Moodle LMS usage patterns of individual students which directly relates to the online participation assessment. Using the survey function in Moodle might seem to be the easiest way to administer the survey, but anonymity of respondents cannot be guaranteed. Second, we were the teachers in two of the classes being surveyed. Ethically, subjects should voluntarily take part in the survey and have the right in withdraw from the survey at any point. If the survey were conducted through the Moodle platform, an access record would be kept in the system log which made absolute anonymity impossible.

Although using a third party survey might be a solution. It is, however, necessary to restrict survey access to only students taking these courses. Paper questionnaire administration in class would be the easiest solution to control access. To ascertain anonymity and voluntary participation, paper questionnaires were distributed in the class with clear instructions on the first page, with strong emphasis on voluntary participation and the purpose of data collection. No personal data that could reveal a respondent's identity (e.g., student number or email address) were collected. Students were instructed to complete the questionnaire during the class if they were willing to participate, and to

return the completed or uncompleted questionnaires to a drop box when they left the classroom. This procedure ensured that the researcher/ teacher did not have any ideas on who had or had not taken part in the survey so that absolute anonymity could be preserved.

Finally, a total of 152 paper questionnaires were returned. There were a total of 140 valid questionnaires that were analyzed in the study, giving a response rate of 92%.

4.2 Measurement

Users' perceptions on personalized IT applications and peer effect during LMS usage, as well as continuance usage behavior were collected with self-administered questionnaire. All constructs, except "Frequency of Past Behavior" and "Continuance Usage", were measured using 7-point Likert scales.

Table 1 presents the instruments (constructs and items) adopted in our study.

Habit		
HAB 1	Using our course Moodle has become automatic to me.	Adapted from Limayem et al. (2007), Limayem & Cheung (2008)
HAB 2	Using our course Moodle is natural to me.	
HAB 3	When faced with a particular task (e.g., seeking help and sharing resources with my peers), using our Course Moodle is an obvious choice for me.	
HAB 4	I use our course Moodle as a matter of habit.	
HAB 5	Using our course Moodle has become a habit to me.	
Frequency of Past Behavior		
F 1	On average, how frequently have you logged in our course Moodle over first four sessions?	Adapted from Limayem et al. (2007), Kim and Malhotra (2005)
Personalization		
PER 1	Our course Moodle is personalized in some way.	Adapted from Burton (1994), Kim and Son (2009), Mark & Vogel (2009)
PER 2	I "set up" Moodle to use it the way I want to.	
PER 3	I have adapted to our course Moodle to meet my needs.	
PER 4	I have chosen features offered by Moodle to suit my style of use.	
PER 5	I find it useful to annotate my personal comments on the materials distributed by the teachers.	
Peer Effect		
PE 1	My friends think I should use our course Moodle.	Adapted from Ouellette and Wood (1998)
PE 2	My peers (i.e., people at the same level as me) think I should use our course Moodle.	
PE 3	My project team-mates believe I should use our course Moodle.	
PE 4	I believe the Department would like me to use our course Moodle.	
PE 5	My teachers (lecturer and tutor) suggest that I use our course Moodle.	
Continuance Intention		
C1	At the beginning of week 4, I intended to continue using our course Moodle rather than discontinue its use.	Adapted from Bhattacharjee (2001), Limayem et al. (2007)
C2	At the beginning of week 4, I intended to continue using our course Moodle rather than other means for eLearning.	
C3	At the beginning of week 4, I would like to continue my use of our course Moodle if I could.	
Continuance Usage		
CU1	On average, how frequently have you logged in our course Moodle over the past month?	Adapted from Limayem et al. (2007), Kim and Malhotra (2005)

Table 1. List of constructs and items

4.3 Data Analysis

Partial Least Squares (PLS) analysis is preferred for a number of reasons: (1) small-to-medium sample size (Chin 1998); (2) simultaneous analysis of relationship between constructs and hypotheses validation; (3) the formative nature of some variables (e.g., continuance usage) is less appropriate to be measured by other techniques, e.g., LISREL.

In accordance with Limayem et al.'s (2007) recommendations, our proposed model is tested with PLS using SmartPLS version 3.00 (Ringle et al. 2005). PLS is adopted in this study because of its ability to (1) specify relationships among the conceptual factors of interests and the measures underlying each construct; (2) show how strong the relationships are; (3) test whether the hypotheses are empirically true (Limayem et al. 2007); and (4) handle small-to-medium sample size (Chin 1998).

5 RESULTS

Reliability on internal consistency is confirmed by values of Cronbach's Alpha (minimum 0.7), Composite Reliability (minimum 0.7) (Nunnally 1978). Additionally, AVE (minimum 0.5) in the validity evaluation provides the third indicator of internal consistency (Fornell and Larcker 1981). All constructs exceed the minimum requirements, implying satisfactory reliability is achieved.

Convergent validity is reflected by the t-value (minimum 1.96) in Outer Model Loadings. All constructs significantly exceed the minimum requirement. Discriminant validity is determined by comparing the square root of AVE of each construct (minimum 0.7) and correlation between the construct and any other construct, so that the latter value should always be less than the AVE for each construct. Table 2 shows the cross-loading within and across different constructs.

	Continuance Usage (CU)	Frequency of Past Behavior (F)	Habit (HAB)	Peer Effect (PE)	Personalization (PER)
CU1	1.000000	0.624174	0.556842	0.506943	0.419128
F1	0.624174	1.000000	0.398490	0.289663	0.365192
HAB1	0.462128	0.310948	0.837923	0.668042	0.549791
HAB2	0.551885	0.402880	0.899360	0.722534	0.477249
HAB3	0.398351	0.239786	0.737923	0.669841	0.592182
HAB4	0.418521	0.313575	0.857011	0.651982	0.419158
HAB5	0.521774	0.410717	0.912860	0.727466	0.529614
PE1	0.521877	0.304382	0.763692	0.917078	0.546376
PE2	0.539841	0.352343	0.780523	0.941816	0.580647
PE3	0.514543	0.252461	0.750839	0.929130	0.555396
PE4	0.338801	0.158294	0.621570	0.795101	0.452898
PE5	0.183174	0.128267	0.534589	0.698775	0.316243
PER1	0.337562	0.284962	0.538132	0.535228	0.852014
PER2	0.390683	0.334775	0.586326	0.522427	0.917323
PER3	0.373325	0.301738	0.513658	0.490120	0.902318

PER4	0.383678	0.346847	0.443485	0.443836	0.889129
PER5	0.200749	0.214692	0.351516	0.364343	0.453329

Table 2. Item loadings and cross-loadings between all constructs and items

To improve discriminant validity, item loadings and cross loadings (minimum 0.6, preferably above 0.7) were further evaluated. Items with poor loadings (PE5 and PER5) were then dropped to provide better measurement model validity. The revised model was analysed using PLS. Figure 2 shows the results of PLS path analysis.

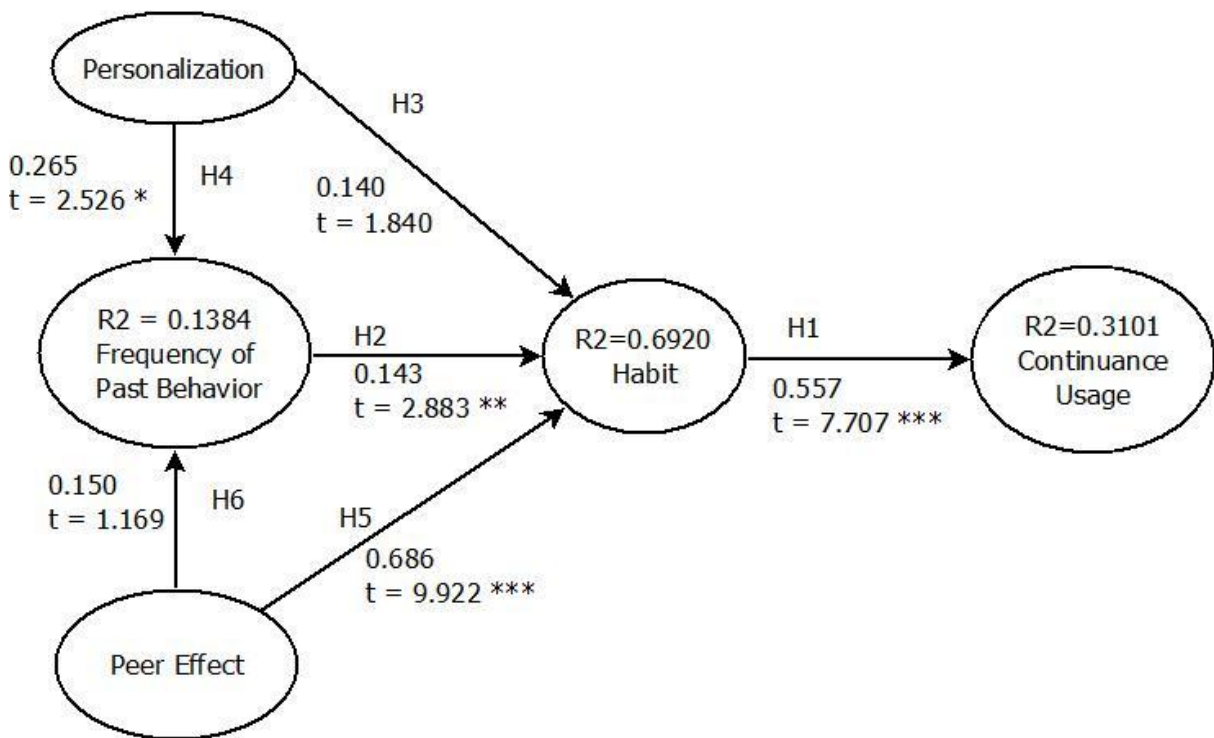


Figure 2. Path analysis of model (*: $p < 0.05$; **: $p < 0.01$; ***: $p < 0.001$)

6 DISCUSSION

Comparison of research settings between the literature in IS habit research with institutional settings e.g., Limayem et al. (2007), and Limayem and Cheung (2008), and the settings in our work provides some clues on the relationship between usage behavior and habit strength. A summary of comparison between the analysis of prior usage behavior and habit or continuance usage behavior is presented in Table 3.

Relationship between habit and usage	Our work	Wilson et. al (2010) – sporadic IS use	Limayem et al. (2007) – frequent IS use
Prior behavior has a direct effect on IS habit	** ($p < 0.01$)	*** ($p < 0.001$)	Partially supported ($p < 0.1$)
IS habit has a direct effect on IS continuance	*** ($p < 0.001$)	** ($p < 0.01$)	* ($p < 0.05$)

Table 3. Relationship between habit and usage in our work and the literature

Explanations on why prior behavior has a more significant effect on habit in our work can be related to the survey settings. In the literature, data were collected on “*university undergraduate students’ World Wide Web use*” over a 13-week period (Limayem et al. 2007) (p.721), and students’ use of BlackBoard LMS over a 9-week period on a departmental (program) basis (Limayem and Cheung 2008). Results collected from the subjects were from their *overall* perceptions and usage statistics with respect to time, assuming learning systems were used frequently and continuously regardless of different courses and different pedagogical designs.

On the contrary, we took a sporadic view of LMS usage and collected data on *per course* basis. In the reality, individual course teaching team maintains its own course site in LMS. Students’ habitual use of resources of one course site does not automatically imply habitual use of resources in another course site. Frequency of access to a course site with active online discussions and other online learning activities supported by the teaching team certainly is higher than the frequency to access another course site only serving as a channel of content distribution. Limayem et al. (2007) also describe this phenomenon, thus advocating that more comprehensive IS usage is a pre-requisite of IS habit formation.

On a practical level, long-term continuance and habitual use of learning systems can be achieved by incorporating additional IT functionalities to support teaching and learning. Personalized IT functionalities are perceived as useful features by users as means to speed up content searching and information retrieval, e.g., tagging, transcription of video/ audio content and personalized annotation in the learning content. Teachers can utilize personalized functionalities by providing relevant keywords for tagging, and to annotate any important points for revision or assessment in the video.

Regarding the need to develop students’ IS habitual usage on the course site as early as possible, teachers can make use of peer effect to increase course site patronage. Before the start of course, teachers can initiate a welcoming message, inviting students to share their background, course expectation, and to give a self-introduction on the discussion forum in the course site. Incentives can be given (e.g., allocation of a small bonus) for active online participation. This technique was found useful in one of the author’s courses: students were performing actively in online activities throughout the semester, which extended beyond the requirements to get the bonus marks.

7 LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

The first limitation of this research is on the sample which restricts its generalizability. As this research was conducted in Hong Kong comprising with samples who are mostly ethnic Chinese in Hong Kong and Mainland China from different academic levels, the subjects have been strongly influenced by East Asian cultural values. To overcome this limitation, the same study could be replicated in other geographical areas (e.g., Western countries and Middle Eastern countries). Further, this study can be replicated in the same institution with international (non-Chinese) exchange or visiting students to ascertain the impact of culture on IS continuance and habit formation with respect to different cultural groups.

The second limitation is on the data collection mechanism in which automatic collection of usage behavior data was not available. This research follows the practice from prior work (Limayem and Cheung 2008 ; Limayem et al. 2007 ; Wilson et al. 2010) using self-reported Likert scale measure as the basis for measurement usage behavior. In the case of habitual usage, Ortiz de Guinea & Markus (2009) argue that IS usage is triggered automatically and unconsciously, and being activated by environmental cues. While recording such unconscious and automatic IS usage by the user himself is unpractical, one ideal possibility to provide accurate data on usage behavior is through automatic tracking and logging by the system. Automatic tracking, however, should be considered cautiously as it involved privacy and other political issues that can negatively affect IS habit development and even usage intention.

The third limitation is on the context of survey settings. Limayem et al. (2007) advocate that potential limitation in the research is data collected in institutional settings, which can affect generalizability. Data sources of this study include sub-degree, undergraduate and postgraduate students across three Hong Kong tertiary institutions, which can ease the problem of generalizability as policy and culture in institutions are different. However, on-the-job and just-in-time training of the working force require significant support by learning systems, which is a trend in personalized learning (Christensen et al. 2008). Although part-time postgraduate students are included in the data source, it cannot provide a complete picture on the actual behavior of learning system users who are under organizational on-the-job training.

Future research can be enhanced with longitudinal study throughout the course duration instead of cross-sectional survey with automatic user activity capturing. System data is more accurate in terms of showing users' behavioral changes over time when compared with users' own memory on IS usage. In the reality, using self-reported questionnaire for data collection can be problematic because subjects are often "fed-up" with questionnaires, especially when multiple questionnaires (e.g., course evaluation and learning experience survey) are conducting simultaneously. Using data captured on user activities might be a more accurate alternative to reduce the length and frequency of data collection by questionnaires. Privacy and security issues, however, should be handled with care as user activity capturing can be contraversal.

8 CONCLUSIONS

As one of the earliest attempts to use a sporadic view of learning systems usage, our work attempts to answer the two research questions in the context of sporadic learning systems usage: (1) What are the antecedents of IS habit in learning systems; (2) In what ways do these antecedents affect IS habit formation; and (3) Does IS habit have a direct relationship with IS continuance in the case of sporadic IS? With support from literature on IS habit, IS continuance, knowledge management and e-commerce, we hypothesize (1) IT functionality design (e.g., personalization) and (2) social effect (e.g., peer effect) have positive relationships with IS habit formation. Adopting Moodle Learning Management System as the empirical study platform, data were collected across different tertiary institutions, with students of different study levels and different study modes on per course basis. Results suggest that (1) Personalization (in the technical domain) and peer effects (in the social domain) are two antecedents of IS habit in learning systems; (2) Personalization has an indirect positive effect on IS habit, mediated by frequency of past behavior; while peer effect has a direct relationship on IS habit; and (3) in a sporadic IS use nature, IS habit shows a more significant impact on IS continuance. Therefore, cultivating IS habit on sporadic learning systems usage should be done early. Teachers can consider designing more online collaborative activities e.g., ice breaking before the semester starts. Additionally, personalized applications in the LMS should be actively promoted to the users. Learning systems designers can incorporate these personalized applications, such as tagging, support to personal content creation and management, as well as social applications e.g., collaboration support for teaching and learning usage involving peer participation.

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